



**Love as a Battlefield: Attachment Anxiety and Comparison-Based
Threats to Self and Relationships**

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A thesis submitted in partial fulfilment of the requirements for the degree of
Doctor of Philosophy

The University of Sheffield
Faculty of Science
Department of Psychology

12th March 2024

Acknowledgements

I'd like to say thank you to my supervisors: Kathy Carnelley, Jilly Gibson-Miller and Abi Millings. Thank you for supporting me to develop the project that I had in my mind, tormenting me for the chance to come out. Thank you for reviewing drafts and submissions with helpful feedback, for being patient with my sometimes convoluted explanations and for your words of encouragement throughout the process.

It's been a long and complicated journey, with a lot of hoop-jumping, to get here, so I'd like to thank both Jilly and Tom Webb for stepping in to help out when it was needed. Jilly in particular deserves thanks for being so supportive when things were difficult in my personal life.

Thank you to Nemanja Vaci for help with some of the most complicated statistics.

For supporting me when things got bad, I want to thank Emily Hillison, Simon Newey and Emma Warren. Emily – I could not have done the final few weeks without your help. Simon – you did try to warn me.

Thank you to my family for their support, and in particular my dad for life-saving last minute reviews of applications and posters.

Thank you to Mike Duncan of the Revolutions podcast, whose hours of content helped to keep me sane and ready to get back to work.

I would have been unable to produce this thesis without the hours of free work provided by strangers on the internet who answer queries on statistics and programming. You are absolute heroes, keep doing what you do.

I'd also like to thank James Clarke of the University of York, whose help with an essay over a decade ago put me on the path to conducting this research.

Abstract

When we perceive other people to be more interesting, attractive, talented or successful than we are, we sometimes perceive them to be threats to our relationships with others, and so experience jealousy. Previous research has linked jealousy to perceived threats to one's sense of self-worth. I refer to the process of evaluating oneself through social comparisons as "zero-sum self-worth". In the introduction, I cite evidence suggesting that some individuals exhibit zero-sum self-worth more than others do. Furthermore, I argue that this may reflect differences in working models of self and others outlined in attachment theory. I propose that attachment anxiety fosters a more zero-sum approach to self-worth, and that this in turn disposes people to feeling more jealous of others. In this PhD, I investigated these hypotheses among young adults in the UK.

In Chapter 2, I report two studies that I conducted to investigate associations between attachment anxiety and zero-sum self-worth. I found that attachment anxiety is associated with self-reports of performing social comparisons more frequently, but that, experimentally, attachment anxiety does not predict greater self-esteem threat from an upward comparison. In Chapter 3, I report on a self-report study in which I found that social comparison frequency was not associated with jealous reactions or suspicions, and furthermore, that comparison frequency did not mediate associations between attachment anxiety and romantic jealousy. By contrast, in Chapter 4, I report an experience sampling study, in which I found that young adults are more likely to experience jealousy after performing social comparisons. Attachment anxiety did not increase self-esteem threat from upward comparisons, but did increase their effects on jealousy.

I did not find strong evidence for an individual difference in zero-sum self-worth among young adults, nor that attachment anxiety increases the tendency to judge oneself in this way. However, attachment anxiety does make high performing individuals seem more threatening to one's relationships, and I finish by suggesting potential strategies for overcoming more chronic senses of threat to self and relationships.

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I, the author, confirm that the Thesis is my own work. I am aware of the University's Guidance on the Use of Unfair Means (www.sheffield.ac.uk/ssid/unfair-means). This work has not been previously been presented for an award at this, or any other, university.

Word Counts

Chapter 1: 19,255 words

Chapter 1 excluding figures: 19,236 words

Chapter 2: 20,326 words

Chapter 2 excluding tables and figures: 19,654 words

Chapter 3: 12,400 words

Chapter 3 excluding tables and figures: 12,021 words

Chapter 4: 21,113 words

Chapter 4 excluding tables and figures: 20,565 words

Chapter 5: 14,163 words

References: 15,359 words

Total: 102,621 words

Total excluding tables, figures and references: 85,639 words

Chapter 1: Introduction

Abstract

In this chapter, I review different theories of self-esteem, including social rank and sociometer theories with regards to the role they give to zero-sum dynamics, i.e., people's standing relative to others. Drawing on these positions, I propose that there is an individual difference in the extent to which people approach their self-worth in a zero-sum manner. I discuss how this difference could result from differences in personal relationships, given what is already known about the way that relationships shape the self. In particular, I focus on attachment theory, and give an account of the working models of self and others that people develop from relationship experiences and discuss how these could come to reflect zero-sum dynamics. Finally, I look at the interpersonal consequences of having one's self-worth threatened by the qualities of other people in the form of jealousy, and lay out a theoretical model for why zero-sum self-worth could account for some of the association between attachment anxiety and jealousy. I conclude by discussing how I tested this model, the population in which I tested it, and present an overall layout of the thesis.

Introduction

In Crocker and Park's 2004 article, *The Costly Pursuit of Self-Esteem*, they argue that, among other problems, seeking self-esteem damages people's relationships with others, because "life becomes a zero-sum game, and other people become competitors and enemies rather than supports and resources" (Crocker & Park, 2004, p. 401). In further research projects, Crocker and colleagues found that pursuing self-image goals tends to lead people to develop zero-sum beliefs about the social world (e.g., "what is good for one person is often bad for another") (Crocker & Canevello, 2008). The concern over competition and hostility in human life is a very old one, and

belief that this condition is linked to preoccupation with the status of the self goes back at least 250 years (Rousseau, 1755/1964). It certainly aligns with some theories of self-esteem, which hold it to be a competitive enterprise (Barkow, 1975; Gilbert, 1989/2017; Gregg et al., 2018). These theories suggest that if people wish for harmony with others, then, they should not seek to have high self-esteem.

However, seeking self-esteem is something that is thought to be somewhat inherent to human life, which would make it difficult for people to avoid. Many theorists have argued that self-esteem serves an important evolutionary function, though they have not always agreed on what this is (e.g., Barkow, 1975; Leary & Baumeister, 2000; Mahadevan et al., 2016). The drive to self-enhance is also thought to reflect important evolutionary functions (Sedikides & Skowronski, 2000). If being motivated to protect and advance one's self-esteem improved a person's chances of survival and reproduction in the ancestral environment, it is likely that those who reproduced would be those whose genetics predisposed them to be concerned with self-esteem and self-enhancement. Indeed, many theorists see maintaining a positive self-image as a fundamental human motive (e.g., Steele, 1988; Tesser, 1988), existing irrespective of one's culture (Sedikides et al., 2003).

This could leave a somewhat bleak picture in which the competition and hostility between people described by Crocker and Park seems inevitable, as individuals are seemingly biologically predisposed to seek self-esteem which will pit them against others. Not only this, but performing poorly relative to others is a consistent predictor of worsened mental health (McCarthy & Morina, 2020; Wetherall et al., 2019). A competitive interpersonal arena must have winners and losers, and being on the losing end appears to be a recipe for misery and suffering. Rousseau (1755/1964) noted that even those who are at the top of the hierarchy are not free of the issues created by needing to be seen well by others. They must be constantly vigilant for signs that their privileged position could be under threat. Indeed, people with (certain forms of) high self-esteem have been found to

respond with aggression when their egos are threatened (Baumeister et al., 1996; Kernis et al., 1989). So, is all this competition and strife inevitable?

This conclusion may be too hasty. The direct line linking the search seeking self-esteem and competition/hostility between people, relies on the idea that self-esteem is to be determined relatively, by reference to one's standing in social comparisons. However, people differ in how readily they make comparisons with others - an individual difference called social comparison orientation (Gibbons & Buunk, 1999) - and the effect that these comparisons have on their wellbeing (Steers et al., 2014) and self-esteem (see Wheeler, 2000). The tendency to place importance in personal status, measured through status anxieties as well as proposed defence mechanisms such as narcissism, substance abuse and consumerism, is also thought to differ between societies, which researchers have attributed to levels of income inequality (Wilkinson & Pickett, 2018). I discuss this further in the section on individual differences in self-esteem and social comparisons. There is also evidence to suggest that the drive to defend one's self-image through social comparisons can be reduced experimentally (Schimel et al., 2001). Avoiding competition and hostility may be less a matter of not seeking self-esteem than seeking self-esteem in ways that do not rely on relative standing, as defined by social comparisons.

In this project, I argue that individuals differ in the extent to which they base their sense of self-worth, both in terms of their self-esteem and their perception of others' regard for them, on their performance/standing in social comparisons. I refer to this as how "zero-sum" their self-worth is. Zero-sum self-worth refers to the extent to which an individual is inclined to view social comparison information as diagnostic of their own worth. This is to say that they view their standing relative to other people, or the outcome of social comparisons, as an informative or important criterion for evaluating and determining their own value as a person, relative to the extent that others do this with their own worth. The extent to which a person's self-worth is zero-sum is the extent to which the failings of others are treated as boosts to one's self-worth, and the successes of

others are treated as threats to self-worth. Anything that is good about oneself can be diminished by someone else being better; for instance, if such a person values their own sense of humour, meeting another very funny person is a threat to their own worth. Conversely, anything that is bad about oneself can be ameliorated by viewing another person performing as or more poorly; for example, if such a person evaluates themselves negatively for being bad at cooking, encountering a person who burns every meal will be a great comfort.

This has parallels in past research. As mentioned before, Crocker and colleagues discuss zero-sum beliefs in relation to the search for self-esteem (Crocker & Canevello, 2008; Crocker & Canevello, 2015). Zero-sum beliefs are characteristic of *egosystem* motivations (as opposed to *ecosystem* motivations), in which people are concerned with accruing gains for themselves and in which others are valuable only insofar as they contribute to these gains. Relationship outcomes are seen as zero-sum in that gains for others (including gains to a sense of worthiness) are seen as coming at the expense of oneself, and so people motivated in this way are concerned with marginal gains for oneself and losses for others.

Zero-sum dynamics play a part in what Deci and Ryan (1995) characterise as contingent self-esteem. A person whose self-esteem is contingent depends on achieving certain standards (Deci & Ryan, 1995). These standards are frequently comparative in nature, e.g., to be viewed as a good athlete, one may need to perform as well as, if not better than others (Ryan & Brown, 2003). Kernis (2003) distinguishes different conceptions of self-esteem into those which emphasise the use of strategies to protect self-esteem - e.g., by derogating rivals (Baumeister et al., 1989; and see Neff, 2011) and those which emphasise contentedness in oneself, and a lack of need for superiority of others (e.g., Rosenberg, 1965). He casts these as two different varieties of self-esteem, secure and fragile, and people vary in how secure vs. fragile their self-esteem is.

Despite sharing similarities with these concepts, zero-sum self-worth is narrower in focus. Egosystem motivations are thought to cast all outcomes (not just those tied to self-worth) as zero-

sum, such that a person must take care not to do too much for others relative to what they get out of a situation (Crocker & Canevello, 2015) and motivate more self-interested behaviour in general. Contingent self-esteem is most often discussed as being dependent on success and failure in one's goals (e.g., Crocker et al., 2006), and these goals may or may not be based on standing relative to others. While Kernis (2003) identifies the need for superiority over others as being indicative of fragile high self-esteem, he also states that this is not definitive of the concept.

In this PhD, I aim to investigate the extent of this variation between people, to discover whether it functions as a trait-like individual difference, or whether it is determined on a more situational basis. I also aim to examine whether basing self-worth on social comparisons can create conditions of hostility between people, specifically disposing people to feel more jealous of others, who often appear as rivals for the attention and value of their relationship partners. There is evidence to suggest that people do differ in their dispositions to jealousy and the circumstances that elicit jealousy from them.

If the tendency to judge oneself on relative standing does create more hostility between people and make people's lives worse, it is important to understand what disposes people to judge themselves in this way. My final aim is therefore to investigate whether attachment theory (Bowlby, 1973), through the internal working models it posits of self and others, can explain why some people tend to approach self-worth as a zero-sum game. Attachment theory provides an evolutionary account of how people develop, and come to differ in, their models of self and others. In particular, I outline a theoretical case as to why attachment anxiety may increase zero-sum self-worth. In Chapter 2, I report research I conducted to study this association, while Chapter 3 focuses on the relationship between zero-sum self-worth and the disposition to interpersonal jealousy. Chapter 4 draws these threads together in a large study into comparison behaviour in daily life.

To understand the role of social comparisons in self-esteem, I will begin this introductory chapter by explaining social comparison theory, in particular, findings that concern the use of social

comparisons in self-evaluation. I will then explain how theories of self-esteem differ from each other in the roles that they take social comparisons to play in self-evaluation, placing the concept of zero-sum self-worth as an individual difference in context. I will then explain why levels of attachment anxiety might cause people to differ in the extent to which they use social comparisons in their self-evaluation. Finally, I will review some of what is known about jealousy, including its relation to social comparisons, self-esteem and attachment. I advance a case for why attachment anxiety might increase the capacity for social comparisons to produce jealousy, and propose that this can help to explain some observed differences in the jealousy seen among young adults.

Social Comparison Theory

Social comparisons are a pervasive part of social life (Corcoran et al., 2011). If a person holds a zero-sum model of self-worth, this suggests they differ from other people in how they use, or how they are affected by social comparisons. To understand what form these differences take, it is necessary to review what is already known about the function of social comparisons in people's lives. I will therefore begin this chapter by explaining some of the basic tenets of social comparison theory (Buunk & Gibbons, 2007; Festinger, 1954) and discuss some findings from this field which informed the design of this project.

Social comparisons are instances in which people compare themselves to other people as a way of evaluating themselves (Festinger, 1954). Leon Festinger is credited as the originator of social comparison theory. In his 1954 article, *A Theory of Social Comparison Processes*, Festinger posited that individuals compare themselves to others in order to evaluate their abilities and opinions when no objective information is available. Individuals select targets¹ who are similar to them as the

¹ Throughout this thesis, when discussing a person performing a comparison, I will usually refer to them as simply "the individual". I will refer to any person they compare themselves with as the "target" of their comparison. This is in line with a great deal of social comparisons research (e.g., Buunk & Gibbons, 2007, Gerber et al., 2018), but may become confusing in relation to some authors (Morina, 2021; Mussweiler, 2003) who refer to this latter person as the "standard" of a comparison. They use the word "target" in a different way, such that it often refers to the person who is performing the comparison.

similarity of these individuals will provide the most diagnostic information for assessing their own abilities.

The definition of social comparisons given above is very broad, and includes instances which are not relevant to this research. For example, one can compare one's opinions or values to those of others in order to evaluate their accuracy or to decide if one should change them. Alternatively, one can contrast one's traits with others as a form of self-definition (e.g., thinking of oneself as bookish rather than sporty by contrast with more athletic-oriented friends). In thinking about zero-sum self-worth, I am only considering comparisons of one's abilities, performance and, following Wilson (1973), general self-evaluations. Taking their lead from Festinger, many social comparison researchers group all these comparisons under the umbrella of *ability* comparisons (e.g., Gibbons & Buunk, 1999).

One important distinction to be made here is between self-evaluation in the sense of understanding one's own abilities in a particular domain – how capable one is at performing particular kinds of tasks – and evaluating oneself overall, in terms of personal worth. This is a distinction made by Wilson (1973), who found that both forms of evaluation can be affected by social comparisons. This project focuses on the use of social comparisons to draw wider conclusions about personal worth, though this can involve consideration of one's specific abilities and performance. One very famous example of this is Morse and Gergen's (1970) study, which found that participants attending a job interview tended to have lower self-esteem when exposed to a rival candidate who seemed to be very competent and professional, but higher self-esteem when exposed to a candidate who appeared dishevelled and incompetent. Indeed, as we will see, a number of the core motivations for which people are thought to perform social comparisons arguably rely on their ability to give information about one's overall worth.

Social Comparison Motivations

In Festinger's (1954) original formulation of social comparison theory, the core motivation for performing social comparisons is to gain accurate information about oneself. This motivation is referred to as "*self-evaluation*" or sometimes "*self-assessment*". Helgeson and Mickelson (1995) found that self-evaluation motives were the most commonly given reasons for performing social comparisons among samples of American undergraduates. Festinger (1954) further suggested that social comparisons come with a unidirectional drive upwards, meaning that people will seek to compare themselves with those doing better than they are. This is thought to reflect a desire for *self-improvement* (Wood, 1989); in order to find ways to improve their abilities and performance, people look to others who seem to have greater skills in the given domain and emulate them. These two motivations are thought to complement one another (Sedikides & Skowronski, 2000), such that information about one's ability relative to others facilitates finding opportunities for improvement. Indeed, people who are particularly prone to self-evaluation motives also tend to engage in more self-improvement (Gregg et al., 2011).

Another commonly cited motive for social comparisons is *self-enhancement* (Sedikides & Alicke, 2012; Wood, 1989), which I have already discussed in this chapter as a core human motivation. People have been found to selectively attend to and process information in ways that bolster a positive sense of self (Sedikides & Alicke, 2012). This can take the form of advancing one's own sense of value as a person (e.g., by taking credit for successes that were the result of other people's efforts) or protecting oneself against threats (e.g., by downgrading the importance of traits and tasks on which one does not perform well), which will here be termed self-advancement and self-protection. Wills (1981) suggested that self-advancement motivates people to perform downward comparisons with others (comparison directions are explained below, under *assimilation and contrast*). However, there are some cases in which upward comparisons can be self-enhancing in a sense, for example, when the comparison target is a member of one's in-group (Collins, 1996).

So far, the motivations cited here have all matched what have been called “cardinal”, i.e., fundamental, self-related motives (Gregg et al., 2011). The only cardinal self-motive which is not frequently identified in typologies of social comparison (e.g., Helgeson & Mickelson, 1995; Wood, 1989) is *self-verification*. In contrast to the self-enhancement motive, in which people prize information that presents a specifically positive view of themselves, self-verification theory posits that people also selectively attend to and trust information that confirms their existing self-views (Pyszczynski et al., 1985; Swann, 2012). While this is not contained within Helgeson and Mickelson’s (1995) typology, they do identify *self-destruction* as a motive for social comparisons. This is represented by items relating to confirming pre-existing fears that things are bad or hopeless and that one is not able to improve them (e.g., “To confirm my fear of getting worse”), except for one item which relates to behaviour (“So that I can give up”). Evidence for this motive therefore overlaps substantially with evidence for self-verification. Insofar as self-verification can be empirically differentiated from self-enhancement, it is in the preference for negative information about the self which is congruent with existing beliefs (e.g., Pyszczynski et al., 1985).

There is reason to believe that self-verification might not increase the frequency with which people perform social comparisons. People are most strongly motivated to verify beliefs about themselves which they are highly certain of (Pelham, 1991), but this is the condition under which people are least motivated to perform social comparisons (Butzer & Kuiper, 2006; Pelham & Wachsmuth, 1995). Self-verification may matter more for the types of social comparisons people perform, rather than the overall frequency of social comparisons.

While this project focuses on self-related motives, it is important to realise that not all motives for social comparisons are self-focused. Another motivation identified in social comparison research is the desire to affiliate with others (e.g., Helgeson & Mickelson, 1995; Schachter, 1959). Identifying others who are experiencing the same situations as oneself may help to forge bonds with them, to prevent oneself from feeling isolated. Alternatively, these others may give one ideas of how

to deal effectively with their current situations. Similar to the self-improvement motive, this means that evaluations of oneself are not the goal of the comparison, but merely a step toward the goal, in this case of connections with other people.

However, not all social comparisons are performed deliberately, with explicit motivations. In fact, there is evidence to suggest that people perform many social comparisons without realising it because later processes can interrupt and nullify their effects (D.T. Gilbert et al., 1995). These later processes assess the diagnostic value of comparisons performed automatically. If the comparisons are taken to be diagnostic of the individual's performance or ability, they are encoded and the individual experiences affective consequences from them. If not, these processes are halted and their cognitive traces erased. Wood et al. (2000) found that as many as half of all social comparisons are performed inadvertently, based on automatic processes.

Mussweiler (2003) notes that comparisons can be brought on without intention simply because the comparative performance of a given target is highly salient. One reason for this might be due to the threat they might pose (Morina, 2021). Humans are thought to preferentially attend to threatening stimuli, including from social threats (Lobue et al., 2010; Lundqvist & Ohman, 2005). This is not necessarily unrelated to motives for performing social comparison deliberately; a target can elicit a comparison due to threatening one's motives, which may include self-enhancement, self-verification or self-improvement (Morina, 2021). Social comparisons can, therefore, be seen as means of fulfilling motives that are common to most if not all people. It has, however, been raised that the disposition to perform social comparisons is not uniform across people (Diener & Fujita, 1997). Instead, the extent to which people are motivated to perform social comparisons is referred to as *social comparison orientation* (SCO); those high in SCO compare themselves to others relatively frequently, while those low in SCO compare relatively less frequently. SCO is assessed using a measure called the Iowa-Netherlands Comparison Orientation Measure (INCOM) (Gibbons & Buunk, 1999). In terms of personality correlates, SCO is related to greater neuroticism (Van der Zee et al.,

1998), lower self-esteem, less tolerance of uncertainty (Butzer & Kuiper, 2006) and greater accessibility of self-related thoughts (Stapel & Tesser, 2001)².

Assimilation and Contrast

Most social comparison researchers see the direction of ability comparisons to be important, both to understanding why they are performed and what effect they will have (Buunk & Gibbons, 2007; Gerber et al., 2018; Morina, 2021; Mussweiler, 2003; Wills, 1981). The direction of a comparison means how well an individual believes they are doing in comparison to their target.

Upward comparisons are situations in which the individual believes they are performing worse than the other person on whatever dimension they are comparing on. *Downward comparisons* are those in which the individual believes they are performing better than their target. Finally, *lateral comparisons* are those in which the individual rates their performance as approximately equal to that of their target.

This direction of a comparison is in some sense an outcome of the comparison; if individuals perform comparisons to gain information, the information that they gain from it is whether they are performing better or worse than the target. However, some theorists have emphasised that comparisons are not performed blindly, with individuals entirely unsure of where they stand prior to performing them. Instead, individuals are thought to have initial hypotheses of whether they are similar or dissimilar (and in which direction) to their target, and the process of comparison is the accumulation of evidence to support or disprove that hypothesis (Mussweiler, 2001). Information that is congruent with the initial hypothesis is likely to be more accessible during this search, so comparisons will confirm the initial hypothesis more often than they disprove it. In support of this, the direction of social comparisons has been found to follow *selective accessibility* effects. For

² Despite a very large number of instances of scientific malpractice in Diederik Stapel's career, the Levelt joint committee found no evidence of malpractice within this paper. Moreover, more recent research has also found similar results (Smeets et al., 2010).

instance, downward comparisons are made more likely when a person is in a bad mood, while good moods tend to encourage more upward comparisons (Wheeler & Miyake, 1992).

The initial hypothesis to be tested influences the extent to which the comparison outcome will reflect *contrast* or *assimilation* effects. Contrast effects, in Mussweiler's model of comparisons, are the shifts in one's evaluations based upon the distance from the comparison target (Mussweiler, 2001; Pelham & Wachsmuth, 1995). As the target anchors the scale on which one is being evaluated, comparing one's skills in a sport to a professional athlete provides a scale in which one's abilities may be relatively low, while comparing to a young child provides a scale in which one's abilities may be relatively high. The converse of these effects are assimilation effects, in which the comparer shifts their own evaluations towards that of the target, e.g., if a person thinks of themselves as better at baking when thinking of a similar person they know to bake very well. Though these are converse effects, Mussweiler and Strack (1999) emphasise that both can take place in a single comparison; people can estimate their abilities lower based on an initial hypothesis of similarity to a low performing target, and yet still estimate that they are more able than the target, and therefore shift their evaluations upward as a result.

It is important to note that assimilation and contrast are not limited to evaluations of ability, performance or worth. Any dimension on which comparisons can be performed can show assimilation or contrast; one common use of this distinction is to look at whether individuals are disposed to emphasise their similarities or differences with other people (e.g., Gabriel et al., 2005). However, for this thesis, I will only be considering effects on self-evaluations of worth, and evaluations of ability, performance as possible proximate influences on these evaluations of worth. Self-worth can be affected by both kinds of comparison effects, with self-evaluations improving because of perceived similarity to a high performing target or suffering because of the distance from a high performing target. The idea of zero-sum self-worth implies not only that people are particularly inclined to judge their own worth using social comparisons, but also that these

judgements follow zero-sum dynamics; one person's successes come at the expense of another person. This means that it is the contrast effects that interest us here, in which upward comparisons decrease self-worth and downward comparisons increase self-worth. In this way, others become competitors in the search for self-esteem.

This dynamic, of measuring one's own worth through contrast effects, is characteristic of a *social rank* dynamic, in which one's own standing is defined by where one is positioned relative to other people. The centrality of the role afforded to social rank dynamics is a defining difference between various theories of self-esteem. I review this debate below, as the position that one takes in this debate will have a substantial impact on how one understands the idea of zero-sum self-worth.

Theories of Self-Esteem

Social-Rank Based Theories of Self-Esteem

Theories of self-esteem based on social rank (e.g., Barkow, 1975; Hill & Buss, 2013; Sedikides & Skowronski, 2000), suggest that self-esteem has an evolved function to track people's standing within status hierarchies. They contend that in the ancestral environment in which self-esteem evolved, individuals would compete with one another for access to resources and mates; having higher standing would thus increase their chances of survival and of future reproduction. This is similar to dynamics observed among chimpanzees in the present day (e.g., Newton-Fisher, 2004), one of the closest living relatives of human beings. Self-esteem would have been necessary to understand one's position in the hierarchy and regulate one's behaviour towards other people (Sedikides & Skowronski, 2000).

Perspectives differ as to the nature and dynamics of status hierarchies. Some have argued that similar to chimpanzees, early humans would have fought one another for dominance (Cummins, 2015). As such, humans have evolved sensitivity to social dominance, as evidenced through higher

stress experienced when social rank is low (Bateup et al., 2001) and sensitivity to disrespect (Tremblay, 1998). Contrasted with this dominance-based viewpoint, other theorists have argued that status-seeking is based upon the drive for *prestige*, i.e., the deference and material advantages that others freely give to a person that they respect (Henrich & Gil-White, 2001). In this view, the most important adaptation which favoured the survival of early humans is the ability to learn from each other. Therefore, in order to learn important skills, people would have ranked others hierarchically, to decide who to learn from, and given people with superior abilities rewards, in the form of material and social advantages. This would incentivise those individuals to share their knowledge and offer instruction to those who rewarded them. In support of this, people afford status to others based on having skills that are relevant to one's own life (Driskell & Mullen, 1990) and willingness to use these skills to help others (Willer, 2009).

Some theorists have emphasised commonalities between these viewpoints, arguing that they may play into the same basic drive for status and social rank in the modern day (Gregg et al., 2018). Arguments from both prestige (Henrich & Gil-White, 2001) and dominance theories (Cummins, 2015) suggest that social status dictates one's *resource-holding potential*, one's ability to get the best food and access to mates, and thus to pass one's genetic material on to the next generation. I believe that, despite some overlap, the two drives should actually produce different concerns. Under dominance theory, people should be motivated to challenge others, either physically or for concrete power and control. Being esteemed by others is not relevant to this drive, except insofar as it helps one to achieve control. Status, in this sense, is antagonistic, and rivalries necessarily involve hostility. Under prestige theory, while hierarchies are competitive, they are not necessarily antagonistic – success is not a matter of beating down one's competition but outperforming them in valued domains. People would be motivated to develop talents which would lead them to gain esteem and positive attention from others. Following Anderson et al. (2015), I will understand status motivations as those which would be predicted by prestige theory.

Due to the hierarchical nature of these struggles, social rank theories of self-esteem suggest that self-esteem has a hierarchical component built into it. However, social rank theorists do not all agree on how central this dynamic is. Some position status-seeking as the fundamental evolutionary reason why self-esteem developed in the first place (Barkow, 1975; Sedikides & Skowronski, 2000). The strongest position to this effect is represented by Barkow (1975, p. 554), who went so far as to suggest that “to evaluate the self as higher than others is to maintain self-esteem”. If this conception of self-esteem is true, all self-esteem is zero-sum, and the rivalry referred to by Crocker and Park (2004) would be an inescapable part of wanting to view oneself in a positive light. Such zero-sum conceptions of self-esteem are often tacitly appealed to by researchers (e.g., Neff, 2011).

Another line of argument that self-esteem must be comparative in nature focuses on the nature of judgements in general. Some theorists have suggested that judgements are inherently comparative (e.g., Mussweiler, 2003). Vlaev et al. (2011) present evidence in support of the contention that the brain has no conception of the “value” of options independent of comparison standards. For example, neural reward coding for financial rewards was dependent on their value related to other options presented, rather than any “absolute” value (Elliot et al., 2008). If this applies to all judgements, it will mean that evaluations of self inherently employ some target to measure the self against, and, importantly, the regard that others have for the self must be comparative as well. Measuring oneself comparatively would be inevitable, and perceiving the regard of others to be comparative would simply be evidence of meta-accuracy.

Not all social rank theorists take the extreme position espoused by Barkow (1975). Gregg et al. (2018), for example, argue that Barkow is somewhat unique in maintaining that self-esteem is relative by definition, and that most theory and measurement of self-esteem holds self-esteem instead means perceiving yourself to have adequate worth. Most of these more moderate theorists also accept that there are other evolved functions for seeking self-esteem (Anderson et al., 2015; Hill & Buss, 2013; Leary et al., 2014), e.g., inclusion in social groups, which I will discuss further below.

While it may not be the only contingency affecting self-esteem, social rank theorists hold that status is a fundamental aspect of self-esteem, and so inevitably plays a large role in determining it (Anderson et al., 2015; Gregg et al., 2018; Hill & Buss, 2013). Based on this view, interpersonal rivalry is always a risk in seeking self-esteem, as relative standing concerns are always relevant to considerations of one's own worth. However, the extent to which people engage in rivalry will depend somewhat on whether they are preoccupied more by status or belonging (Anderson et al., 2015; Leary et al., 2014; Mahadevan et al., 2016).

There is evidence to suggest that social status is important to self-esteem. Indeed, the drive to be respected by others has been identified in many different countries and cultures and is a very consistent predictor of self-esteem (Tay & Diener, 2011). Self-perceived relative rank has a positive effect on self-esteem across individuals from school age to college (Fournier, 2009; Gruenewald et al., 2006). Ball and Chernova (2008) found that relative standing in income is more important in predicting happiness than absolute income. Beyond this, and specifically examining self-esteem Mahadevan et al. (2021) found that people's perceptions of their relative social status predict their self-esteem more strongly than their objective or perceived relative income.

In terms of physiological studies, Mendes et al. (2001) found that cooperating with upward comparison targets induces cardiovascular activity consistent with threat (increased sympathetic-adreno-medullary and pituitary-adreno-cortical activation followed by cortisol release). Swencionis and Fiske (2014) reviewed neuroimaging studies into social comparison and found that upward comparisons on competence and performance intensify the experience of threat/social pain after failure (measured through activity in the dorsal anterior cingulate cortex) and attenuate reward from victory (measured through activity in the ventral striatum and orbitofrontal cortex) in cognitive tasks, while downward comparisons tend to do the inverse in both cases. Envied individuals also stimulate activity in the dorsal anterior cingulate cortex especially when they have abilities or possessions of self-relevance to participants (Takahashi et al., 2009). Generally speaking, then,

people's neurological reactions to social comparisons seem to reflect increased threat from upward comparisons and decreased threat from downward comparisons. Dickerson and Kemeny (2004) found that social-evaluative threat is the most consistent predictor of stress hormone release, so it is plausible that this threat is social-evaluative in nature. As such, the available neurological evidence appears to point to the idea that social evaluation is shaped by contrast effect with others, plausibly indicating a concern with one's relative rank.

Non-Hierarchical Theories of Self-Esteem

However, others have argued that self-esteem need not follow zero-sum dynamics at all. Another evolutionary function for self-esteem is that proposed by sociometer theory (Leary & Baumeister, 2000; Leary et al., 1995), namely inclusion and acceptance in social groups. Individuals who are rejected by social groups will be less likely to survive, and so evolutionary processes favour individuals who care about indices of interpersonal acceptance. This theory argues that self-esteem acts as an indirect indicator of acceptance; if an individual does things that improve their chances of acceptance, their self-esteem rises, while if they do things that jeopardise those chances, their self-esteem falls. Attaining acceptance is not a zero-sum goal; being more accepting towards one person does not simultaneously imply being more rejecting of another person.

Leary et al. (2014) argued that seeking social status is just one way to achieve inclusion in social groups. An individual can seek to be instrumentally valuable to others (in the sense of possessing skills that will help them), which these authors identify with the search for status. Alternatively, an individual can seek intrinsic value (in the sense of being liked by others and sharing interdependent relationships with them). In this latter case, inclusion is not based on relative standing, because a person who is valued intrinsically is not directly replaceable by others (Leary et al., 2014). These two facets of personal value are also those used by Tafari and Swann (2001) in their dual model of self-esteem, with self-competence reflecting instrumental value and self-liking reflecting intrinsic value. Leary et al. (2014) argue that seeking inclusion through relational value will

be a more fundamental drive, because intrinsic value will hold across many different contexts, while status can be lost if the specific qualities that elicited it are no longer valued.

Anderson et al. (2012) found that while sociometric status (the level of respect and social standing participants reported themselves to possess) positively predicted subjective well-being, this effect did not hold when controlling for social acceptance (see Model 4, Table 1; Anderson et al., 2012). It is important to note, though, that this is not the conclusion that Anderson et al. (2015) take from this data. They instead argue that sociometric status predicts well-being even when controlling for self-esteem, and it is unclear to me how they arrive at this conclusion from the data they cite. Finally, even though prestige theorists give convincing arguments as to why status must involve relative judgements of skill in particular domains (Anderson et al., 2015; Henrich & Gil-White, 2001), they do not offer strong explanations of why this would extend to ranking individuals in an overall social hierarchy. While Tay and Diener (2011) found a universal link between being respected and self-esteem, respect does not connote relative standing in the same way as “status”.

It is important to note that Crocker and colleagues, who suggest that the search for self-esteem involves people in competition with others, acknowledge that sources of self-esteem need not put people into conflict with one another, and that self-worth can in fact, be best achieved through positive, mutually supportive relationships with others (Canevello & Crocker, 2011). Nonetheless, they contend that orienting one’s behaviour around having a positive self-image tends to undermine these conditions, paradoxically implying that seeking self-esteem often prevents a person from attaining it (Canevello & Crocker, 2011). This preoccupation with self-image was likely Crocker and Park’s (2004) intended target when they argued that seeking self-esteem leads people into conflict with one another. Yet even this tacitly supports the idea that one’s self-image necessarily involves dynamics of superiority and inferiority.

Some researchers have in fact argued that self-evaluation based on relative standing is antithetical to self-esteem (Brummelman et al., 2016). They propose that self-views can take one of

two forms: self-esteem and narcissism, which have separate etiologies. A narcissistic self-image tends to be built around a sense of superiority to others and those higher in narcissism tend to favour competition with others (Morf & Rhodewalt, 2001). Brummelman et al. (2016) argue that high self-esteem is differentiated from narcissism specifically because its model of self-worth is not built on social comparisons. Where more narcissistic people rate themselves highly on agentic traits, those with high self-esteem rate themselves highly on communal traits (Campbell et al., 2002), and it is agentic traits that lend themselves to vertical (better/worse) comparisons (Locke, 2003). Indeed, more narcissistic people are more likely to rate themselves as better than their romantic partners, which is not a trait associated with high self-esteem (Campbell et al., 2002; Krizan & Bushman, 2011).

Importantly, narcissistic people can see themselves as better than others and yet still not like themselves (Myers & Zeigler-Hill, 2012), though this does not mean that a deep-seated dislike of oneself underlies narcissism. Instead, narcissistic people can have high or low implicit self-liking, but prize their superiority to others on agentic traits (Campbell et al., 2007). Overall, narcissism is positively related to self-esteem (Campbell, 1999), but it can manifest in ways which betray negative views of oneself, referred to as vulnerable narcissism (Dickinson & Pincus, 2003). People exhibiting vulnerable narcissism have a propensity to shame and a hypersensitivity to criticism, avoiding relationships with others (Miller et al., 2011).

Positions have differed as to the unity of these forms of narcissism. Social psychological research has found different personality traits to be associated with grandiose and vulnerable narcissism (Miller et al., 2011; Smolewska & Dion, 2005), including different experiences in childhood (Otway & Vignoles, 2006). On the other hand, Pincus and colleagues (Pincus et al., 2014; Pincus & Lukowitsky, 2010), coming from a clinical background, posit narcissistic *grandiosity* and narcissistic *vulnerability* as two sides of the same coin. They cite a number of case studies in which patients fluctuate between the two (Pincus et al., 2014), and quote other clinical work which argues

that this occurs when narcissistic self-enhancing strategies fail (Horowitz, 2009; Ronningstam, 2009, cited in Pincus & Lukowitsky, 2010). Gore and Widiger (2016) investigated this hypothesis and found that patients do indeed fluctuate between the two over time, with “grandiose” narcissists being especially likely to have episodes of vulnerability.

Both forms of narcissism are associated with a greater desire for status (Mahadevan & Jordan, 2022) and positively associated with hypercompetitiveness (Luchner et al., 2011), though this latter study used an alternate taxonomy (“overt” vs. “covert” narcissism). Indeed, Mahadevan et al. (2019) suggest that while self-esteem evolved to monitor and respond to interpersonal inclusion and position in status hierarchies, narcissism specifically evolved to track status. This evidence points to the idea that narcissism is built around a specific approach to self-worth, focusing on agentic traits which allow a person to gain status and feel superior to others. This appears to foster hostility; researchers have identified interpersonal antagonism as a defining feature of narcissism (Miller et al., 2011; Paulhus, 1998). This approach also has an unfortunate flipside for oneself; if one is not superior, one must be inferior. Indeed, vulnerable narcissism has been found to predict lower levels of self-esteem following upward comparisons (Ozimek et al., 2021).

A meta-analysis of social comparison research offers some support for the idea that self-esteem is essentially non-comparative. Gerber et al. (2018) found that comparisons tend to lead to contrast effects on domain-specific self-evaluations and performance satisfaction, but they found no overall effect of comparison direction on self-esteem. Seeing oneself as less able than others on particular dimensions does not seem to dictate one’s overall self-evaluation. People tend to rate their abilities and performance more poorly following an upward comparison, but may be just as likely to experience increased self-esteem as decreased self-esteem as a result.

How can we reconcile this finding with the neurological evidence cited above? The experience of threat and the attenuation of neural reward following social comparisons do not imply anything definitive about self-esteem. Pegler (2018) finds evidence that across the psychological

literature, self-esteem is not defined as an emotional, but instead a cognitive, evaluation of self. This is much more difficult to map neurologically. The idea that the mind must employ comparisons to assess one's own value (Vlaev et al., 2011) does not imply that the standard must be another person. Many forms of comparison are possible, e.g., temporal comparisons to oneself in the past, or comparisons to ideal versions of oneself (Morina, 2021). On the other hand, combining the evidence that upward social comparisons seem to yield lower evaluations of ability/performance with evidence of threat from neurological research suggests that upward social comparisons do, in the main, yield social-evaluative threat. Additionally, Gerber et al. (2018) only reviewed four studies that involved the effect of social comparisons on self-esteem.

Individual Differences in Self-Esteem and Social Comparisons

From the above debate, we can glean a spectrum of positions:

- Self-esteem is zero-sum by definition (Barkow, 1975).
- Zero-sum dynamics are an integral part, though not the whole, of self-esteem (Anderson et al., 2015; Hill & Buss, 2013).
- Self-esteem can follow zero-sum dynamics but need not do so (Leary et al., 2014).
- Self-regard based on zero-sum dynamics is, by definition, not self-esteem (Brummelman et al., 2016).

I do not believe that the last conclusion can be justified. There is a body of evidence that relative social status positively predicts self-esteem as well as narcissism (e.g., Mahadevan et al., 2019). Individuals with high self-esteem tend to rate themselves as better than others on agentic as well as communal traits (Campbell et al., 2002), and it is not impossible to perform vertical comparisons on communal traits (Locke, 2003). Beyond preoccupations with competition, understanding one's abilities relative to others can improve (or threaten) a sense of personal worth just by giving context for assessments of whether one is doing well (Mussweiler, 2003).

Nevertheless, I do not believe that the first conclusion can be justified either. If self-esteem means considering oneself a person of worth and value (Gregg et al., 2018; Pegler, 2018), this need not rely on being a person of *more* worth or value than others. Even if social comparisons have some role in the self-esteem of most if not all people, the preoccupation with superiority and competition among more narcissistic people does seem to represent a more zero-sum model of self-worth. In this project, I proposed that there is an individual difference in the extent to which people's self-judgements rely on social comparisons, and in this section, I provide evidence to this effect.

Various contributions to self-esteem research indicate not only that individuals differ in the content of their self-evaluations, but also in the dynamics that alter them across time. The most obvious individual difference is the valence of trait self-esteem, which runs from low to high (Rosenberg, 1965). People also differ in the (in)stability of their self-esteem, measured by the fluctuations in their state self-esteem over a short period, e.g., five to seven days (Kernis & Goldman, 2003). Self-esteem instability is thought to indicate a person's level of ego-involvement in everyday situations, i.e., to what extent these events impact their sense of self-worth. It is this instability in self-esteem that makes people more likely to respond to others with aggression, especially when their self-worth is threatened (Baumeister et al., 1996; Kernis et al., 1989).

It is clear that self-esteem processes are far from uniform across the population, and what causes some people to increase or decrease in their self-estimations may have little to no impact on others. A person's self-esteem can rise and fall as the result of their strengths and weaknesses, or successes and failures, across a number of different domains, referred to as different contingencies of self-worth (Crocker & Wolfe, 2001). For example, a person's physical appearance can make them see themselves in a positive or negative way, just as academic performance or social approval can. Importantly, people differ in which of these domains most strongly affect their self-worth (Crocker & Wolfe, 2001), such that some people take great pride in their appearance, while some may care less about that and more about the respect they command in their job. These contingencies can be seen

as more or less intrinsic to a person, and so people differ in the extent to which their self-esteem is based intrinsically vs. extrinsically (Deci & Ryan, 1995). In a sense, zero-sum self-worth can be seen as a contingency of self-worth, as I am proposing that individuals differ in the extent to which comparisons to others determine their self-worth.

There are reasons to think that people may differ in how much their self-worth is determined by social comparisons. One source of evidence for this is across societies, based around levels of inequality. Wilkinson and Pickett (2018) compile evidence that preoccupation with social status is associated with higher levels of income inequality. For instance, individuals from countries with greater income inequality are more likely to endorse the statement “people look down on me due to my job situation or income” (Layte & Whelan, 2014). Low perceived social rank, in general or income-related terms, is a consistent predictor of mental distress and mental illness (Wetherall et al., 2019; Wood et al., 2012) and rates of mental illness are positively associated with income inequality across US states, and across countries (Melgar & Rossi, 2012; Messias et al., 2011; Pickett & Wilkinson, 2010; Steptoe et al., 2007), though a large WHO study found this to only apply in wealthier nations (Cifuentes et al., 2008). On the flipside, people from less economically equal countries are more likely to display a self-enhancement bias (Loughnan et al., 2011), while rates of narcissism have risen in the USA alongside the growth in income inequality (Wilkinson & Pickett, 2017). Wilkinson and Pickett (2018) cast these as functional strategies within societies that are highly economically stratified; when success seems dependent on doing better than others, people are motivated to maintain – and project - images of themselves as superior to others. Indeed, perceived wealth inequality is positively associated with the belief that success is a zero-sum game (Davidai, 2023).

There is also evidence of variation in the extent to which people are affected by social comparisons within a given culture, for example, in terms of the effects of comparisons on depressive symptoms (Steers et al., 2014). As self-esteem has been found to negatively predict

depression Ye et al., 2012), this may well indicate that people also meaningfully vary in the effect of comparisons on their self-esteem. Waschull and Kernis (1996) posited that differences in self-esteem stability may partially reflect how strongly self-esteem is affected by social comparisons.

I have already mentioned that people differ in how frequently they perform social comparisons. People who are high in SCO not only compare themselves to others more frequently, they also tend to have stronger reactions to these comparisons (e.g., Buunk & Brenninkmeijer, 2001). They tend to evaluate their own network of social relationships as less satisfying when exposed to an upward comparison (a person describing a very positive network), and more satisfying when exposed to a downward comparison, as compared with people lower in the SCO (Buunk et al., 2007). In particular, social comparisons have been found to affect self-esteem more strongly among people high in SCO (Vogel et al., 2015). As partial evidence for Waschull and Kernis's (1996) assertion, SCO is, at a trait level, associated with less stable self-worth (Neff & Vonk, 2009), as well as self-worth that is more contingent, i.e., more dependent on the individual meeting certain criteria. SCO therefore appears to represent not just an increased tendency to make comparisons, but also an increased relevance of those comparisons to people's perceptions of their world and themselves.

Another form of evidence for an individual difference comes from self-affirmation theory (Sherman & Cohen, 2006; Steele, 1988). Self-affirmation theorists maintain that when the self is threatened, one can respond to it defensively, e.g., by diminishing the relevance of the threat, or by affirming valued parts of one's overall identity (Sherman & Cohen, 2006). One example of a defensive response is engaging in downward social comparisons (see Wills, 1981). It has been found that this tendency can be experimentally reduced by validating core elements of a person's identity, while validating their achievements does not have the same effect (Schimel et al., 2001). As the authors of that paper observe, this not only confirms the hypotheses of self-affirmation theory but also shows that the contingencies on which one is grounding one's sense of self-worth (extrinsic

achievements vs. intrinsic identity) at that moment can influence the extent this sense of self-worth relies on outperforming others. This raises the possibility that, because people differ chronically in the contingencies on which their self-worth is based (Crocker et al., 2006; Crocker & Wolfe, 2001), they also differ chronically in the comparativeness of their self-evaluations.

The above evidence suggests that the tendency to judge one's self-worth in a hierarchical fashion does not seem to be uniform across all people. My first goal in this research is to identify the extent of this variation; do people meaningfully differ in the extent to which their sense of self-worth is zero-sum?

Let me be clear about what "zero-sum self-worth" does *not* mean here. Through the evidence cited above, it seems that judging oneself in comparison with others is relatively commonplace. Therefore, saying that someone has a more zero-sum model of self-worth only implies that comparative judgements are especially pervasive in their evaluations of themselves, not that they exhibit a qualitatively distinct phenomenon to everyone else. Additionally, I assume it to take very diverse forms. For example, some people will hold explicit beliefs to the effect that comparisons determine personal worth, while others will hold explicit beliefs to the contrary and yet continue to use comparisons to judge themselves and others. People are likely to differ in what domains they compare themselves to others on (appearance, academic performance, career success, social skills or by musical or athletic skill), and potentially also in whether they compare themselves to specific others locally, on particular tasks and abilities, or whether they see the whole social world as a single competition to be won or lost. All of these are examples of self-worth which is zero-sum. I expect that people exhibit zero-sum self-worth in ways that vary in all the ways in which self-worth judgements in general are known to vary. In this way, zero-sum self-worth is not a personality trait, like neuroticism or narcissism, but merely a description of one form of variation in self-worth judgments.

Holding a zero-sum model of self-worth is not identical to being concerned with status. Status is something specifically conferred on a person by others (Anderson et al., 2015; Henrich & Gil-White, 2001), and involves more than just their opinions about that person. For a person to have high status, they must be given deference by others, i.e., others must decide to comply with their wishes (Henrich & Gil-White, 2001). Zero-sum self-worth does not imply anything about the actions of other people, but only the value that one is held in, by oneself and by others. Even in terms of others' views, status seems to indicate an overall position in a social group, and potentially incorporating the viewpoints of many people. As Anderson et al. (2015, p. 2) put it, "the higher the number of group members who confer higher status and voluntarily defer to an individual, the higher the status that individual can be said to possess in the group." This need not be the case for all cases of zero-sum self-worth. As I discuss below, some dynamics in personal relationships may give rise to a zero-sum approach to self-worth, even if the individual only cares about the views of a single individual. This will become particularly relevant later, when I discuss the role of attachment anxiety.

The Experience of Zero-Sum Self-Worth

How is zero-sum self-worth experienced? Wolsko (2012) provided some insights on this by collecting detailed diary entries from participants reflecting on their tendency to compare themselves to others. One participant described the process of persistently performing social comparisons as "exhausting" (p. 340) while another described it as a "fruitless effort that got me nowhere" (p. 341). Even if social comparisons serve some motivation, like avoiding a sense of inferiority, they are not necessarily performed deliberately, nor welcome when they occur. Another participant in that study made reference to the "rollercoaster of inferiority and superiority" (p. 340). Comparing oneself downwards may seem to offer a benefit when one could seem superior to others, but if this is what makes one worthy, then one is vulnerable to the possibility of being made to feel inferior at any moment. Finally, and in support of the idea that it worsens people's

interpersonal relationships, Wolsko (2012, p. 340) quotes one participant who reported that “when comparing myself to someone else some very nasty things can enter my mind”.

The Role of Personal Relationships

There is evidence to suggest that experiences in personal relationships may be a factor which accounts for variation in how much people base their self-worth on social comparisons. The first piece of evidence comes from the study performed by Schimel et al. (2001), above. These authors found that the difference in effect between validating a person’s achievements and validating their core self was mirrored when participants were instead primed with different personal relationships. When primed with a person who accepted them unconditionally, participants also tended to perform fewer defensive social comparisons, though this was not true when primed with a person who only accepted them contingently.

This evidence demonstrates that differences in the extent to which self-worth follows zero-sum dynamics is not simply a matter of whether a person seeks worth through personal relationships or wider social status. Not all personal relationships give a person a sense of being valued intrinsically and securely, in the manner that Leary et al. (2014) identify with relational value. However, secure, supportive relationships may lead people to value themselves in more intrinsic and less competitive ways. Indeed, this is reflected in the divergent etiologies of self-esteem and narcissism. High levels of narcissism tend to result from parental overvaluation, while high self-esteem is a result of parental warmth (Brummelman et al., 2015). Consistent with Schimel et al.’s (2001) work, it is not valuation that leads a person to be secure in themselves but supportive acceptance of them.

This recalls the work of Carl Rogers (1961), who argued that unconditional love and support would allow individuals to feel worthy without the need to meet certain specific standards, and without needing to employ defensive distortions of reality to protect their self-image. Rogers believed that individuals have a fundamental motivation to seek the love and support of others and

if this attempt is blocked, it will interfere with a person's development. If the love and acceptance of others is contingent on certain conditions (for example, when parents will only show love and support if a child lives up to certain standards), he believed that individuals *introject* those standards, which is to say uncritically incorporate them into their motivations and begin behaving in line with them, to gain the approval of others. Support for Rogers' view was found by Assor et al. (2004) in a study of university psychology students, who found that individuals who reported experiencing more conditional regard from their parents tended to introject more, measured as a feeling of inner compulsion to perform certain behaviours.

Self-determination theorists (Deci & Ryan, 1995; Ryan & Brown, 2013) later took up this view, arguing for a distinction between contingent and true self-esteem; the first being determined by meeting external contingencies, and the other reflecting an abiding sense of intrinsic worth. This division appears to map very well onto Leary et al.'s (2014) division between seeking social inclusion through relational value or instrumental social value. A person may believe that their relationship partner accepts them as a person - in which case their relational value may seem to be secure and non-contingent - or they may believe that their relationship partner values them only insofar as they live up to certain instrumental standards. This instrumental valuation could prime concern with one's place in a competitive hierarchy (Anderson et al., 2015; Henrich & Gil-White, 2001), and therefore lead the person to compare their worth to that of others.

The importance of the support of others, the association between love and support with views of self, and the pathways by which individuals come to differ from one another in their views of self and others are all explored in detail by attachment theory (Bowlby, 1969/1997; 1973). In particular, the relevance of security within relationships is one of the cornerstones of this theory. Mikulincer and Shaver (2016) suggest that the unconditionally supportive individual from Schimmel et al.'s (2001) study represents a person with whom one has a secure attachment relationship. Parental warmth, identified as a precursor to narcissism, is also related to stronger attachment security

(Collins & Read, 1990). From all this foregoing evidence, I believe that attachment theory can help us to understand what disposes people to value themselves in a comparative vs. a non-comparative manner. I therefore turn to a discussion of this theory now.

Attachment Theory

Attachment relationships are persistent emotional connections to specific individuals, in which individuals seek to achieve a sense of security (Ainsworth, 1989; Bowlby, 1969/1997). The attachment behavioural system is theorised to have evolved because the presence of caregivers keeps individuals safe from threat, particularly in the early stages of life (Bowlby, 1969/1997). The earliest attachment figures tend to be parents, but as an individual progresses through adolescence, friends and romantic partners begin to take on attachment functions in preference to parents (Allen, 2008; Trinke & Bartholomew, 1997). Though these later bonds tend to involve a reciprocity of giving and seeking support, they can otherwise exhibit similar dynamics to parent-child attachment relationships. An individual is attached to another person if they seek to *maintain proximity* to that other, if unexpected separation from the other causes them anxiety, if they turn to the other as a *safe haven* at times of trouble and if they can use the security provided by that other as a *secure base* from which to explore and/or pursue other goals (Ainsworth, 1989). Evidence suggests that these behaviours characterise the emotional closeness of romantic love (Hazan & Shaver, 1994).

Early experiences with caregivers, particularly those that involve seeking support, influence the patterns of attachment that people exhibit (Bowlby, 1969/1997). Out of specific memories, individuals form scripts, or generalised expectations, of how their attachment figures will behave in future interactions (Baldwin et al., 1993). For example, a person might expect that expressing distress might cause other people to rush to their aid. This might not be an explicit belief, but might be discernible from the person's willingness to be open about things that cause them distress. These scripts are commonly referred to as "internal working models" of others.

Different working models of others tend to generate different patterns of attachment behaviour. Individuals who have come to expect consistent support from their caregivers will seek support when needed, but otherwise use caregivers as a *secure base* to explore the world and focus on other goals (Shaver & Mikulincer, 2002). This is the normative functioning of the attachment system, and a relationship of this kind is said to be *secure*. By contrast, when past experience leads people to expect that their attempts to gain support will be ignored – or even punished – tend to *deactivate* the attachment system, de-emphasising their reliance on support, rejecting intimacy and instead focusing on self-reliance (Shaver & Mikulincer, 2002). Individuals are said to be *avoidant* when they show this pattern in relationships. Finally, when past experience leads people to expect support to be unpredictable or inconsistent, they tend to *hyperactivate* the attachment system, emphasising their reliance on support and thereby encouraging caregivers to pay attention to their needs (Shaver & Mikulincer, 2002). This pattern of behaviour is known as *attachment anxiety*. These latter two approaches are usually characterised as orthogonal dimensions, collectively known as *attachment insecurity* (Brennan et al., 1998).

The deactivation of the attachment system makes it harder to encode memories about positive attachment experiences (Fraley et al., 2000), which compounds the issue of negative experiences in attachment relationships. Individuals high in attachment avoidance are therefore likely to view others as cold and uncaring, and have little trust in the good intentions of others (Collins & Read, 1990; Cozzarelli et al., 2000). As such, their overall opinions of others tend to be negative (Bartholomew & Horowitz, 1991). Attachment anxiety tends to involve a mixed model of others. Individuals who are more anxiously attached tend to idealise their attachment figures (Bartholomew & Horowitz, 1991), but they also tend to experience these figures as capricious and rejecting (N. Collins, 1996; Collins & Feeney, 2004). Both forms of attachment insecurity are related to instability in esteem for a relationship partner (Alfasi et al., 2010).

Attachment patterns/strategies are somewhat relationship specific; an individual can be securely attached to their mother but insecurely attached to their father, or vice versa, reflecting different models of these caregivers (Baldwin et al., 1996). Despite this variability, there is a moderate degree of continuity between early attachment patterns in and patterns in later relationships (Fraleigh, 2002; Pinquart et al., 2013). There are numerous reasons for this. Firstly, attachment strategies (hyperactivating/deactivating) bias processing of attachment information such that events congruent with existing models are stored more readily (Mikulincer & Shaver, 2003). Secondly, models (scripts) of how relationships operate provide expectations for new relationships (Baldwin et al., 1993). Finally, at the highest level of generality, specific attachment-related memories may be subsumed into expectations of the social world as a whole (Bretherton et al., 1990), e.g., “if you trust people, they let you down”.. For example, Collins and Read (1990) showed that experiences with cold or inconsistent parents can undermine belief in the trustworthiness, altruism or integrity of other people. If an individual believes that other people lack altruism or integrity, even warm and consistent treatment in future relationships can be interpreted as insincere or selfishly motivated.

Attachment patterns can be measured as individual trait-like characteristics (Brennan et al., 1998), reflecting the characteristics of the individual’s more general models of self and other (Main et al., 1985). Trait-level attachment characteristics as indicate the relative accessibility of certain working models when approaching relationships generally (Baldwin et al., 1996). However, many theorists have observed that an individual can contextually show more security at certain times or in certain situations than others (e.g., Mikulincer & Shaver, 2003). as certain situational features (or current motivations) can make different models more accessible.

Attachment Anxiety and Self-Esteem

The idea that attachment relationships shape an individual’s model of self has a long history in attachment research. Complementary to their models of others, Bowlby (1973) posited that

individuals must be sensitive to the aspects of themselves that elicit or deter support from caregivers, and so build working models of their own acceptability or worth as well. Attachment anxiety tends to predict low self-esteem (see Mikulincer & Shaver, 2016, for a review) because experiences of rejection by attachment figures form a model that suggests the self is not the kind of person that others will support. Results for avoidance are more mixed, but where significant results are found, they also indicate a negative relationship (Mikulincer & Shaver, 2016). This gives some support for the idea of the self as a motivated meaning system; individuals judge themselves based on their ability to live up to standards which impact on important contingencies.

There is some overlap between attachment theory's working models and both contingencies of self-worth (Crocker & Wolfe, 2001) and the ideas of introjected standards employed by self-determination theorists (Assor et al., 2004). This overlap is interesting, given contingencies of self-worth are posited as "beliefs about what one must be or do to have worth and value as a person" (Crocker et al., 2006, p. 1752). By contrast, attachment theory explicitly follows evolutionary logic, in which the workings of symbolic consciousness can aid evolved processes, but the fundamental building blocks of these processes must be capable of existing outside of conscious awareness (Bowlby, 1969).

This is where the concept of cognitive scripts can act as an important bridge between these viewpoints. Instead of relying on direct beliefs (e.g., "I must be attractive in order to be worthwhile/acceptable"), cognitive scripts allow the individual to develop associations between certain personal qualities and performance and desired or feared outcomes (Baldwin et al., 1993). For example, individuals with low self-esteem tend to be faster to identify rejection-related words when primed with failure-related words (Baldwin & Sinclair, 1996), indicating a cognitive association between failure and rejection. These "if-then" rules of performance leading to interpersonal outcomes can enter conscious awareness (e.g., "I must be attractive or people will reject me"), but this is not necessary for them to guide a person's behaviour or cognitive preoccupations, as

experiencing shortcomings in certain domains will trigger expectations of feared outcomes whether or not the individual can identify why.

Within personal relationships, attachment anxiety is related to a greater drive to be liked by others (Brennan & Bosson, 1998), and a greater worry that one is not (N. Collins, 1996). To take the first of these, the hyperactivation of the attachment system makes attaining the support of others a more salient goal, so acceptability to others, particularly attachment figures, is more important in judgements of self. Indeed, attachment anxiety is positively associated with basing self-worth on these contingencies, as well as on contingencies which more are more bound up with the views of others, such as one's physical appearance (Knee et al., 2008; Park et al., 2004).

Secondly, attachment hyperactivation makes the individual more vigilant for cues that their attachment figure(s) might not be responsive to their needs (Mikulincer & Shaver, 2016). This means being more sensitive to rejection-related cues, and to those self-aspects that might deter support. Individuals high in attachment anxiety are higher in rejection sensitivity (Feldman & Downey, 1994), meaning they are more vigilant for rejection and react to it with greater intensity. N. Collins (1996) found that anxiously attached individuals tend to jump to negative conclusions about their partners' feelings and loyalty even when the evidence for disinterest or disloyalty is ambiguous or non-existent.

The fear that a caregiver may not come to support the individual can create, in parallel, the concern that one may not be adequate to be given support (Mikulincer & Shaver, 2003), which should therefore lead to stronger effects of rejection on self-esteem. In support of this, Hepper and Carnelley (2012) found that people's level of attachment anxiety positively predicted lower self-esteem following rejecting feedback from a romantic partner. In sociometric terms, we might say that attachment anxiety raises the threshold for interpersonal acceptance – much more is needed to persuade an anxiously attached individual that they are accepted, and conversely much less is needed to signal rejection. Indeed, Srivastava and Beer (2005) observed that attachment anxiety

predicts intensified sociometric effects, specifically greater decreases in self-esteem when impressions made on others are poor.

People with higher levels of attachment anxiety seem to have self-esteem which is generally more changeable in response to daily events; Foster et al. (2007) found that attachment anxiety is associated with less stable self-esteem, indicating that more anxiously attached people seem to be more ego-involved in their daily lives. In support of this, Crocker et al. (2009) observed that attachment anxiety was associated with more self-image goals in romantic relationships. We have already seen that there are reasons to believe that self-esteem instability might be related to weighting social comparisons more highly in self-evaluations, while self-image goals in relationships tend to give rise to zero-sum beliefs (Crocker & Canevello, 2008). However, is this true for the self-esteem goals and instability observed among more anxiously attached people? Does their heightened ego involvement translate into greater need to compete with others, to more frequent and more consequential social comparisons?

Attachment Anxiety and Social Comparisons

To answer the above question, we should examine how attachment anxiety might relate to the commonly cited motivations for performing social comparisons. One promising candidate might be self-enhancement. After all, our discussion so far has mentioned the use of defensive social comparisons to maintain a positive self-image. If attachment anxiety is associated with heightened self-image goals, and to gain approval in the eyes of others, it might seem likely that anxiously attached individuals would be particularly motivated to use downward social comparisons to self-enhance. This is in line with the logic for downward comparisons proposed by Wills (1981), that individuals under threat, particularly those with lower self-esteem, would be particularly motivated to compare downwards with other people to self-enhance.

However, it is in fact individuals with higher levels of self-esteem that tend to self-enhance more (Hepper et al., 2010), and engage in self-enhancing comparisons under conditions of threat

(Vohs & Heatherton, 2004). Attachment anxiety actually tends to dispose people to derogate themselves under conditions of threat (Mikulincer, 1998). This potentially reflects a more protective strategy pursued by those low in self-esteem, and a tendency for anxiously attached individuals to emphasise their own weakness in order to gain support from others (Mikulincer & Florian, 1998). Overall, people appear more likely to engage in upward comparisons under conditions of threat (Gerber et al., 2018).

Individuals with lower self-esteem also seem to engage less in self-improvement (Baumeister et al., 1989), possibly because they are doubtful of attaining positive change, and so considering their own shortcomings in detail is not worth the pain it induces. The negative self-views which tend to accompany attachment anxiety are therefore likely to suppress their use of social comparisons for self-improvement. Some evidence suggests that more contingent self-esteem is associated with greater self-improvement motivations (Ito & Kodama, 2006), but this is among Japanese university students, and it remains to be seen whether the same is true of young people in Western cultures.

Following Festinger (1954), we might also expect attachment anxiety to increase self-evaluation motives. Those who feel a particular lack of self-knowledge, or who are less able to tolerate uncertainty about themselves should theoretically be particularly motivated to perform social comparisons. Indeed, lower levels of self-concept clarity and greater intolerance of uncertainty do tend to go hand in hand with more frequent social comparisons (Butzer & Kuiper, 2006). Insecure attachment patterns tend to be related to poor levels of self-knowledge. Initial evidence for this comes in terms of discrepancies between self and other reports of distress; people high in avoidance tend to self-report lower levels of distress than clinical observers, while people high in anxiety tend to report higher levels of distress (Dozier & Lee, 1995). Wu has found that these uncertainties in fact extend to self-knowledge in general; insecurely attached individuals tend to be generally uncertain about their self-judgements (Wu, 2009).

In theory, then, attachment anxiety is related to motives for performing social comparisons in a mixed fashion, seeming likely to increase self-evaluation motivations, but potentially likely to decrease self-enhancement and self-improvement motivations. Once again, however, it is important to remember that a high proportion of social comparisons are not performed out of deliberate motives, and especially that they can be brought on by threat. Park et al. (2023) posit attachment anxiety as a moderator of - both in terms of vigilance for and reaction to - social evaluative-threat. Attachment anxiety is associated with heightened threat following stressors (Mikulincer et al., 2003) and higher levels of blood cortisol (Jaremka et al., 2013). In situations where social comparison information (e.g., the high performance of another person) is a potential threat, a heightened sensitivity for threat might well raise the salience of this information. As such, attachment anxiety could increase the number of social comparisons which people find themselves making inadvertently because available social comparison information is more salient in their perception.

Attachment Anxiety and Zero-Sum Self-Worth. Threats may be particularly likely to arise in romantic relationships. I have already mentioned that attachment anxiety involves sensitivity to rejection and a model of others as capricious and uncommitted to them. Doubts over a partner's loyalty could make an individual worried that their partner is considering relationship alternatives. After all, romantic partners are more likely to end relationships if they think alternatives are more appealing (Rusbult & Buunk, 1993). This makes the superior performance of relationship alternatives a threat to one's place in a relationship, clearly important to people high in attachment anxiety. This threat could therefore heighten the number of inadvertent comparisons made by people high in attachment anxiety.

A greater fear of partners looking for relationship alternatives is one way in which attachment anxiety might dispose people to experience relationship events in a more competitive manner. Another might be competition for the attention of attachment figures. Gilbert (1989/2017) theorised that human beings have an in-built motive to seek social attention, and it functions as an

important marker of interpersonal value. This is likely to be heightened when the attachment system is hyperactivated. Mikulincer and Shaver (2016) repeatedly emphasise the attention of the attachment figure as a core set-goal of the hyperactivating strategy. Caregivers need to pay attention to the individual to be responsive, and so lack of attention can be interpreted as lack of availability.

When individuals are young, or in the early stages of relationships, they rely upon very concrete indications of support and commitment, like proximity and attention, in order to regulate distress and achieve a sense of security (Mikulincer & Shaver, 2016??). As people get older, reliable indications of caregiver support give them confidence that even if the caregiver is not currently providing attention and support, this can be attained if needed. This process is, to some extent, recapitulated in each new relationship, to build this model of this specific person as being reliably available. This explains why attachment anxiety tends to be higher in new relationships (Eastwick & Finkel, 2008). If individuals have tended to receive only intermittent and unreliable support, it is harder for them to feel confident without direct indications of commitment and availability. This is appropriate to some contexts, as it would be dangerous to be complacent about receiving support from others if those others are extremely capricious.

Such a lack of availability may itself be experienced as threatening, because anxiously attached individuals tend to have little confidence in their ability to cope independently (Berant et al., 2005). In support of this, research into social media use has found that attachment anxiety predicts greater attention-seeking behaviours online (Hart et al., 2015). Bretherton and Munholland (2008) argue that if attachment goals are not met supportively, this conveys rejection to the individual, as the attachment figure being unavailable when needed. We have already seen that rejection tends to worsen the self-esteem of anxiously attached individuals, making them feel less worthy (Hepper & Carnelley, 2012).

Gilbert and his colleagues (P. Gilbert et al., 1995) argue that attempts to hold social attention generate social comparisons. Giving one's attention to another, in the sense of devoting one's time to focusing on them, is in some ways a zero-sum affair; if an individual pays attention to one thing, they necessarily have that much less attention to devote to other things, or other people. In monitoring the qualities of others that other people tend to value and respond to, we can measure how much more or less of these qualities we possess, and thereby assess our potential to hold such attention. This is supported by evidence from the Interpersonal Orientation Scale (Decker et al., 2012; Hill, 1987), in which seeking attention and the drive to compare oneself to others are positively correlated. Building on Trivers (1974), Gilbert et al. (1995) suggest that the amount of care and attention a child gets from their parent compared with a sibling is a determiner of the child's self-esteem because it affects their assessment of their potential to hold social attention.

To put Gilbert et al.'s (1995) argument in attachment theoretic terms - if an attachment figure does not meet the individual's demand for attention, this may convey to the individual that they are unworthy. If that attention is given to another person, this may convey that this other person is more worthy, as the attachment figure prefers to pay attention to them, i.e., worth is determined relatively. Memories of being ignored due to the presence of others could get stored in scripts such as "if you are less interesting/appealing than others, people will reject you" and, at a more general level, "acceptance is something you have to compete with others for". Unlike the case made above regarding romantic alternatives, this is not restricted to romantic relationships. We have already seen a theoretical case for competitive dynamics occurring in sibling relationships due to a need for the attention of parents. Theoretically, this dynamic could occur in any attachment relationship.

According to the argument I outline here, the less secure the partner's value for the individual seems to be, the more likely their attention being diverted away from the individual will be taken as a sign that they don't value the individual and are liable to abandon them. The more the

individual feels that they are in need of the partner's attention, proximity and support, the more this act will be seen as an act of explicit rejection, of lack of care for the individual's needs. This rejection would be motivated, seemingly, by the appeal of the other individual. This should be exacerbated in the case of more anxiously attached people by a negative attribution bias, which encourages them to view the behaviour of others as indicating hostility, blame and rejection (Li et al., 2023). If relationships appear to be operating on these dynamics day to day, it should not be surprising that one would feel the need to be more appealing than others in order to remain worthy.

The idea that attachment anxiety gives people a more competitive experience of their relationships is speculative at this point, but there are clear logical arguments for it, based on threat from possible romantic rivals, and a need to win the attention of attachment figures. There is also empirical evidence that attachment anxiety is linked to some of the psychological features already mentioned, those that dispose people to measure their worth in competitive ways. As I have already mentioned, attachment anxiety is positively associated with self-esteem instability (Foster et al., 2007) and with self-image goals in relationships (Crocker et al., 2009). Importantly, attachment anxiety, assessed through current self-ratings or memories of experiences with parents, is positively associated with vulnerable narcissism (Otway & Vignoles, 1996; Smolewska & Dion, 2005). Narcissism, after all, is thought to involve a focus on competition (Luchner et al., 2011) a model of self-worth that focuses on being superior to others (Brummelmann et al., 2015; Krizan & Bushman, 2015; Morf & Rhodewalt, 2001) and suffers from signs of inferiority (Miller et al., 2010; Ozimerk et al., 2021)

It is specifically this feature of working models of self, of self-worth hinging on relative performance, that I aimed to study in this project. Does attachment anxiety foster a zero-sum self-esteem system? Chapter 2 of this thesis focuses on studies which I conducted to investigate the associations between attachment anxiety and markers of a more zero-sum form of self-worth.

Jealousy

The final element of this project concerns the potential knock-on effects on a person's life of a more competitive model of self-worth. Wilkinson and Pickett (2018), in their book *The Inner Level*, suggest that societal problems as social anxiety, addictions and consumerism can be understood in terms of status striving, with people in unequal societies being affected more negatively by having low social status, and therefore being more preoccupied with it. Believing the world to be a competitive place has been found to be associated with worsened mental health (Gilbert et al., 2009), as has possessing low levels of status (Mahadevan et al., 2021; Wetherall et al., 2019). So far, though, I have only discussed judging oneself on a comparative basis in terms of what it means intrapersonally. However, I began this thesis with a quote indicating that judging oneself in this way carries interpersonal difficulties, specifically in terms of one's relationships. What does it mean for people's relationships if they see other people as competitors and enemies instead of supports and resources?

I have mentioned that more anxiously attached people tend to rate themselves as inferior to others (Irons & Gilbert, 2005), such that the initial hypotheses they test using social comparisons (Mussweiler, 2003) are likely to indicate their inferiority to others, i.e., the comparisons are likely to be in an upward direction. Upward comparisons have the potential to automatically generate an ego-threat (Brickman & Bulman, 1977; Morse & Gergen, 1970;; Tesser, 1988; Vogel et al., 2015), especially when one's self-worth is built around social comparisons. The question therefore becomes: what are the social consequences of experiencing other people as ego threats? How might competition, rivalry and hostility manifest in people's interpersonal lives?

One manifestation of this rivalry is envy. Envy involves contrastive social comparisons in which one feels threatened by the successes, attributes or possessions of another person (Alicke & Zell, 2008; Salovey, 1991). Envy can encourage individuals to improve, to better their own situation out of desire to have what others have or to be what others are (Lange & Crusius, 2015). However, it

can also involve hostility to the envied other, denigration of them and attempts to remove their advantages (Lange & Crusius, 2015). Theorists differ as to whether these are two distinct types of envy, or whether both of these are manifestations of the same drives and emotional states (Cohen-Charash & Larson, 2017; Lange & Crusius, 2015). What is clear is that envy is a potential outcome of ego threat from social comparisons, and can, at least under some conditions, lead to hostility towards other people.

Another form of rivalry associated with social comparisons, closely linked to envy, is jealousy. Different researchers have characterised – and subdivided – jealousy in different ways, but consistently identify it as involving anger and hostility towards the targets of one’s jealousy (e.g., Parker et al., 2005; Parrott & Smith, 1993; Salovey & Rodin, 1986). Salovey and Rodin (1986) argue that the distinction between envy and jealousy³ is one of intensity, rather than quality. Studying emotional reactions to both romantic and social comparison jealousy prompts, they found that both envy and jealousy involve very similar factor structures (in terms of emotions such as anger, sadness and hostility), though jealousy elicited more intense negative reactions.

However, Parrott and Smith (1993) point out a key difference between the two concepts; jealousy is triadic (also see Harris & Darby, 2010). While envy only requires an envious individual and a target for their envy, jealousy involves three people: the jealous individual, the target of their jealousy, and a third person, one who the jealous individual has or desires some kind of relationship with. The target of one’s jealousy is an individual who poses a threat to this relationship. Threats to valued relationships are present in many definitions of jealousy, for example: “a complex of thoughts, emotions, and actions that follows loss or threat to self-esteem and/or the existence or quality of the (romantic) relationship” due to a real or potential rival (White & Mullen, 1989, p. 9, parentheses mine), or: “a protective reaction to a perceived threat to a valued relationship, arising

³ These authors actually refer to these as “romantic jealousy” and “social comparison jealousy”. However, they acknowledge that social comparison jealousy is “traditionally termed envy” (Salovey & Rodin, 1984, p. 780)

from a situation in which the partner's involvement with an activity and/or another person is contrary to the jealous person's definition of their relationship" (Hansen, 1991, p. 213). While the latter definition allows for jealousy to occur without a target individual, I will not be considering such cases as instances of jealousy.

Harris (2003) emphasises that a relationship need not be threatened in its entirety for jealousy to be experienced. As well as romantic rivals, jealousy can also be experienced towards the friends or family of a relationship partner (Bevan & Samter, 2004; Gomillion et al., 2014; Kennedy-Lightsey & Booth-Butterfield, 2011). Similarly, the relationship under threat need not be romantic, people can experience jealousy in family and peer relationships (Bevan & Samter, 2004; Volling et al., 2010). Harris (2003) follows Tov-Ruach (1980) and Parrott (1991), in claiming that jealousy occurs when there is a threat to the "formative attention" an individual gets from their relationship partner; in other words, attention that is valued highly because it is important to the self-concept of the jealous individual. Similarly, Parrott and Smith (1993) argue that people can experience jealousy in any relationship that is important to their self-concepts.

In this project, I investigated not just the potential associations between attachment anxiety and zero-sum self-worth, but also the potential effects of comparative self-models on jealousy. There are a number of reasons why I focused on jealousy rather than envy. Firstly, because of jealousy's essential basis in personal relationships. It involves the way a person sees themselves, but also the perceived regard of others, as perceived regard might determine, for example, how far can one trust a partner's commitment and loyalty (Murray et al., 2000) and therefore the extent to which the relationship might be under threat (Rodriguez et al., 2015). The triadic nature of jealousy means the scope of hostility it generates is wider than that of envy. Anger and resentment can be directed not just at the target of one's jealousy, but also at the relationship partner, or the person one desires a relationship with. This can damage the relationships that one may prize the highest. Jealousy is linked to a high proportion of cases of intimate violence (Mullen, 1996; Pichon et al.,

2020), along with possessiveness, which is arguably a consequence of jealousy (Carson & Cupach, 2000). This also highlights another reason why I focused on jealousy; its consequences can be extremely severe. Finally, there are seemingly important variations in dispositions to jealousy which stand in need of explanation.

Evolutionary theorists believe that jealousy, no less than self-esteem, serves evolutionary functions. In particular, jealousy is thought to help people to manage threats to relationships (Buss & Shackelford, 1997; Chung & Harris, 2018). Jealousy could serve reproductive purposes, particularly in romantic relationships, by warding off mate-poachers (Schmitt & Buss, 2001) and dissuading partners from emotional or sexual infidelity, because all these factors can threaten an individual's reproductive success (Buss & Shackelford, 1997). It could also serve to maintain close relationships in general and encourage relationship partners to invest more time and resources into oneself (Dillon, 2013; Chung & Harris, 2018), as these would have been important to survival, particularly when resources were scarce. If jealousy has an evolved function, this suggests it is somewhat inevitable in human relationships. In support of this, jealousy tends to be positively correlated with one's level of attraction for a partner and level of investment in a relationship, and with love (Mathes & Servera, 1981; Swami et al., 2012; White, 1984). Individuals, from infancy to adulthood, seem to be jealous when their parents seem to invest more time and affection into others than into the individual (Hart, 2016; Rauer & Volling, 2007).

The inevitability of jealousy could be seen as a good thing, especially in a romantic context. Higher levels of jealousy have been found to predict relationship longevity (Mathes, 1986). Reactive jealousy, i.e., jealousy in response to real infidelity, is associated with higher levels of relationship quality in heterosexual relationships (Barelds & Barelds-Dijkstra, 2007), possibly because it functions as a sign of investment in a relationship. Considering jealousy to be integral to love can be dangerous, however. Research has found that this belief can lead to tacit support of controlling behaviours and intimate partner violence (Papp et al., 2017; Puente & Cohen, 2003). Jealousy is a

form of hostility between people (Parrott & Smith, 1993). I have already mentioned the association between romantic jealousy and intimate partner violence (Pichon et al., 2020). Friendship jealousy tends to lead to relational aggression among adolescents (Culotta & Goldstein, 2008; Parker et al., 2005), including derogation of a rival to one's other friends. Jealousy has been found to be a leading cause of resentment among 15-18 year olds in Türkiye (Öztürk & Atli, 2021). Meanwhile, sibling jealousy is associated with poorer adjustment in adult life, including greater conflict with siblings (Hamwey & Whiteman, 2021) and greater distress in later romantic relationships (Rauer & Volling, 2007). Jealousy is also a major reason why people seek therapy for their relationships (White, 2008).

Given reactive jealousy is not associated with poorer relationship quality (in at least some relationships), some researchers differentiate between good and bad forms of jealousy (e.g., Attridge, 2013). 'Bad jealousy' usually refers to something like anxious jealousy (Buunk, 1997), in which an individual ruminates on possible threats to a relationship. This form of jealousy is particularly negatively associated with relationship quality (Barelds & Barelds-Dijkstra, 2007). However, jealousy in response to real infidelity can also result in violence (Pichon et al., 2020), and so it too can therefore be a cause for concern. Reactive jealousy is also not associated with better relationship quality in homosexual relationships (Barelds & Dijkstra, 2006). The researchers who found this attribute it to the prevalence of consensually non-monogamous relationships among gay men. Non-monogamous individuals tend to have different attitudes to extradyadic intimacy and sex (Mogilski et al., 2019). These results point to the possibility that some effects of jealousy, particularly the beneficial effect of reactive jealousy, are not absolute, but relative to the structure and expectations of the relationships they occur in.

Jealousy and Consensual Non-Monogamy

Consensually non-monogamous (CNM) relationships are gaining more attention in the current era. In CNM relationships, individuals engage in sex or intimacy with multiple people, with the consent of all those involved (Conley et al., 2017). Recent census estimates in the USA show that

12% of adults report having engaged in consensual extradyadic sex at some point in their lives, and 6% currently being involved in “completely non-monogamous” relationships, with a further 6% indicating a relationship more similar to complete non-monogamy than to complete monogamy (YouGov, 2023a). The numbers are smaller in the UK, with only 2% of people reporting being in a polyamorous relationship, but young adults are both more open to the idea and more likely to be involved in these relationships (YouGov, 2023b).

This generates a puzzle. How can the fear of partners engaging in extradyadic sex or intimacy lead some people to attack or even murder their partners (Pichon et al., 2020; Puente & Cohen, 2003; Spencer & Stith, 2020), while others engage in relationships where extradyadic intimacy is allowed or even encouraged? If jealousy evolved to prevent extradyadic sex and intimacy, why would some people not be troubled by these events occurring? Individuals in CNM relationships report similar levels of relationship quality to those in monogamous relationships (Balzarini et al., 2019; Mitchell et al., 2013). In fact, though it is a common belief that monogamous relationships lead to less jealousy than CNM relationships (Conley et al., 2013) – and are superior in part for this reason – some studies have actually found that people in CNM relationships experience less jealousy than their monogamous counterparts (Conley et al., 2017; De Visser & Macdonald, 2007).

Importantly, though, studies comparing jealousy between monogamous and CNM individuals tend to rely on measures of how much jealousy a person would experience at a given event, and do not take into account how often these jealousy-provoking events occur. If one’s partner having sex with another person makes a person in a CNM relationship moderately jealous, they might experience more jealousy overall than a monogamous person who would be made severely jealous by the same event, given this event may happen less frequently in this individual’s life. Nonetheless, there are studies which find that individuals engaging in CNM often experience jealousy in less damaging ways (Ritchie & Barker, 2006) and that they sometimes react with vicarious joy to a partner being emotionally or sexually involved with other people (Mogilski et al., 2019). It is

noteworthy that discourse around CNM relationships often acknowledges the likelihood of jealous feelings, but stresses that this does not imply a partner's lack of feelings or commitment (e.g., Easton & Hardy, 2009).

Clearly intimate partner violence is not the usual response to jealousy-inducing events among either monogamous or CNM individuals. But this only further demonstrates the variety of responses – and intensities of response – to the occurrence or fear of extradyadic sex and intimacy. What can account for this variation between people?

Conley et al. (2017) raise the possibility that individuals who are more disposed to jealousy may be less likely to seek out CNM relationships, though they do not investigate this directly. These individuals may have a correct belief that CNM relationships would make them personally more jealous, and monogamous relationships would therefore be more positive for them. In support of this, Moors et al. (2015) found that these groups differ in attachment orientations, with anxiously attached individuals being less likely to engage in CNM relationships, while securely attached individuals are more likely to do so. They argue that partners engaging in extradyadic sex and intimacy could exacerbate anxiously attached individuals' worries about abandonment and trigger their disposition to jealousy. I extend this argument by maintaining that attachment anxiety will increase people's vulnerability to feeling that they are being compared to, and judged against, others, and that through being viewed less positively than these others, they are likely to feel their relationships under threat. I explain these connections in greater detail below.

Attachment Anxiety, Jealousy, and Zero-Sum Self-Worth

The connection between attachment anxiety and jealousy is well-established (e.g., Collins & Read, 1990; Knobloch et al., 2001; Rodriguez et al., 2015). In fact, this relationship is so consistent that researchers often use attachment anxiety to assess concurrent validity on jealousy scales (e.g., Gomillion et al., 2014). Attachment anxiety also specifically predicts greater levels of jealous abuse (Dutton & White, 2012; Rodriguez et al., 2015). Sharpsteen and Kirkpatrick (1997) note that

attachment anxiety and jealousy both serve the function of maintaining close relationships. Jealousy occurs when there is a threat to a valued relationship, involves attachment-relevant emotions, e.g., feelings of insecurity and distress (Bush et al., 1988; Harris & Darby, 2010), and motivates efforts to retain the relationship. This is consistent with Harris and Darby's (2010) two-step model of jealousy dispositions, in which attachment insecurity heightens sensitivity to threat.

The association between attachment anxiety and sensitivity to relationship threat can be expressed in terms of working models of others. As we have seen, anxious attachment involves models of others as inconsistent and rejecting. When a person is emotionally reliant on people who are not highly committed and liable to abandon them, they need to be sensitive to possible indications of likely abandonment (Bowlby, 1973). Seeing people in this way therefore makes it natural that a person would be more sensitive to relationship threat, as has been observed among people high in attachment anxiety (Feldman & Downey, 1994). As jealousy is a response to relationship threats (Sharpsteen, 1995; White & Mullen, 1989), attachment anxiety may heighten a tendency to jealousy because it involves doubts about the commitment of others.

However, I contend that this association can also be expressed in terms of working models of self. Models of self are thought to complement models of others (Bowlby, 1973), so if others are seen as inconsistent and rejecting, it is likely that this goes hand in hand with a perception of oneself as apt to be rejected. As White and Mullen's definition above indicates, jealousy can result from threats to self-evaluation, specifically in which one's self-evaluation has been threatened by the target of one's jealousy (e.g., DeSteno et al., 2006; Sharpsteen, 1995). Differences in self-worth dynamics may therefore be reflected in the experience and expression of jealousy.

These ego threats are often based in social comparisons. Salovey and Rodin (1986) identified social comparisons as underlying both the experiences of jealousy and envy. DeSteno and Salovey (1996) propose that romantic jealousy is a self-evaluation maintenance (SEM) process; that is, a partner's interest in a romantic rival can signal their preference of the rival to the individual. They

found that individuals tend to experience more jealousy in response to a partner flirting with a rival if that rival excels at a domain central to the individual's self-definition. The rival constitutes an upward comparison target and jealousy is the response to the self-evaluation threat posed by this rival. Along similar lines, Broemer and Diehl (2004) found that encouraging an individual to notice similarities between themselves and a rival increases their jealousy. The authors propose that this is because the rival threatens the individual's sense of distinctiveness, i.e., those qualities that make them irreplaceable to their partner.

These comparative dynamics do not merely apply to romantic jealousy. Hamwey and Whiteman (2021), for example, found that making more social comparisons with one's siblings tends to be associated with greater sibling jealousy. Self-esteem threat has been found to lead to greater jealousy even when the relationship under threat is newly formed and merely focused on completing a shared activity (DeSteno et al., 2006). After all, as mentioned above, some theorists have argued that all these forms of jealousy are thought to reflect the same underlying concern, threats to the "formative attention" granted by important relationships.

A partner's decision to spend time with another person in preference to oneself is frequently cited as a source of jealousy, in peer relationships (Bevan & Samter, 2004) and romantic relationships (Kennedy-Lightsey & Booth-Butterfield, 2011). Kennedy-Lightsey and Booth-Butterfield (2011) found that jealousy in romantic relationships occurs most frequently when partners choose to spend time with non-romantic others. These authors attribute this jealousy to the self-esteem threat caused by a partner choosing someone else over the jealous individual. This may be troubling when the rival is a non-romantic other, because, as Gomillion et al. (2014) observe, people often expect their partners to be more responsive to them than to their friends. We saw earlier that the difference in attention that parents devote to each child was posited by P. Gilbert et al. (1995) to be a determiner of children's self-esteem. Difference in time spent with each child is one of the dimensions of what Volling et al. (2010) call parental differential treatment of children. This overall

construct was found to lead to more comparisons with one's sibling and greater sibling jealousy (Hamwey & Whiteman, 2021).

In this way, jealousy is not merely a result of self-worth dynamics, but can also help to make their functioning more concrete. When an individual sees their relationship partner devoting time and attention to another person, it can make the individual feel like they are being ignored in favour of this other person, and that they are therefore less valued as a relationship partner. In this way, the other person becomes a threat to them and their place within the relationship, and therefore earns their hostility and resentment. Jealousy appears to exemplify competition for a sense of worth, considered both in terms of self-esteem and one's value to a relationship partner.

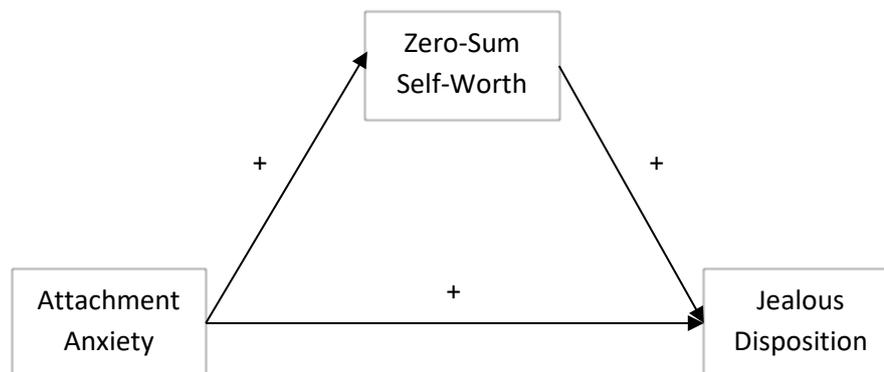
If jealousy is brought on by ego threats from social comparisons with possible rivals, then the more that one experiences ego threats from social comparisons, the more jealous that person should tend to become. The more an individual experiences their own worth and value as being determined relatively, i.e., the more their self-worth seems to be a zero-sum game, the more positive attention being given to other people should make them feel threatened, and therefore the more likely they should be to react to the other person with jealousy. Furthermore, this should be particularly dangerous for individuals who are high in attachment anxiety, as they are already predisposed to view themselves negatively (Mikulincer & Shaver, 2016) and engage in self-criticism (Rogier et al., 2023). If they feel they are being judged against others, it may be easy for them to believe they are being seen as worse.

I have laid out a case arguing that the working models of self and others which develop as part of attachment anxiety have an increased focus on social comparisons. This implies that highly performing others, and their attendant ability to garner the attention and value of a relationship partner, is more of a threat to the sense of self-worth of a person who is high in attachment anxiety, . If my argument is correct, it is no wonder that more anxiously attached individuals are less likely to be drawn to CNM relationships. They will tend to view their own worth as on the line (Foster et al.,

2007), especially in relationship settings (Knee et al., 2008), and if their negative self-views cause them to see themselves as less appealing than others, the interest shown to another party is likely to make them feel more threatened by the presence of this other person, threatening their relationship and its quality in turn..

Figure 1

Proposed Mediation Model to be Tested in this PhD



Based on the case outlined above, I propose that, as in Figure 1, the association between attachment anxiety and jealousy is mediated by a zero-sum form of self-worth. This is not the only mediating mechanism that is likely to account for the relationship between attachment anxiety and jealousy. While working models of self and others are somewhat complementary, they are not perfectly so, and models of others as capricious, rejecting and prone to abandon one are likely to exert a mediating effect of their own. This effect may well overlap somewhat with the effect of models of self, but I assume that both will be distinguishable as distinct mediating mechanisms between attachment anxiety and jealousy. Therefore, the indirect effect through zero-sum self-worth shown below is assumed to be a partial mediation.

Previous evidence offers support for this mediation model. One study found that ego threat mediated the link between attachment anxiety and jealous responses⁴ to imagined sexual infidelity (Besser & Priel, 2009), while another found that this relationship was mediated by a sense of inferiority (Karakurt, 2012). Besser and Priel (2009) also found that vulnerable narcissism predicted stronger jealous responses, though this relationship was non-significant when attachment anxiety

⁴ They do not describe it as jealousy, but look at anger, anxiety, dysphoria and hostility following infidelity, which overlaps substantially with reactive jealousy (Buunk, 1997)

was included as a predictor. They argue that attachment anxiety is what confers the vulnerability to rejection associated with vulnerable narcissism, at least in this case. Given we have already seen that narcissism seems to involve a more competitive, antagonistic approach to self-worth, this makes it plausible that a more comparatively based model of self-worth can explain tendencies to react more intensely to extradyadic sex, if not all forms of extradyadic romantic contact.

It is important to acknowledge the position I start from as a researcher and what my aims are in this project. I begin from a belief that a zero-sum approach to self-worth can heighten jealousy, and that such an approach is not an immutable part of human nature. Evidence that a zero-sum approach can be reduced opens the possibility that this can also reduce the experience of jealousy in some cases. My intention is not to doubt the validity of jealousy as such, which is thought to have strong evolutionary roots (Buss & Shackelford, 1997; Chung & Harris, 2018), and appears to provide benefits to relationships in some circumstances and in some manifestations (Barelds & Barelds-Dijkstra, 2007; Neal & Lemay, 2014). However, evidence that jealousy is beneficial in relationships that prize exclusivity, but not in relationships that do not raises the question as to whether some functions served by jealousy can be achieved without the hostility and conflict it entails. These questions are beyond the scope of my PhD, but I hope that future researchers will investigate whether the tools used by some individuals to attenuate and mitigate jealousy (e.g., Mogilski et al., 2019, Ritchie & Barker, 2006) can be extended, and to what extent it is desirable to do so. A wider implication from investigating the roots of jealousy is the opportunity to build up resources which could reduce conflict between people. If and when people do pursue strategies to reduce jealousy, I believe that people would benefit from a more detailed understanding of what makes themselves and their partners susceptible to feeling jealous in the first place, helping them to foresee and manage the risks and challenges that will arise.

The Population

I set out to investigate the aforementioned mediation model among young adults in the UK. There were a number of reasons for choosing this population. The first related to the ease of conducting my research. Undergraduate students at the University of Sheffield must take part in psychological research for course credits, and they attend classes in the psychology department where recruitment posters could be placed, thus reducing the time and financial burden of recruitment. Additionally, the experimental manipulation I adapted for use in Study 2 was originally intended for university students (Aspinwall & Taylor, 1993) and required a sample with a set of strongly shared experiences, such as the transition to university.

The second reason for focusing on young adults was the fact that the relationship experiences of this population make these questions highly relevant. Young adulthood is a transition period in people's social lives. One of the most important changes that occurs in interpersonal relationships tends to occur at around this time in people's lives, which is the changing of people's dominant attachment figures. Earlier, during adolescence, peers begin to replace parents as the target of people's attachment system (Hazan & Zeifman, 1994), such that individuals begin to seek proximity with peers, turn to peers when in distress and, eventually, use peers as a *secure base* as people who can be relied upon in times of need to allow the individual to engage confidently with the other trials of life. As adolescence gives way to young adulthood, Hazan and Zeifman (1994) found that romantic partners tend to become people's dominant attachment figures, though they only tend to be the focus of all attachment functions (proximity seeking, safe haven, secure base) after around two years into the relationship. The length of relationships are important, as while most studies concur that romantic partners are the dominant attachment figures of young adults (Doherty & Feeney, 2004; Trinke & Bartholomew, 1997), at least one study found that young adults turn to friends over romantic partners to meet their attachment-based drives (LaGuardia et al., 2000) when romantic relationships are short-lived. On the other hand, attachment anxiety tends to

play a particularly strong role in romantic relationships as they are forming, hyperactivating the attachment system, which then leads people to seek out these specific others in order to fulfil their attachment drives (Eastwick & Finkel, 2008). Among young adults, there is substantial variation in the position that different relationships play in their lives, which could lead people to be uncertain of the importance that others hold in their relationships.

The self-esteem of young adults tends to be relatively volatile, both in terms of instability, and contingency, especially on the approval of others (Meier et al., 2011). Young adults are also often uncertain of their identities (Lodi-Smith & Roberts, 2010) and may therefore look for external markers of their successes and failures. Younger people are also more reactive to daily events because they use fewer adaptive strategies for dealing with negative situations (Coats & Blanchard-Field, 2008). As people get older, begin to have more certain self-concepts and avoid negative situations, their self-worth tends to be less reactive and contingent. Attachment anxiety does seem to exacerbate these issues among young people, as it was among a sample of undergraduate students that Foster et al. (2007) found attachment anxiety to predict self-esteem instability. The opportunities for the approval of others to be gained and lost may be particularly consequential for people at this stage in life.

Finally, the variation in jealousy responses are most pronounced in this population. As discussed, reactions to extradyadic activity can range from violence to joy, and this is seen most clearly among young adults. On the one hand, intimate partner violence is most commonly perpetrated in the early stages of adulthood (Johnson et al., 2015), implying that the self and relationship related insecurities mentioned above can weigh particularly heavily on young people. However, consensual non-monogamy is also most commonly practised by younger adults (Hauptert et al., 2017). Thus, among this age group, the different ways that people process relationship events appear to be very consequential. In summary, then, the processes investigated in this project have their most obvious application to a population of younger adults.

The Project

My main research questions in this project are:

1. Does attachment anxiety increase the role of contrastive social comparisons in working models of self, i.e., does attachment anxiety make self-worth more zero-sum?
2. Does a zero-sum model of self-worth lead to increased levels of jealousy?
3. Does a zero-sum model of self-worth partly account for the association between attachment anxiety and heightened jealousy?

As zero-sum self-worth is a new construct, I have additional goals in preparing the ground for future research into it. Firstly, in this introductory chapter, I have laid out the concept of zero-sum self-worth and how it relates to previous concepts in psychology. Secondly, in Chapter 2, I explore how zero-sum dynamics in self-esteem can be measured. Thirdly, because I have posited zero-sum self-worth as an individual difference, I aim to investigate the extent of variation in zero-sum self-worth between people, which I investigate most directly in Study 3, in Chapter 4. My final research goal is methodological; I investigate whether the relationships specified in my research questions are consistent across research contexts, or whether experimental, daily life and retrospective research methods give different pictures of people's social comparisons and jealousy.

I conducted three studies to answer these questions:

- **Study 1** was a cross-sectional online study using self-report survey measures. Participants reported on their attachment dimensions, social comparison frequency, romantic jealousy and self-esteem.
- **Study 2** was an online experimental study measuring the effect of a manipulated social comparison on state self-esteem.

- **Study 3** was an experience sampling study in which participants reported on social comparisons, self-esteem and jealousy multiple times per day through a phone app.

The three empirical chapters of this thesis, however, are not divided along the lines of these studies, but rather in line with my research questions. **Chapter 2** focuses on zero-sum self-worth and its relationship with attachment anxiety. I begin this chapter by providing an operational definition of zero-sum self-worth, introducing the measures I use to study it. I critically review past research which has found associations between these operational components and attachment anxiety, before reporting on social comparison and self-esteem relevant elements from Study 1 and then on Study 2. I conclude by discussing how my findings refine and extend this existing research.

Chapter 3 focuses on jealousy, and its links with attachment anxiety and zero-sum self-worth. I review different means of studying jealousy, and critically review past research which has found associations between measures of jealousy, attachment anxiety, social comparisons and self-esteem. I then report jealousy-relevant elements of Study 1, which explored whether jealousy is heightened by comparative models of self-worth, operationalised as the frequency with which people performed social comparisons. I also performed mediation analyses testing whether the effect of attachment anxiety on jealousy is mediated by social comparison frequency. I conclude this chapter by discussing the substantive and methodological implications of my findings, before discussing alternative means to measure social comparisons and jealousy.

Chapter 4 brings together these separate strands, by investigating social comparison behaviour in daily life through experience sampling methods. I begin by discussing the ways in which daily life research can supplement, but also challenge, self-report and experimental research, and look at past research that has used this methodology. I then report the findings of Study 3, examining the effects that social comparisons have, in the immediate and extended term, on state self-esteem and jealousy, as well as the role played by situational factors. I also investigate how these effects differ across participants, particularly as a result of attachment anxiety. I conclude by

comparing these results with prior research and my own prior studies to see what substantive conclusions can be drawn about comparison behaviour among young adults, and why methodologies may differ in the conclusions they suggest.

These three studies used different quantitative methodologies. This diversity of methods was employed to investigate the extent of methodological convergence in this area; while significant effects in one study could be a methodological artefact, congruent effects across studies give more reliable evidence for a true effect in the population. In particular, experience sampling methods aim to provide an understanding of how psychological processes occur in people's actual everyday lives (Bolger et al., 2003), while experimental studies attempt to remove confounding influences to study the effects of certain effects quite precisely. The different studies, therefore, gave me a chance to compensate for the failings of each method through the strengths of the other.

Finally, in **Chapter 5**, the general discussion, I review what these studies tell us about zero-sum self-worth, in terms of its status as a genuine individual difference in self-evaluation, how it relates to attachment-theoretic working models of self, and how it affects people's disposition to regard each other as threats and rivals. I conclude by discussing how psychologists could extend these findings, and the ways that people can help to manage and overcome a zero-sum sense of self-worth.

Chapter 2: Attachment Anxiety and Zero-Sum Self-Worth

Abstract

Maintaining and advancing a positive view of oneself is a fundamental drive in human life. However, when self-esteem is based upon hierarchical contingencies, this drive can threaten to turn others into enemies as their successes become a source of threat, and their failings an opportunity. I propose that people differ from one other in the extent to which they approach self-worth as a zero-sum game, and I outline two operational methods to measure this disposition. I conducted two studies to investigate whether this approach to self-worth is associated with attachment anxiety, which has previously been found to lead to less stable and more contingent self-worth. In Study 1 ($N = 163$), participants completed measures of attachment orientations, social comparison orientation and trait self-esteem. Attachment anxiety was associated with performing social comparisons more frequently, and my data supported a model in which this social comparison frequency led to lower self-esteem. In Study 2 ($N = 306$), I exposed participants to a manipulated upward social comparison target, and investigated whether this comparison would have a stronger effect on state self-esteem among people who were high in attachment anxiety. I did not find evidence of a moderation effect in this study, for attachment anxiety or for other trait-level variables. I found inconsistent evidence for a link between attachment anxiety and a zero-sum approach to self-worth, and I conclude this chapter by discussing other methods that researchers could use to gain a clearer answer to this question.

Defining Zero-Sum Self-Worth

In the previous chapter, I presented a theoretical and empirical case that attachment anxiety may dispose people to view their own worth, and their acceptability to others, as being determined by their standing relative to other people, i.e., to develop a zero-sum form of self-worth. In this chapter, I explain the two ways in which I operationally define zero-sum self-worth, and report on two studies that I conducted to test attachment anxiety's association with these components, before reviewing what we can learn from these results about how individuals high in attachment anxiety evaluate themselves.

Firstly, when studying self-esteem, it is important to pay attention to the difference between self-liking and self-competence (Tafarodi & Swann, 2001). Self-competence refers to a sense of self-efficacy, the extent to which one rates oneself as able to perform important tasks and achieve what one sets one's mind to. Self-liking, on the other hand, refers to "the valuative experience of oneself as a social object, a good or bad person" (Tafarodi & Swann, 2001, p. 655). As I stated in Chapter 1, these relate to the categories of *instrumental* and *intrinsic/relational* value as the two paths to social inclusion discussed by Leary et al. (2014). Theoretically, either of these can be zero-sum, and can vary in the extent to which they are zero-sum. A person can evaluate their abilities at performing tasks relative to the ability of others (Mussweiler, 2003; Festinger, 1954), or they can evaluate their abilities based on whether these allow them to achieve certain specific goals (Bandura, 1986). Similarly, one can, in line with the idea of intrinsic self-value (Leary et al., 2014; Rogers, 1961), evaluate oneself as a person of worth regardless of any contingencies or relative standing, or one can see judgements of relational value to be inherently comparative, such that whether or not one is worthy of being liked depends on how one compares to other people (Gilbert et al., 2007).

In this project, I use a conception of self-esteem which is mostly based on self-liking. In light of this, zero-sum self-worth here refers to the extent to which people view themselves as good or bad based on how what is likeable in them compares to what is likeable in others. This is more

clearly relevant to both insecure relationships and the experience of jealousy. Attachment anxiety is related to low levels of both self-liking and self-competence (Brennan & Morris, 1997). However, Brennan and Morris (1997) also explain that self-liking has primacy, from an attachment-theoretic perspective. Self-liking should result from secure and reliable caregiving, in which the individual comes to anticipate and feel worthy of the support of the other (Bowlby, 1973). Once a secure relationship is in place, the individual can engage in exploration, which builds a sense of self-competence (Bowlby, 1973). In seeking the approval of attachment figures (Brennan & Bosson, 1998; Park et al., 2004), and their ongoing commitment (Knee et al., 2008), more anxiously attached individuals are most immediately concerned with their relational value.

In Chapter 1, I stated that having a zero-sum approach to self-worth means viewing social comparison information as being especially diagnostic of one's self-worth. I will now explain why this would lead to both an increased frequency of social comparison, and more intense effects of social comparisons on self-esteem.

Self-related motives (self-evaluation, self-enhancement, self-improvement and self-verification and/or self-destruction) represent the most commonly cited reasons for performing social comparisons (Helgeson & Mickelson, 1995; Wood, 1989) aligning with the most prominent self-related motivations (Gregg et al., 2011). The more diagnostic a person perceives social comparisons to be of their own worth, the better they serve as a strategy to fulfil (most) self-related motives. To see this, imagine two people: the first believes that their worth as a person can be definitively established through social comparisons, and the second does not. If both have an opportunity to compare themselves with another person, this comparison is more informative for the first person's self-evaluation. If their comparison target is performing worse than they are, this is likely to improve the self-evaluations of the first person more than the second and thus represents a better strategy for their self-enhancement. An equivalent point can be made for self-verifying comparisons. It is unclear whether this applies to self-improvement motivations, which are aimed at

changing one's current status rather than simply establishing it. However, it would not make sense to perform a social comparison to self-evaluate, self-verify or self-enhance if the comparison was not perceived to be diagnostic of one's own abilities or worth, at least to some extent. Comparisons performed in service of these motives are therefore made more likely when the comparisons appear more diagnostic of one's own standing. As these are among the most common motivations for social comparison, this should mean that zero-sum self-worth will increase the overall frequency of deliberate social comparisons.

The foregoing logic does not imply that a person is more likely to perform any given comparison if it is more diagnostic of their self-worth. Some social comparisons are counterproductive to self-related motives. While any social comparison can serve the function of self-evaluation, unflattering (most likely upward) comparisons are counterproductive to self-enhancement, and comparison information which does not align with initial self-assessments is counterproductive to self-verification. This is all the more true as the perceived diagnosticity of these comparisons increases. High perceived diagnosticity of comparisons is therefore likely to decrease the likelihood of people deliberately performing comparisons which run counter to their motivations. As I noted in Chapter 1, though, not all comparisons are carried out deliberately, (D. Gilbert et al., 1995; Wood et al., 2000).. Morina (2021) argues that salient features of a situation can induce a person to perform a social comparison, especially when those features are threatening. For example, an individual motivated by self-enhancement or self-protection motivations is likely to be threatened by information that could reflect negatively on them and their worth as an individual or relational partner. Thus, the threatening nature of certain comparisons, which makes people less likely to perform them deliberately, can make people more likely to perform them inadvertently.

People tend to be threatened by negative social-evaluative information about themselves; social-evaluative threat has been found to be one of the strongest predictors of stress hormone release (Dickerson & Kemeny, 2004). In Park et al.'s (2023) model of social-evaluative threat, basing

one's self-worth on a particular contingency is a key moderating factor which makes people more sensitive to threats in that domain. The more a person's self-worth rests on social comparisons, therefore, the more sensitive they should become to zero-sum threats. If social comparison information constitutes a source of social-evaluative threat, its distressing nature is likely to make it highly salient in one's perception, as humans are thought to selectively attend to sources of threat, including social threat (Lundqvist & Ohman, 2005; Lobue et al., 2010). Sensitivity to a particular form of threat is partly constituted by vigilance for it (Park et al., 2023), so individuals who are sensitive to zero-sum threat are likely to pay more attention to social comparison information. As such, negative comparisons should be more threatening, and therefore more likely to be performed inadvertently, the more self-worth is treated as a zero-sum game. Individuals who base their self-worth on social comparisons are likely to compare themselves to others more frequently, partly as an active strategy and partly because possible comparisons attract their attention as they go about their lives. Therefore, I take social comparison frequency to be a key indicator of basing one's self-worth upon social comparisons.

The second component of threat sensitivity that Park et al. (2023) identify is having more intense responses to threat. From this I derive the second operational component of zero-sum self-worth; the reactivity of self-esteem to social comparisons. Basing one's self-worth on a particular contingency implies that successes and failures in that domain will have greater effects on one's self-esteem (Park et al., 2007). In the previous chapter, I reviewed some evidence that the intensity of reactions to social comparisons varies substantially between people, and suggested that this might be a trait-like individual difference. Moreover, one's reactions to social comparisons tend to be stronger the more frequently one is disposed to perform them (e.g., Buunk & Brenninkmeijer, 2001). Frequent comparers tend to evaluate their own network of social relationships as less satisfying when exposed to an upward comparison target (a person describing a very positive network), and more satisfying when exposed to a downward comparison target, as compared with people lower in the trait (Buunk et al., 2007). In particular, upward social comparisons have been found to affect

self-esteem particularly strongly among people who perform more social comparisons (Vogel et al., 2015). When people who take a zero-sum approach to self-worth perform social comparisons, they are likely to take the information these provide as more definitive of their own worth.

The above evidence suggests that: individuals differ meaningfully in the frequency with which they perform social comparisons and in how strongly these affect their self-esteem, and also that these components are interrelated. In other words, there seems to be a general individual difference in zero-sum self-worth. I will now explain the measures I will use to test these two components.

Measuring Zero-Sum Self-Worth

It might seem that there are already adequate measures for capturing the extent to which self-worth is based on social comparisons, in the Competition subscale of the Contingencies of Self-Worth scale (Crocker & Wolfe, 2001) or the Striving to Avoid Inferiority Scale (Gilbert et al., 2007). Contingencies of self-worth (CSWs) represent specific domains on which a person stakes their sense of self-worth, with competition sitting alongside academic competence, approval, appearance, family support, virtue and god's love (Crocker & Wolfe, 2001). If a person rates themselves highly on the competition subscale, this suggests that their self-worth relies on outcompeting others. The link between competition and social comparison was drawn by Festinger and his colleagues (Hoffman et al., 1954, p. 156), who stated "competition arises because individuals, in situations where they are evaluating some ability, are strongly motivated by a concern about their comparability to other members of the group.". Concern with competition reflects a specifically comparison-focused mindset. The Striving to Avoid Inferiority Scale (SAIS) asks individuals to rate statements about the competitiveness of their social world, such as "To get on in the world, you have to compete with others" and "People compare me with others to see if I match up". The felt need to compete with others is part of a variable called *Insecure Striving*. This has the advantage of not simply measuring

one's personal evaluation of one's worth (self-esteem), but also one's perception of the regard of others.

I believe that neither of these measures will suffice to measure zero-sum self-worth, however. The items of the competition subscale make reference to performance in competitive situations (e.g., "My self-worth is influenced by how well I do on competitive tasks"). Zero-sum self-worth is thus slightly different to competition CSW, as it does not mean staking one's self-worth on a specific domain, but evaluating oneself in a comparative manner, which can be based on performance in any domain. For example, take a person who stakes their self-worth on academic performance. Successes in this domain can be established non-comparatively, e.g., by achieving specific grades, or alternatively, they can be established comparatively, by outperforming one's peers. Both of these are examples of an academic contingency, as opposed to a specifically competition-based contingency, though the latter is an example of zero-sum self-worth.

Additionally, concerns have previously been raised with the self-report nature of the contingency of self-worth methodology. For example, Lemay and Ashmore (2006) point out that people with low self-esteem report basing their self-esteem on the approval of others more than those with high self-esteem. But longitudinally, when individuals of any self-esteem level experience rejection, their self-esteem decreases, and they begin to more strongly endorse the idea that their self-esteem is based on approval (Lemay & Ashmore, 2006). This suggests that people only realise how much they depend on the approval of others when they lose it, and the self-reported contingency is more a reflection of this awareness than the actual contingency itself. In a similar vein, it could be argued that social comparisons affect the self-esteem of all people to the same extent, but individuals who tend to feel inferior to others, such as those high in attachment anxiety (Irons & Gilbert, 2005), have more experience of the negative consequences that this brings, and therefore report basing their self-esteem this way more often.

Some items on the SAIS relate to competing with others, but others relate far more to the need to achieve, e.g., “To be valued by others, I have to strive to succeed” and “I struggle to achieve things so that other people will not look down on me”. This makes the SAIS a fairly broad measure. Beyond this limitation, the SAIS is predominantly a measure of *beliefs* about the world, rather than the frequency with which one compares or the extent to which one’s self-esteem is actually affected by social comparisons. This means that a high score in Insecure Striving is a good sign that an individual has zero-sum beliefs about their self-worth, but does not measure zero-sum self-worth directly. Instead of using these partially-relevant self-report measures, then, I will directly measure social comparison frequency and effect of comparisons on self-esteem.

As stated in Chapter 1, people differ in the frequency with which they perform social comparisons (Diener & Fujita, 1997). This individual difference is known as Social Comparison Orientation (SCO) and is most often measured by a self-report tool called the Iowa-Netherlands Comparison Orientation Measure or INCOM (Gibbons & Buunk, 1999). The INCOM shows positive correlations with other measures of social comparison and has been validated for use among American, Danish, Dutch and German samples (Gibbons & Buunk, 1999; Schneider & Schupp, 2011). Separate variants have also been created for Russian, Spanish and Portuguese speaking participants (Buunk et al., 2020; Garanyan et al., 2016; Veleza et al. 2023). Most of the studies investigating social comparison frequency cited above utilise the INCOM as their measure of this variable. As an established and validated measure, then, I will use SCO as a measure of the first component of zero-sum self-worth, frequency of social comparisons. However, the INCOM is not without drawbacks. Firstly, it does not ask about specific frequencies of social comparisons, and instead relies on subjective interpretations of performing comparisons “a lot”. Secondly, as a self-report measure, the INCOM is vulnerable to recall biases (Gorin & Stone, 2001). As such, in Chapter 4, I report a study in which I measured social comparison frequency through more direct means, asking individuals to report multiple times per day on any social comparisons they have performed.

The second component of zero-sum self-worth is the effect of social comparisons upon self-esteem. Some research has explored this using cross-sectional studies which measure associations between retrospective self-report measures of social comparisons and current self-evaluations. Bamford and Halliwell's (2009) study is an example of this, though they assess body dissatisfaction rather than self-esteem. Relationships between trait-level social comparison and self-esteem are measured by Liu et al. (2017) and Wang et al. (2017). As will be explored further in the discussion in this chapter and introduction to Chapter 4, these measures of social comparison are vulnerable to recall and reporting biases, such that they may not be accurate in measuring people's real social comparison behaviour. Additionally, it is difficult to be clear on the directionality of associations; where some (e.g., Bamford and Halliwell, 2009; Liu et al., 2017) see self-esteem levels as an outcome of social comparisons, others (e.g., Wayment & Taylor, 1995) specify the relationship in the opposite direction. Ultimately, it appears that there are reciprocal effects at play, such that self-esteem level influences how many social comparisons a person performs and vice versa (Schmuck et al., 2019). These studies can therefore provide preliminary evidence of associations between social comparisons and self-esteem, but to clarify exactly how the two are interrelated, it is important to measure self-esteem following specific social comparisons.

The most common way to do this is using experimentally induced social comparisons. There is some research on social comparisons performed in everyday life (e.g., Fuller-Tyszkiewicz et al., 2019; Locke, 2003), i.e., using experience sampling or ecological momentary assessment, but these will be reviewed further in the discussion and chapter 4. Here I review the most prominent experimental paradigms in past research. In particular I focus on the validity of these manipulations as to whether they clearly involve a social comparison, but also their ecological validity, the extent to which the comparison performed resembles the sorts of comparison a person might perform in their lives outside of the research.

Some manipulations induce social comparisons by giving participants manipulated feedback to tasks which rank them compared to others (Schimel et al., 2001; Lockwood, 2002, studies 3 & 4; Mahadevan et al., 2019; Strickhouser & Zell, 2015). Such manipulations have been studied for their effect on self-evaluation (e.g., Lockwood, 2002; Mahadevan et al., 2019; Strickhouser & Zell, 2015), and have tested personality variables as moderators (e.g., Vaughan-Johnston et al., 2021), and so could well be used to test whether attachment anxiety moderates the effect of social comparisons on self-esteem. These procedures tend to have good general validity as social comparison manipulations, because test results of this kind consistently involve implicit social comparison information; either participants are told about others' (purported) performance on those tests (e.g., Lockwood, 2002) or they are told their (purported) overall score in terms of the percentile they fall in (e.g., Mahadevan et al., 2019), which are calculated based on their performance relative to that of others.

In the case of ecological validity, however, the case seems somewhat mixed. Test performance is a fairly standard way for people's academic ability to be assessed, and so comparisons on this dimension in daily life are likely to be quite similar to the manipulations. On the other hand, researchers sometimes present scores on tests that purport to show people's ability in very different dimensions, e.g., social sensitivity or creativity (Tesser et al., 1988), or which assess a person's likely social status in the future (Mahadevan et al., 2019). In these cases, it appears unlikely to me that these comparisons are particularly similar to the kinds of comparisons on creativity, sensitivity or social status that people tend to make in their everyday lives.

Some studies ask participants to imagine social comparisons, e.g., by asking them how they would feel or respond if a given individual performed better/worse than them in a given domain (Beach et al., 1998; Lockwood, 2002, studies 1 & 2; Scinta & Gable, 2005). Again, researchers have used this paradigm to study effects on self-esteem (Lockwood, 2002) and the moderating role of attachment dimensions (Scinta & Gable, 2005). This paradigm has the advantage that the

comparison targets can be people in the participants' social lives, who they might be likely to compare themselves to in daily life (Tesser, 1988). However, there is debate about the validity of imagined scenarios as social psychological manipulations, as some research finds convergence between emotional responses to imagined and real scenarios (e.g., Robinson & Clore, 2001), while other research finds that people often forecast their emotional responses to imagined events incorrectly (Harris, 2002; Wilson & Gilbert, 2005). People have also been found to have different evaluations of others in real vs. imagined scenarios (Wojciszke & Bocian, 2018).

Another paradigm involves presenting participants with an individual selected or constructed to embody positive or negative characteristics (e.g., Ascone et al., 2017; Aspinwall & Taylor, 1993; Buunk et al., 2007; Mitchell & Schmidt, 2014). The classic example of this is Morse and Gergen's (1970) Mr Clean/Mr Dirty experiment, in which job applicants are presented with another candidate who appears either very presentable or very dishevelled. Later variants involve presenting a written passage purportedly written by a comparison target (e.g., Aspinwall & Taylor, 1993; Buunk et al., 2007) or presenting an individual's online profile (e.g., Vogel et al., 2015), which are easier and cheaper to set up than research involving an in-person interaction with a confederate. Researchers have used such manipulations to assess the effect of social comparisons on self-esteem (e.g., Morse & Gergen, 1970; Vogel et al., 2015; Weber et al., 2022), and also investigated potential moderating roles for personality variables (Vogel et al., 2015).

I chose to use this latter paradigm because it appeared to have a number of relevant advantages. For example, it is possible to specify an individual who excels in almost any given dimension, to prompt comparison on any given dimension. Unlike imagined social comparisons, it is possible to introduce the social comparison situation in an inconspicuous manner, such that a cover story could disguise the purpose of the study. This would therefore reduce the influence of demand characteristics (Nichols & Maner, 2008). It also measures people's real reactions to a (purportedly) real individual and situation, which seems as close as possible to the kinds of social comparisons that

individuals would perform in their daily lives, i.e., by encountering individuals exhibiting certain characteristics. Manipulations of a similar nature are used in measuring people's responses to images in the media (e.g., Tiggemann et al., 2009). However, because of the context in question, these manipulations tend to be focused on comparisons on one's body image and do not extend easily to other dimensions.

Studies using this paradigm have measured self-esteem through state measures administered after a comparison (e.g., Alfasi, 2019; Vogel et al., 2015). Other research has employed longitudinal designs, in which trait self-esteem is measured in wave designs (e.g., Schmuck et al., 2019; Vogel et al., 2014).. This raises the question of whether self-esteem is best measured at state or trait level, a question which relies on both theoretical and practical elements. On a theoretical level, does zero-sum self-worth refer to self-esteem being determined by comparative standing on a momentary, state-level basis, or overall? On a practical level, can zero-sum changes to state and trait self-esteem both be measured with precision?

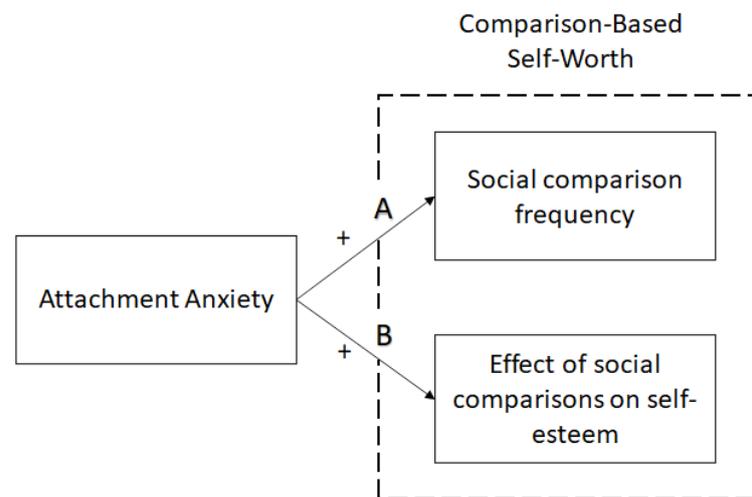
In terms of definition alone, if another person's performance changes one's self-evaluation, whether short-term or long-term, that person takes on the role of a rival or competitor for personal value, and therefore exemplifies zero-sum self-worth. In terms of effects, changes to trait and state self-esteem are both important intrapersonally and interpersonally. Both low trait self-esteem and unstable state self-esteem positively predict depression (Butler et al., 1994; Sowislo et al., 2014), while both low self-esteem and self-esteem threat positively predict jealousy (Besser & Priel, 2009; DeSteno et al., 2006; Parker et al., 2005; Rydell & Bringle, 2007), though associations with trait self-esteem can be somewhat mixed (Stieger et al., 2012). Both trait and state self-esteem are thought to be affected by the same kinds of processes (MacDonald & Leary, 2012), for instance, how accepted one feels by other people (Leary et al., 1998; Lemay & Ashmore, 2006). If social comparisons can raise and lower state self-esteem through making people feel more/less secure or more/less adequate, they should be able to impact trait self-esteem similarly.

Despite the foregoing equivalence between trait and state self-esteem, measurement of trait self-esteem can obscure important comparative dynamics. People engage in strategies to repair self-esteem after threats (Bongers et al., 2009; Campbell & Sedikides, 1999, Steele, 1988), including performing downward social comparisons with others (Vohs & Heatherton, 2004), which may return their self-esteem to pre-threat levels. In this way, a stable level of trait self-esteem over time might obscure two (countervailing) effects of zero-sum self-worth.

To some extent, different measures will be appropriate in different circumstances. State self-esteem measures are designed to be more sensitive to immediate, temporary influences (Heatherton & Polivy, 1991). This makes them more precise measures of the effects of social comparisons if they are administered directly following such comparisons, e.g., in an experimental or intensive longitudinal study. In a cross-sectional study in which no social comparisons are manipulated, trait self-esteem is a more relevant variable to study as state self-esteem will be more influenced by immediate situational factors, which are unrelated to comparisons, or unprovoked temporal fluctuations. In this project I use cross-sectional, experimental and intensive longitudinal methods and therefore use both measures of self-esteem as evidence of the second component of zero-sum worth.

Figure 2

Hypothesised Model Linking Attachment Anxiety to Components of Comparison-Based Self-Worth



Attachment Anxiety and Zero-Sum Self-Worth: The Evidence

Now that we have a working idea of the components of zero-sum self-worth, and how we can measure them, the next question is whether attachment anxiety is likely to be associated with the two operational components of zero-sum self-worth just outlined. My theoretical model is shown in paths A and B of Figure 2. I now turn to empirical research which supports these hypothesised associations.

In Chapter 1, I mentioned that Park et al. (2023) posit attachment anxiety as a moderator of social-evaluative threat. Partly this is due to the effect of attachment anxiety on threat sensitivity in general (Mikulincer et al., 2003), but also it sensitises people to relationship threat, in the form of possible rejection (Feldman & Downey, 1994). Rejection sensitivity tends to orient people's attention towards possible threats (Berenson et al., 2009). This suggests that attachment anxiety would make people particularly likely to notice social comparison information which reflects negatively upon them in their social environment. Attachment anxiety is also associated with higher

levels of self-image goals (Crocker et al., 2009), likely due to an increased need for approval. These might be favourable comparisons, satisfying self-enhancement motivations, or unfavourable, satisfying self-verifying motivations among people with poor self-image.

In the previous chapter, I suggested that the heightened demand for attention and direct proximity brought on by attachment anxiety recruits social comparison processes; the need to be more appealing than anyone else around disposes people to view the conditions of their worth in a more competitive manner. Combining this argument with the research cited above, there are good reasons to believe that attachment anxiety would lead a person to perform social comparisons more frequently. Some of the known correlates of social comparison orientation (SCO) include low self-concept clarity and intolerance of uncertainty (Butzer & Kuiper, 2006), low self-esteem (Wayment & Taylor, 1995) and neuroticism (Gibbons & Buunk, 1999), all of which are empirically linked with attachment anxiety (Bartholomew & Horowitz, 1991; Shaver & Brennan, 1992; Wright et al., 2017; Wu, 2009).

Body image researchers have found links between attachment anxiety and social comparison frequency. Attachment anxiety positively predicts both frequency of body comparisons (Bamford & Halliwell, 2009) and general social comparisons, in the form of SCO (Powell et al., 2018). Body-based comparisons were found to mediate the link between attachment anxiety and body dissatisfaction (Bamford & Halliwell, 2009), suggesting one negative consequence of this heightened social comparison, and one that seems to be particularly self-evaluative. In the same vein as Park et al. (2023), these researchers attribute the association between attachment anxiety and social comparison frequency to a heightened need for approval and a heightened sensitivity to threat. Based on my own arguments in Chapter 1, I argue that this association likely also reflects a more specific sensitivity for threats to relative standing because more anxiously attached people are more likely to judge themselves in this way.

Consistent with past research, I expect attachment anxiety will be associated with a higher frequency of social comparisons. As the most popular and well-validated measure of social comparison, I will measure this through associations between scores on the Iowa-Netherlands Comparison Orientation Measure (INCOM) and attachment anxiety scores.

Attachment anxiety tends to predict self-esteem instability (Foster et al., 2007), as well as making self-esteem more sensitive to the ups and downs of social acceptance (Hepper & Carnelley, 2012; Srivastava & Beer, 2005). Washull and Kernis (1996) suggest that differences in how strongly social comparisons affect self-esteem may be a key driver of differences in self-esteem stability. Ego-involvement, which is thought to underlie self-esteem instability, means experiencing situations as reflecting on oneself. This has a substantial overlap with the idea of self-activation, which has also been found to increase the frequency of social comparisons (Smeets et al., 2010; Stapel & Tesser, 2001). Information about another person can be processed in different ways, e.g., as a means of understanding of the other, as a means of understanding of one's own situation, or to aid judgements of oneself. People who are more self-focused are likely to preferentially process information in ways that are relevant to understanding themselves. Information can be made salient by the extent that it may serve or threaten one's motives (Morina, 2021). The more self-focused one's motives are, the more comparisons between oneself and another should become salient, and thus ego-involvement should increase the extent to which information about the performance of others is processed as an aid to self-judgement.

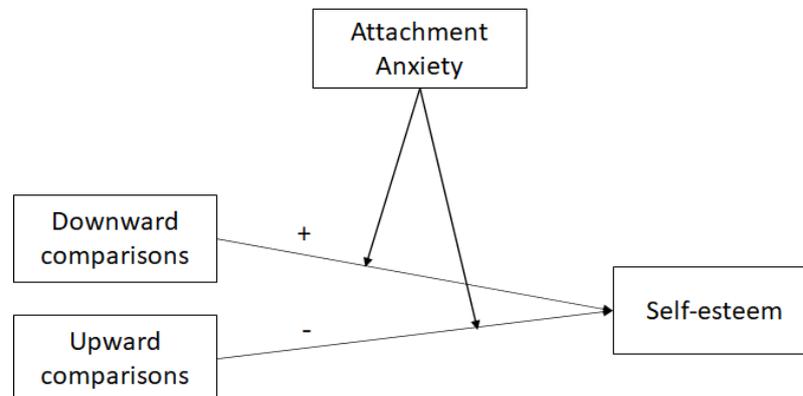
People high (vs. low) in attachment anxiety also tend to be higher in insecure striving (Gilbert et al., 2009). As I indicated before, this measure of the extent to which the social world is a competitive and judgemental place, serves as an indirect indicator of zero-sum self-worth. Feeling in competition with others should make people more likely to contrast themselves with others and feel threatened when these others perform well. Attachment anxiety also positively predicts envy (Tobin

et al., 2020), which specifically involves contrastive social comparison in which one feels threatened by the successes, attributes or possessions of another person (Alicke & Zell, 2008; Salovey, 1991).

Some evidence offers partial support for this hypothesis. Park et al. (2004) found that individuals with preoccupied attachment styles (high anxiety, low avoidance) are more prone to report basing their self-worth on competition with others. On the other hand, they found that fearful attachment (high anxiety, high avoidance) was unrelated to competition CSW, and neither attachment style was associated with this contingency when controlling for other CSWs. Importantly, however, this does not imply that people with a preoccupied attachment style are not more likely to endorse basing their self-worth on competition, but merely that this could be accounted for by a shared association with the other contingencies they base their self-worth on (physical appearance and social approval, most characteristically). This in fact could suggest that these participants see success in these domains to involve competition with others.

Figure 3

Expansion of Path B (Figure 2): Hypothesised Interaction Between Attachment Anxiety and Social Comparisons in Predicting Self-Esteem



From this evidence, it seems that attachment anxiety is likely to increase contrast effects from social comparisons on self-esteem, as shown in Figure 3. In order to test this idea, I will examine the moderating effect of attachment anxiety on the relationship between social comparison and self-esteem. Finding evidence of such a moderating effect will support the idea that attachment anxiety is linked with zero-sum self-worth.

I have laid out evidence which suggests that attachment anxiety tends to lead to more zero-sum forms of self-worth. However, there are alternative explanations and countervailing evidence for some of these findings which are worth exploring here. Firstly, there is an explanation for the association between attachment anxiety and SCO which does not rely on a greater relevance of these comparisons to one's sense of worth, or even a sensitivity to social-evaluative threat. Social comparison theory suggests that people perform comparisons because of a need for information about the self (Festinger, 1954). Specifically, individuals with low levels of self-certainty tend to engage in more social comparison (Butzer & Kuiper, 2006). Attachment anxiety has been found to predict low levels of certainty about oneself in general (Wu, 2009), and therefore anxiously attached

individuals might have a greater need to perform social comparisons merely in order to derive this information. Under this interpretation, zero-sum information could play the same role in self-worth irrespective of attachment anxiety levels, but more anxious individuals might simply need more information due to less certainty in their self-views. In order to use social comparison frequency as evidence of zero-sum self-worth, it is important to first investigate whether any association found between attachment anxiety and social comparison orientation can instead be attributed to a lack of self-certainty.

Gilbert and his colleagues have an explanation for the association between attachment anxiety and insecure striving which is based on sensitivity to social-evaluative threat, but which arises very differently to the mechanisms that I propose (Gilbert et al., 2009; Irons & Gilbert, 2005). They argue that humans base their interpersonal approach on the level of support available in the environment. When supportiveness is low, people tend to focus more heavily on the ability of others to harm them, on what might allow others to ridicule or shame them, which encourages individuals to be more competitive with others. This means that the unsupportive environment is a common cause of attachment insecurity and competitiveness, rather than the two being directly related. If this argument is correct, then we would expect social comparison orientation to be at least as strongly related to attachment avoidance as to attachment anxiety. After all, while attachment anxiety is thought to be the result of inconsistent or unpredictable support, attachment avoidance is the result of absent or insensitive caregiving (Ainsworth et al., 1978). Gilbert et al. (2009) did find attachment avoidance to be positively associated with SAIS.

Another possible explanation for observed effects linking attachment anxiety and zero-sum self-worth is that these are spurious, being driven by the effects of other variables, e.g., neuroticism or optimism. Attachment insecurity is strongly positively correlated with neuroticism (Nofle & Shaver, 2006) and negatively related to optimism (Carnelley et al., 2011; Heinonen et al., 2004). Optimism has specifically been found to moderate the effect of social comparison on self-esteem, such that

individuals lower in optimism experienced lower self-esteem after upward social comparisons (Liu et al., 2017). This is, most likely, because optimistic individuals are more likely to believe that they can improve if their current performance is poor. Neuroticism predicts higher levels of social comparison and also reduces positive emotion after a comparison (Buunk et al., 2001, Van der Zee et al, 1998). Jonkmann et al. (2012) found that neuroticism also exacerbates the zero-sum Big Fish Little Pond Effect (BFLPE) for evaluations of maths ability, such that individuals evaluate themselves as less capable at maths when surrounded by classmates who have higher maths ability. Neuroticism involves experiencing ordinary events as threatening (Widiger & Oltmanns, 2017), suggesting that it could predict extra sensitivity to the social threat occasioned by social comparisons.

Despite evidence to support the idea that attachment anxiety leads to stronger effects of social comparisons on state self-esteem, the one study that has investigated this relationship directly did not find support for it. Alfasi (2019) studied the effect of online social comparisons on self-esteem and found that attachment anxiety did not moderate this relationship, while SCO did. In this study, the social comparison manipulation was a condition in which participants scrolled through their own Facebook news feed, which is believed to be a source of upward comparisons in particular (Lee, 2014). The author concluded that upward comparisons did not trigger the attachment system because they were not direct threats to personal relationships. However, Alfasi made no attempt to control the content that individuals were exposed to. Even if upward comparisons are very prevalent on Facebook, this does not prove that all participants witnessed content that was likely to prompt social comparison. Additionally, the sample size in this study was small ($N = 80$), and the author does not detail any power analysis carried out to justify it. Moderation analyses are frequently underpowered, as interaction effects tend to be very small compared to main effects (Aguinis et al., 2005; Giner-Sorolla, 2018).

The Present Studies

Previous evidence is congruent with the idea that attachment anxiety fosters a more zero-sum approach to self-worth, but does not provide direct support for it. In this project, I used different methodologies to investigate the association between attachment anxiety and social comparison frequency on the one hand, and self-esteem vulnerability to comparisons on the other. In Study 1, I used self-report questionnaire-based measures to see whether I could replicate the association between attachment anxiety and social comparison orientation when controlling for the influence of level of self-knowledge. Additionally, I assessed how well my data supported the claim that the social comparisons performed by those high in attachment anxiety affected their trait self-esteem. In Study 2, I investigated whether the effect of a specifically manipulated social comparison on self-esteem differed across levels of attachment anxiety. In examining the relationship between attachment anxiety and zero-sum self-worth, I also included other variables as covariate predictors. I had no hypotheses regarding these variables, but where attachment anxiety is not able to account for variance in zero-sum self-worth, exploratory findings may indicate whether these variables are plausible alternative predictors.

Study 1

In my first study, I sought to replicate past associations between attachment anxiety and social comparison orientation (SCO), testing path A in the model linking attachment anxiety and zero-sum self-worth (Figure 2). While previous researchers have found evidence of this association, and attributed it to attachment anxiety raising concerns over personal worth and social acceptance (Lev-Ari et al., 2014; Powell et al., 2018), they have failed to rule out important alternatives to this explanation, i.e., the role of low self-knowledge and the possibility that attachment insecurity and proclivity to social comparisons have a common cause in low environmental support. Study 1 therefore aims to correct this omission.

Methods

Design. This study was a mediation study drawn from online, self-report questionnaires, hosted by the online survey website Qualtrics and administered at a single timepoint. The details of the study measures, procedure and analyses were approved by the University of Sheffield Research Ethics Committee (16/02/2021) and preregistered via the Open Science Framework at: <https://osf.io/dme69>. Participants signed up on the website where they found the study, and were then directed to Qualtrics, the survey hosting website, to take part. Participants completed demographic measures, followed by questionnaires measuring attachment orientations, self-certainty, SCO and self-esteem. After completion of these scales, the participants were debriefed and thanked for their participation.

Participants. I recruited participants from the University of Sheffield's Online Research Participation System, as well as through social media posts, and on research participation websites (SurveyCircle, CallForParticipants, Psychological Research on the Net and Social Psychology Network). Participants could therefore take part from anywhere in the world, as long as they were aged 18 or over and fluent in English. Following data screening (described below), the final sample consisted of 163 individuals (133 women, 26 men and 4 individuals who were outside the gender binary). This exceeded the intended sample size of 162, based on cut-offs provided by Fritz & Mackinnon (2007) to detect two effects of roughly $\beta = .26$ in a bootstrapped mediation analysis. All participants had been in a romantic relationship, either currently, or in the past. This inclusion criteria was used partly because the ECR (below) discusses romantic relationships, but also because this study also assessed romantic jealousy (discussed in Chapter 3).

Measures. Demographics: Participants indicated their gender (Male, Female or Non-Binary/Other), Age (measured categorically with categories of 18-25, 36-49, 50+), sexual orientation (Heterosexual, Homosexual, Bisexual/Pansexual, Asexual, Other) and relationship status (Single, In a Romantic Relationship, Married, Divorced). Due to extremely uneven frequencies of certain categories, relationship status was collapsed into a dichotomous variable with levels of 0

(Single/Divorced) and 1 (In a romantic relationship/married) while sexual orientation was collapsed into a dichotomous variable with levels of Heterosexual vs. Non-Heterosexual (All other categories).

Attachment Anxiety and Attachment Avoidance: Experiences in Close Relationships scale (Brennan, Clark & Shaver, 1998), a 36-item questionnaire measuring attachment orientations ($\alpha = .91$ for anxiety, $\alpha = .94$ for avoidance). Participants rate statements about their behaviour, emotions and tendencies within romantic relationships generally (e.g., "I prefer not to show a partner how I feel deep down") on a 7-point Likert scale from Disagree Strongly (1) to Agree Strongly (7). It combines two 18-item subscales for anxiety and avoidance.

Self-Certainty. Self-Attributes Questionnaire (Short-Form) (Pelham & Swann, 1989) ($\alpha = .67$ for self-certainty), a two part questionnaire in which participants first rate themselves compared to their peers on five specific qualities (e.g., intellectual ability, athleticism) on a 9-point scale from Bottom 5% (A) to Top 5% (J). Next, they indicate how certain they were of their rating on each of the foregoing qualities on an 8-point Likert scale from Not at all Certain (A) to Extremely Certain (I). Self-certainty scores are the mean of these latter ratings.

Social Comparison Orientation. Iowa-Netherlands Comparison Orientation Measure (Gibbons & Buunk, 1999) ($\alpha = .86$), an 11 item measure, in which participants rate statements about comparisons they make (e.g., "If I want to find out how well I have done something, I compare what I have done with what others have done") on a 5-point Likert scale from Disagree Strongly (1) to Agree Strongly (5).

Self-Esteem. Rosenberg Self-Esteem Scale (Rosenberg, 1965) ($\alpha = .90$), a 10-item measure assessing people's evaluations and attitudes towards themselves, on a 4-point Likert scale from Strongly Agree (1) to Strongly Disagree (4).

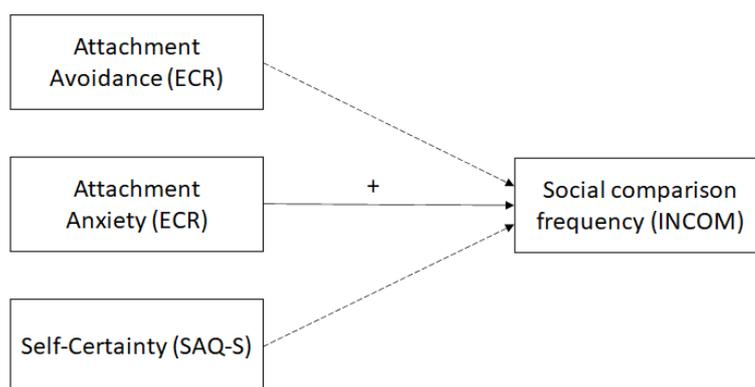
Analysis Plan

Data Screening. Missing data were imputed using expectation maximisation in SPSS. I screened out participants who had completed <80% of the overall survey or who showed evidence of careless responding, as measured by overly rapid response times (under 4 minutes) and longstring analysis (>6 consecutive identical responses). Forty-nine participants were removed in this manner. No cases were found to be multivariate outliers using the Mahalanobis distance at $p = .01$.

Confirmatory Analyses. Hypothesis 1. Attachment anxiety will positively predict social comparison orientation, when controlling for attachment avoidance and self-certainty. This model is shown in Figure 4. I tested this using a hierarchical multiple regression in SPSS. Demographic variables associated with both predictor and outcome variables were included in the first block of predictors to control for potential confounds.

Figure 4

Regression Model to be Tested Measuring the Unique Effect of Attachment Anxiety on Social Comparison Orientation



Beyond social comparison frequency, if attachment anxiety leads to zero-sum self-worth, this also implies that social comparisons will have a stronger impact on self-esteem. As mentioned above, in a cross-sectional study, I can only test effects on trait self-esteem. The first step to this was testing whether, overall, social comparison orientation was associated with self-esteem. In line with previous research (Gibbons & Buunk, 1999; Wayment & Taylor, 1995), I expected that they would be negatively associated.

Hypothesis 2. Self-Esteem will be negatively correlated with social comparison orientation. I tested this using a bivariate Pearson's r correlation in SPSS.

Exploratory Analyses. If individuals high in attachment anxiety are predisposed to upward social comparisons, zero-sum self-worth should mean that their frequency of social comparisons would translate into a negative effect on trait self-esteem. I could have specified a mediation model to this effect. I did not do this, however, because the relationships between the relevant variables could run in numerous directions. While I had specific hypotheses of how the social comparisons performed by those high in attachment anxiety should affect state self-esteem, the case for effects on trait self-esteem was more vague, and I was therefore unclear whether self-esteem would act more as a predictor or an outcome of social comparison orientation. The different possible effect directions are discussed in the description of the models, below.

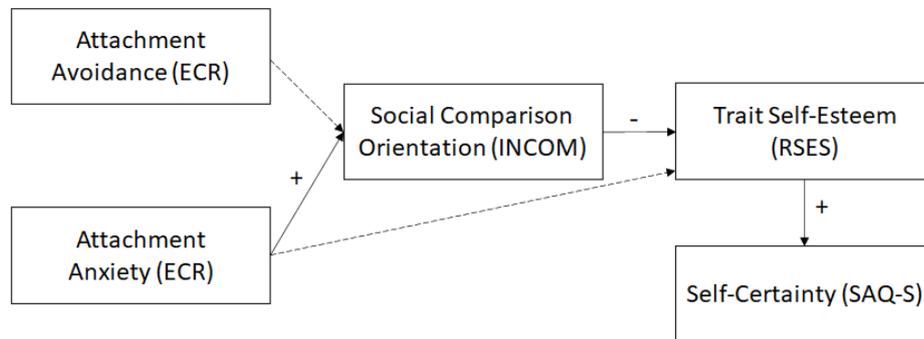
I therefore performed exploratory tests of competing candidate models using path analysis, including attachment avoidance as a covariate on any prediction effect of attachment anxiety. In my pre-registration, I stated that I would use MPlus for these analyses. However, the Yuan-Bentler test statistic is recommended for small sample sizes like this one (Ullman & Bentler, 2012), which is simplest to compute in R. I therefore inspected model fit indices of these path models using the lavaan structural equation modelling package in R. As a minimum, path models had to achieve a non-significant χ^2 value ($p = .05$), an RMSEA value of $< .10$ and a CFI of $> .95$. The RMSEA and CFI cut-offs were incorrectly stated in my pre-registration as $> .10$ and $< .95$, respectively. Finally, any

models that passed these baseline checks were compared using AIC values, showing relative performance in accounting for the data. Consistent with recommendations (Tabachnik & Fidell, 2018), I also made alterations based on modification indices so long as these were justified by past theory and did not change the basic structure or logic of the models.

Below are the three models I tested along with the relevant prior research which supports them. Support for a model cannot act as direct evidence for its purported directionality, as all data is cross-sectional and I cannot use it to draw causal conclusions. However, a substantial difference in model fit could indicate whether a given model is more statistically plausible than its alternatives.

Figure 6

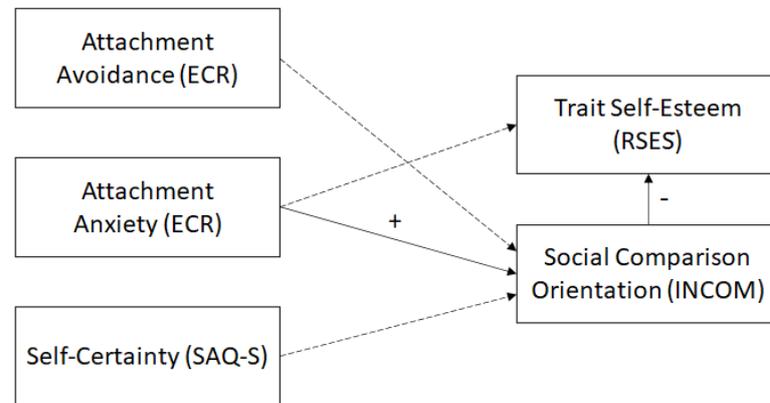
Candidate Model B Explaining Associations Between Attachment, SCO and Self-Esteem



Model B. As opposed to the assumptions made by Model A, covariance found cross-sectionally between self-esteem and social comparisons could instead result from an inverse causal relationship, wherein social comparisons affect trait self-esteem. This is consistent with evidence provided by Vogel et al. (2014) and Schmuck et al. (2019) and reflects the working of zero-sum self-worth. Nezlek and Plesko (2001) found that low self-esteem tends to lead to low self-certainty, rather than the other way around. Lower levels of self-certainty could thus be an indirect effect of social comparison orientation, resulting in a model like figure 6, above.

Figure 7

Candidate Model C Explaining Associations Between Attachment, SCO and Self-Esteem



Model C. If model B was correct and self-certainty was an effect of social comparison orientation, this would also imply that the regression model in Figure 4 is misspecified. Figures 4 and model B specify inverse causal relationships from one another between self-certainty and SCO. If variance in self-certainty was found to ultimately result from the role of attachment anxiety, this shared variance should not be partialled out of attachment anxiety's effect on SCO. I therefore wished to test the statistical fit of a model which reflected path A of Figure 2 (with self-certainty as a covariate predictor of SCO), to establish whether my regression model was appropriate, or whether its effects were likely to be distorted. This is represented by Model C (shown in Figure 7) which extended the tested regression model by including an effect of SCO on self-esteem. Support for either models B or C would be some evidence of zero-sum self-worth, as self-esteem in both cases is affected by SCO (and not the other way around).

Results

INCOM Factor Structure. I initially used a single factor structure for the INCOM, according to the recommendations of Gibbons and Buunk (1999), who designed the measure, and consistent with Buunk et al.'s (2020) findings in Spain and Chile. However, other researchers have found a two-factor solution to be a better fit to their data (Gerson et al., 2017; Schneider & Schupp, 2011): ability comparisons (e.g., "I always pay a lot of attention to how I do things compared with how others do things") and opinion comparisons (e.g., "I often try to find out what others think who face similar problems as I face"). Of these two factors, only comparisons on ability were relevant to my research questions. I therefore ran a principal component analysis on the INCOM to see what factor structure was exhibited in my data. Two factors emerged with an eigenvalue of greater than 1 (factor 1 = 4.79, factor 2 = 1.48). All items loaded meaningfully onto the first factor. In general ability items (items 1-6 & 11) load slightly more strongly onto this than opinion items (items 7-10). A second factor had the opinion items loaded onto it, with weak, negative loadings for the ability items. Contrary to previous findings (Gibbons & Buunk, 1999; Schneider & Schupp, 2011), item 1 ("I often compare how my loved ones (boy/girlfriend, family members etc.) are doing compared with how others are doing") did not load strongly onto the first factor. Its loading (.42) was actually lower than those of the opinion items. This item also had very poor communalities with other items in the analysis (.21). As it refers to comparing close others to other people as opposed to comparing oneself, it is also theoretically unrelated to ability comparisons. I therefore recommend this item be dropped from the measure in future research.

While two factors did emerge from the data, all items loaded well onto the first factor. I also ran confirmatory factor analyses to see which factor structure fit the data better. In the first model, all items loaded onto one factor (comparison). In the second, items 6-10 loaded onto the "opinions" factor, while all others loaded onto the "ability" factor. Here there was no ambiguity in model performance. The one-factor model showed poor fit to the data ($X^2 = 180.23$, $df = 44$, $p < .001$, $RMSEA = .14$, $CFI = .81$). The two-factor model, by contrast, showed acceptable fit to the data ($X^2 =$

67.57, $df = 43$, $p < .05$, $RMSEA = .06$, $CFI = .97$). Furthermore, when ability and opinion comparison were computed as two separate variables, the two were only moderately correlated ($r = .54$).

I therefore ran all analyses involving SCO using only the ability factor (items 2-6 and 11) in place of full SCO scores.

Table 1*Means of All Study 1 Variables by Demographics (N = 163)*

| Demographic Variable | | N | Attachment Anxiety | Attachment Avoidance | Self-Certainty | SCO | Self-Esteem |
|----------------------|----------------------------|-----|--------------------|----------------------|-------------------|-------------------|-------------------|
| Gender | Female | 133 | 3.92 | 2.85 ^a | 6.06 | 3.64 | 2.77 ^b |
| | Male | 26 | 4.13 | 3.34 ^b | 6.39 | 3.69 | 2.34 ^a |
| | Non-Binary/ Other | 4 | 4.50 | 3.23 | 4.75 | 3.79 | 2.15 |
| Sexual Orientation | Heterosexual | 123 | 3.83 ^a | 2.90 | 6.19 | 3.56 ^a | 2.44 |
| | Non-Heterosexual | 35 | 4.39 ^b | 2.94 | 5.78 | 3.94 ^b | 2.76 |
| Relationship Status | In a romantic relationship | 84 | 3.77 ^a | 2.47 ^a | 6.04 | 3.60 | 2.64 |
| | Single | 79 | 4.17 ^b | 3.43 ^b | 6.14 | 3.70 | 2.73 |
| Age | 18-25 | 122 | 4.08 ^b | 2.96 | 5.89 ^a | 3.80 ^c | 2.65 ^a |
| | 26-34 | 22 | 3.93 ^a | 3.09 | 6.20 | 3.77 ^b | 2.50 ^a |
| | 35-49 | 12 | 3.78 ^a | 2.78 | 6.65 | 3.07 ^b | 2.68 ^a |
| | 50+ | 13 | 3.16 ^a | 2.68 | 7.15 ^b | 2.65 ^a | 3.43 ^b |

Note. Means with different subscripts within column subdivisions differ from one another at $p = .05$. Non-binary/other participants were not included in mean comparisons due to insufficient numbers. Some *Ns* do not add up to 163 as participants could indicate that they preferred not to respond to these questions.

Demographic Checks. First I tested whether any of the demographic variables might act as confounds on my main analyses. If mean differences in both predictors and outcome variables were found across demographic categories for a given analysis, I included the relevant demographic variable as a covariate in this analysis. Full means for all variables across categories can be seen in Table 1.

Mean differences across dichotomous demographic variables (gender, sexual orientation and relationship status) were assessed using t-tests. Consistent with past findings in western cultures (Kirkpatrick, 1998; Schmitt et al., 2003), men had higher ($t(157) = 2.02, p < .05$) levels of attachment avoidance than women. On the other hand, women had higher ($t(157) = 3.53, p < .001$) levels of self-esteem than men, which is the opposite to many previous findings (e.g., Zuckerman et al., 2016), though a male self-esteem advantage tends to be smaller in recent studies of university age individuals and non-existent in older samples (Zuckerman et al. 2016). There was no significant difference between the genders on any other variable. For this reason, gender was not included as a covariate in any analyses. Heterosexual and non-heterosexual participants differed on attachment anxiety and self-esteem; non-heterosexual participants had higher ($t(156) = 2.72, p = .007$) attachment anxiety than heterosexual participants, while heterosexuals had higher ($t(156) = 2.90, p < .001$) levels of self-esteem than non-heterosexuals (consistent with previous findings: Bridge et al., 2019). SCO was also higher among non-heterosexual than heterosexual participants ($t(156) = 2.21, p = .028$). Sexual orientation was therefore included as a covariate in my exploratory path analyses (Figures 3, 4 and 5). Consistent with past research (Pepping & Macdonald 2019), attachment anxiety was also higher among single people than among those in relationships ($t(161) = 2.43, p = .016$), as was attachment avoidance ($t(161) = 5.93, p < .001$). There were no differences between these groups on self-esteem, self-certainty and social comparison orientation, and so relationship status was not included in the main analyses.

I assessed mean differences in study variables by age group using one-way ANOVAs. Consistent with past theory and empirical research (e.g., Erikson, 1968; Lodi-Smith & Roberts, 2010), there was a main effect of age on self-certainty ($F(3,158) = 5.72, p < .001$), such that levels of self-certainty were higher at every age range interval. Replicating past research findings (Chopik, et al., 2019), attachment anxiety was lower in older participants ($F(3,158) = 3.02, p = .032$), as was SCO ($F(3,15) = 9.63, p < .001$), while self-esteem was higher in older participants ($F(3,158) = 9.22, p < .001$). At first glance, this last effect appears broadly in line with past research (e.g., Orth et al., 2012). However, pairwise contrasts revealed that this last effect was specifically due to higher self-esteem in those aged 50+; the other age range intervals did not differ from one another in self-esteem. This is contrary to the findings cited above, which find self-esteem to begin to decline in this age group. There was no effect of age on attachment avoidance. Age was related to predictors and outcomes for all my analyses and was therefore included as a covariate in all of them.

Table 2*Descriptive Statistics and Zero-Order Correlations Between Study 1 Variables (N = 163)*

| Variable | Mean | SD | 1 | 2 | 3 | 4 | 5 |
|-------------------------|------|------|--------|--------|--------|--------|---|
| 1. Attachment Anxiety | 3.96 | 1.09 | | | | | |
| 2. Attachment Avoidance | 2.93 | 1.14 | .13 | | | | |
| 3. Self-Certainty | 6.09 | 1.21 | -.23** | .02 | | | |
| 4. Ability SCO | 3.66 | .73 | .30** | .03 | -.23** | | |
| 5. Self-Esteem | 2.68 | .59 | -.39** | -.23** | .20* | -.28** | |

* $p < .05$ ** $p < .01$

Confirmatory Analyses. Table 2 show the correlations between the trait-level study variables. As can be seen, social comparison orientation was uncorrelated with attachment avoidance, but positively correlated with anxiety and negatively correlated with self-certainty.

Hypothesis 1 was that attachment anxiety would positively predict social comparison orientation, when controlling for attachment avoidance and self-certainty, which I tested through a multiple regression analysis. I used weighted least squares regression instead of OLS due to heteroscedasticity observed in the residuals plot which could not be resolved by transforming variables. Despite the initial correlation between self-certainty and ability SCO, when attachment anxiety and self-certainty were entered as predictors in the regression equation (Table 3), SCO was only uniquely associated with attachment anxiety. Avoidance was still unrelated to SCO and the association between SCO and self-certainty was now small and non-significant. 16% of the variance in this model was explained by these predictors. Hypothesis 1 was supported: attachment anxiety predicted higher levels of ability SCO. Being anxious about their position in personal relationships appears to mean that people compare themselves to others more frequently. When this association was included, being uncertain in one's self-evaluations, or being uncomfortable with closeness was unrelated to social comparison frequency.

Table 3

Multiple Regression Predicting Ability-Based Social Comparison Orientation (N = 163)

| Variable | B | SE | β | t | 95% CI | |
|----------------------|-------|-----|---------|-------|--------|-------|
| | | | | | Lower | Upper |
| Attachment Anxiety | .18** | .06 | .22 | 2.89 | .07 | .37 |
| Self-Certainty | -.07 | .06 | -.10 | -1.30 | -.25 | .05 |
| Attachment Avoidance | <-.01 | .06 | <.01 | -.03 | -.14 | .14 |

** $p < .01$

Having found support for path A, I wanted to investigate how much support the data showed for the possibility that the social comparisons performed by people high in attachment anxiety have an impact on their self-esteem. As a precursor to these analyses, I tested hypothesis 2, to see if social comparison orientation was associated with levels of trait self-esteem. Controlling for the effect of age, I found that ability SCO was negatively correlated with trait self-esteem ($r(160) = -.21, p = .007$). The more comparisons a person reported performing, the lower their self-esteem was likely to be.

Exploratory Analyses⁵. I have established significant covariance between attachment anxiety and ability SCO as well as between ability SCO and trait self-esteem. Next, I tested the competing candidate models offering different directional interpretations of these effects. These are the models introduced in the analysis plan, though, in line with the results of my factor analysis, and similar to my analyses above, I used ability SCO instead of SCO as a single factor. This again was a divergence from my preregistered analyses. Below are the initial fit indices for these three models.

Model A: $X^2 = 27.90$, $df = 9$, $p = .001$, $RMSEA = .12$, $CFI = .85$

Model B: $X^2 = 20.91$, $df = 8$, $p = .007$, $RMSEA = .10$, $CFI = .90$

Model C: $X^2 = 14.98$, $df = 6$, $p = .020$, $RMSEA = .10$, $CFI = .93$

None of these models met baseline fit checks. Models B and C approached acceptable fit by the RMSEA and CFI, but both models had significant X^2 values. I next examined the modification indices to see whether there were any theoretically justified alterations that might improve the models. For Model A, the largest index was a direct path from attachment anxiety to ability comparison orientation. This was the only model to not have this effect specified, and its addition

⁵ These analyses were conducted using the INCOM as a single-factor measure, unlike the confirmatory analyses, above. This was an issue with time as I was not able to reproduce the analyses using ability SCO in time for submission

was justified by my theorising for the other models. While its addition would make model A more similar to the other models, it would retain its most important unique feature; self-esteem predicting ability comparison orientation, and not the other way around. For models B and C, the largest modification index was for a direct path from attachment avoidance to self-esteem. Leaving this path out of my models was an oversight, as there is plenty of research to indicate that attachment avoidance negatively predicts self-esteem (e.g., Feeney & Noller, 1990). I next ran each model with these additional paths added. New models are indicated by their original letter and the subscript 1.

Model A₁: $X^2 = 15.56$, $df = 8$, $p = .049$, RMSEA = .08, CFI = .94

Model B₁: $X^2 = 9.37$, $df = 7$, $p = .227$, RMSEA = .05, CFI = .98

Model C₁: $X^2 = 3.45$, $df = 5$, $p = .631$, RMSEA = .00, CFI = 1.00

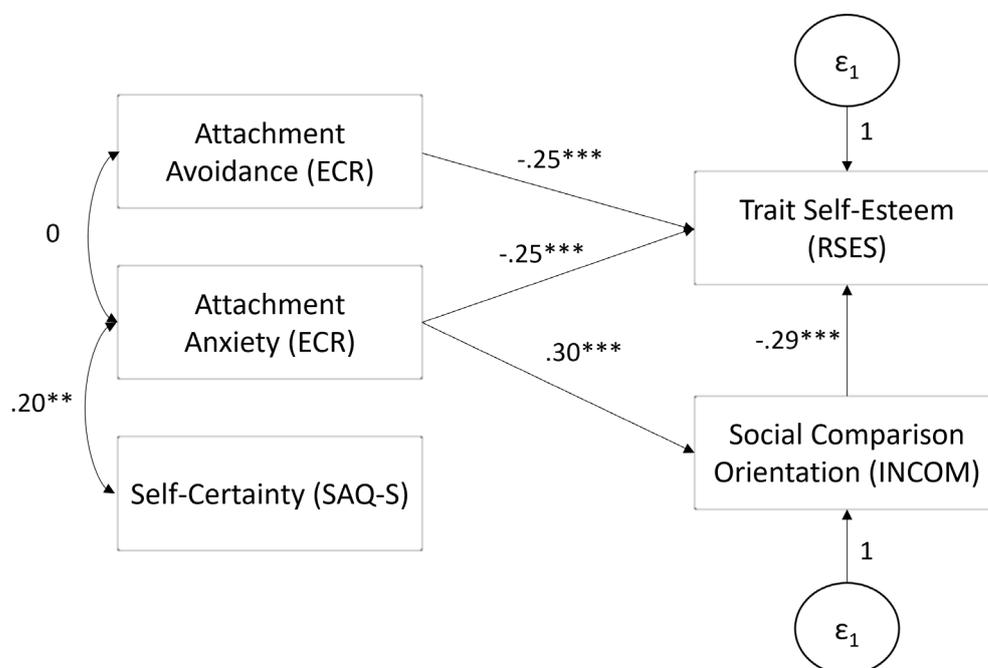
Both models B₁ and C₁ met baseline requirements. While Model A₁ did not meet baseline checks, further alterations (the addition of a direct path from self-esteem to ability comparison, and the removal of the direct path from self-certainty to ability comparison) did produce an acceptable model (A₂: $X^2 = 9.63$, $df = 7$, $p = .210$, RMSEA = .44, CFI = .98). This goes against the specific hypothesis of Wayment and Taylor (1995), but is in-keeping with the idea that low self-esteem leads to more social comparisons. Having produced three models which all met baseline checks through theoretically justified paths, I then turned to the performance of the models relative to each other, using the AIC statistic. (C₁ = 2579.65, B₁ = 2581.58, A₂ = 2581.83)

The difference in model fit between these models was minimal, though model C remained the best fit to the data. I also checked to see if the model was improved by reversing the relationship between self-esteem and comparison orientation. This worsened the fit of the model, but only slightly (AIC = 2580.07). These results provide evidence that my multiple regression model tested in hypothesis 1 was not misspecified, and including self-certainty as a covariate predictor of ability SCO

was appropriate. This also makes plausible that the self-esteem of my participants was somewhat zero-sum, as the error between predictions and observed data was at least as reduced when trait self-esteem is posited as an outcome, not a predictor of social comparison orientation, than when the opposite was specified. However, there were no substantial differences in model fit. Ultimately, this probably best supports the reciprocal effects model in which self-esteem and ability social comparisons mutually reinforce one another (Schmuck et al., 2019)

Figure 8

Finalised Path Model Accounting for Associations between Attachment Anxiety, Social Comparison Orientation and Trait Self-Esteem (N = 159)



Note: Path effects are standardised regression weights and are all significant at $p = .05$. The covariance between attachment dimensions was affixed to be 0.

The final version of Model C, with non-significant paths removed, is shown in Figure 8. Consistent with my multiple regression analysis, the initially specified paths from self-certainty and attachment avoidance to social comparison orientation were non-significant. Trait self-esteem tended to be lower among people who were anxious about their relationships, those uncomfortable with emotional closeness as well as those who frequently compare themselves to others. Attachment anxiety may have a direct negative effect on trait self-esteem, as well as an indirect one by increasing people's frequency of social comparisons.

As Model C had found Attachment Anxiety to positively predict Ability SCO, which in turn negatively predicted trait self-esteem, this suggested that the social comparisons performed by individuals high in attachment anxiety might lead them to have lower trait self-esteem. As an additional exploratory analysis, I therefore performed a mediation analysis using 2000 bootstrapped samples with PROCESS for SPSS (Hayes, 2022), specifying an indirect relationship between attachment anxiety and trait self-esteem via ability SCO. Attachment avoidance and age were included as covariates in this analysis, as trait self-esteem, ability SCO and attachment anxiety all varied significantly by age group.

The indirect association between attachment anxiety and trait self-esteem through SCO crossed 0, though to two decimal places, the higher bound of the confidence interval was on 0 ($B = .03$, $SE = .02$, $\beta = .06$, 95% CI[-.12, .00]). It is not entirely clear, therefore, whether there is an indirect association of attachment anxiety with trait self-esteem through ability SCO.

Discussion

In this study, I found that attachment anxiety positively predicts ability-based social comparison orientation, even when controlling for self-certainty and attachment avoidance. Individuals who are more anxious about personal relationships and their place within them tend to report comparing themselves to others more often. This was not due to a mutual relationship with self-certainty, and so is unlikely to be due to a need for self-knowledge. Additionally, these results suggest that the association between self-certainty and social comparison orientation might be spurious, due to a mutual association with attachment anxiety.

One possible criticism is that the SAQ-S self-certainty subscale did not show good levels of reliability in this study, only barely meeting acceptable levels ($\alpha = .67$; Nunnally, 1978). In future, the Self-Concept Clarity Scale (Campbell, 1990) could be used in the place of this measure, as its consistency scores are generally high (Campbell et al., 1996; Lewandowski et al., 2010). However, I believe that it is more appropriate to think of the items on the SAQ-S as causal indicators of self-

certainty, rather than effect indicators (Bollen & Lennox, 1991). The individual items of the SAQ-S each assess how sure a person is of a different attribute of themselves. These individual certainties are not supposed to grow out of a global sense of self-certainty, but rather, a person's overall self-certainty can be said to be constituted by their certainties in these individual domains. Consistent with this, past researchers have used measures of certainty in different domains separately, e.g., to measure whether certainty in particular domains correlates with positivity or importance of those domains (Moscovitch et al., 2009; Pelham & Wachsmuth, 1995). As such, the intercorrelations between scores on each item are not important to how well the measure assesses self-certainty.

The results also showed no association between attachment avoidance and social comparison orientation, which means that the data do not support Gilbert and colleagues' interpretation of the positive association between attachment and social comparisons; that people adopt a generally competitive interpersonal approach when there are low levels of support in their environment (Irons & Gilbert, 2005). Avoidantly attached individuals, who also tend to have experienced low levels of interpersonal support (Ainsworth et al., 1978) are not more likely to compare themselves with others. It seems to be particularly the hyperactivation of the attachment system, i.e., attachment anxiety, which is associated with a greater need to compare the self to others. Performing a high number of social comparisons therefore most likely serves the drives for support and approval.

This study therefore provides evidence against explanations for the positive association between attachment anxiety and SCO based on self-certainty and a confrontational mindset. I have argued that this association relies instead on concerns around personal worth (both in terms of self-esteem and approval from others), and reflects differences in working models of self and others.. Future research could investigate these mechanisms more directly. For example, researchers could examine support for a positive indirect effect of attachment anxiety on SCO through increased self-image goals (Crocker et al., 2009).

Another possibility for future research would be to investigate the content of attachment working models. If social comparison concerns play a greater role in working models of self at higher levels of attachment anxiety, we might expect this to be reflected in either explicit beliefs (e.g., ‘people will reject me if I am outcompeted by others’) or implicit associations, such as expecting rejection or criticism from others following being outcompeted in some way, without knowing explicitly why. At the explicit level, Gilbert et al. (2009) have shown that beliefs to this effect are positively associated with attachment anxiety. Future research could examine implicit associations using lexical decision tasks, like those used by Baldwin and his colleagues to demonstrate the differences in relationship expectations across attachment styles and self-esteem level (Baldwin et al., 1993; Baldwin & Sinclair, 1996). These tasks might involve priming with stimuli relating to performing better or worse than others, followed by a test of processing speed for words relating to acceptance or rejection. Faster processing implies cognitive associations between these words and the priming stimuli.

I argued above that if a person has a specific propensity to view their worth as dependent on relative performance, social comparisons ought to have more of an effect on their self-esteem. Consistent with this, and with previous findings (Gibbons & Buunk, 1999; Vogel et al., 2014; Wayment & Taylor, 1995), SCO was negatively correlated with self-esteem; individuals who had less favourable opinions of themselves tended to compare themselves with others more frequently. As noted above, there are two theoretically supported explanations for this association; firstly that self-esteem is lowered by the impact of social comparisons (e.g., Vogel et al., 2014), or that people with low self-esteem tend to have lower certainty about themselves, which leads them to perform more comparisons (Wayment & Taylor, 1995).

In the path analysis, I found that the model in which self-esteem was an outcome of SCO fit the data better than models in which it was included as a predictor, though this difference was not large. There is therefore statistical support for the idea that self-esteem levels are explained by

social comparison frequency. Of course, the data in this study are cross-sectional, so we cannot definitively conclude the directionality of these effects on this basis alone. Additionally, there may well be a reciprocal effect at play here (Schmuck et al., 2019). Another limitation with this finding is that even if we knew that SCO had a direct causal effect on self-esteem, we would not know whether that was due to contrast effects, which are essential to the concept of zero-sum self-worth. This finding could result from upward comparisons leading to lower self-esteem through contrast effects, or from people assimilating their performance toward lower performing targets (Mussweiler & Strack, 1999).

My findings offer some reason to believe that individuals high in attachment anxiety are particularly concerned about comparative standing, above and beyond concern with anything that reflects negatively upon them. Even when, as an exploratory analysis, self-esteem was specified as a concurrent predictor, attachment anxiety still had a unique positive effect on social comparison orientation, which means this effect is not accounted for by an association between low self-esteem and social comparison orientation. This also suggests that the association may not rely on a need for approval alone, and therefore could reflect a particularly zero-sum focused model of self-worth. Low self-esteem and (reported) need for approval are highly correlated, and the association between the preoccupied attachment style and basing self-worth on others' approval has been found to disappear when controlling for self-esteem level (Park et al., 2004).

Theorists who believe that social comparison is integral to all forms of self-esteem could argue that there is no difference between people in how diagnostic they believe social comparisons are of their own self-worth, but that those higher in attachment anxiety simply measure their worth more because they are more preoccupied with their self-image (Crocker et al., 2009). In order to test this against the hypothesis that attachment anxiety leads to zero-sum self-worth, experimental and longitudinal studies are needed to investigate whether attachment anxiety makes self-esteem more responsive to social comparisons, which I will provide in studies two and three, respectively.

One possible issue with this study was simply its use of a retrospective self-report measure of the frequency with which participants perform social comparisons. People's memories can be distorted through various biases. For example, people are most likely to recall occurrences that happened recently, or those that made a strong impression on them, referred to as recency and salience biases (Gorin & Stone, 2001). People tend to better remember information which is consistent vs. inconsistent with their existing beliefs, unless that inconsistent information is highly anomalous (Maier & Richter, 2013). Ross (1989) reviewed evidence showing that memory is influenced by implicit personal or cultural theories, for example in relative pain levels experienced at different parts of the menstrual cycle (McFarland et al., 1987) or in the improvement made in academic performance before and after taking a study skills course (Ross, 1989). Additionally, recollections can be distorted in a self-enhancing fashion, by overestimating past performance or, instead, how much one has improved in an attribute (Cameron et al., 2004). Kahneman et al. (2004) found that despite spending time with one's children being rated very high in enjoyment in one-off self-reports, in near-term reports, parents tend to rate times that they did spend with their children as very low in enjoyment compared to other activities. The authors suggest that this is partly because parents are motivated to recall enjoying spending time with their children, as the converse would be socially inappropriate.

Biases like the ones mentioned above could well have influenced the findings from this study. People who are affected strongly by social comparisons may be more likely to remember performing them than others can, and so report performing them more often. This could potentially obscure the difference between comparison frequency and impact, and might have inflated the frequency given by people high in attachment anxiety. As mentioned already, some individuals have negative attitudes towards social comparisons (Schlechter et al., 2023), and so self-enhancement concerns could bias them against recalling social comparisons.

In this study, I allowed individuals of any age, and from any country to take part. This is a limitation of the study, given I intended to study the relationships between attachment anxiety, social comparisons and jealousy among young people, specifically from the UK. This was partly because my focus on younger people developed in the course of my research, as I learned more about the particular relevance of social comparisons, self-concept and jealousy to this younger population. The majority of participants were aged between 18 and 25, which was the population I was interested to study. Having since performed these analyses with only participants aged 18-25, I can confirm that the results were effectively unchanged. I did not do this with the mediation or path analyses, which I was underpowered to perform with 115 individuals. Future research could solely focus on a single population in order to assess the effects of specific conditions affecting these individuals.

Study 1 provided preliminary support for my hypothesis that attachment anxiety leads to more zero-sum self-worth. For path A of my hypothesised model, I replicated the finding that individuals with high levels of attachment anxiety tend to compare themselves with others more frequently. Improving upon past evidence for this relationship, I also provided evidence against explanations for this effect which did not attribute it to self-worth concerns arising from attachment anxiety. There is still a necessity for further research to look into these relationships with different methodologies due to the possibility of recall biases affecting estimations of social comparison frequency. For path B of the model, I also found that the negative relationship between social comparisons and trait self-esteem could be attributed to social comparisons worsening self-esteem, with both theoretical and statistical plausibility. . However, this evidence was cross-sectional, and to truly test this path, I also used experimental and longitudinal methods in my later studies.

Study 2

In Study 1, I found evidence for path A of my hypothesised model; that attachment anxiety positively predicts social comparison orientation (SCO), which I attributed to self-worth concerns. In

Study 2, I aimed to build upon this finding by testing path B, investigating whether attachment anxiety moderates the effect of social comparisons on self-esteem. If attachment anxiety does moderate this effect, it will suggest that anxiously attached individuals perform a high number of social comparisons because they perceive these to be especially relevant to their self-worth. If there is no moderation effect (but there is a main effect of comparisons on self-esteem), it is likely that social comparisons are relevant to people no matter their level of attachment anxiety, but anxiously attached people are more preoccupied with factors which reflect on their self-worth.

I also aimed to build upon Study 1 by using an experimental social comparison design, rather than a retrospective, cross-sectional design. The issues that I outlined with self-report studies do not pertain to experimental studies, as they do not rely on memory or projection of other situations, but instead measure reactions to currently occurring situations. Conducting an experimental study also allowed me to study the effect of social comparisons on state self-esteem. As mentioned previously, measuring state self-esteem directly post-comparison has an advantage over measuring associations between social comparisons and trait self-esteem, as the latter could be obscured by compensatory processes (Campbell & Sedikides, 1999; Vohs & Heatherton, 2004). One aim in this study was to test the main effect of social comparisons on self-esteem. As mentioned before, Gerber et al. (2018) found no main effect of social comparison direction on state self-esteem in their meta-analysis. They did find that social comparisons tend to yield contrast effects in evaluations of ability, but self-esteem is a general evaluation of oneself, distinct from (though related to) specific self-evaluations (Rosenberg et al, 1995; Pegler, 2018). Recent longitudinal studies, however, have found a substantial negative effect of social comparison direction on self-esteem (Diel et al., 2021; Vogel et al., 2014), meaning that upward comparisons result in decreased self-esteem and downward comparisons result in increased self-esteem. It must be noted, however, that these are individual pieces of research, and do not have the same weight as meta-analyses. Yet it is also important to point out that Gerber et al. only studied a small number of studies with self-esteem as a dependent variable.

There is reason to believe that young adults might have self-esteem which is more strongly impacted by social comparisons than that of older individuals. Younger people tend to have less stable self-esteem than older people (Meier et al., 2011) as well as lower self-concept clarity (Lodi-Smith & Roberts, 2010), which tends to buffer against the effect of feedback on self-esteem (Guerrettaz et al., 2014). Thus, young people, with an unstable sense of self, may be particularly susceptible to the feedback effect of social comparisons.

Additionally, I intended to study the effects of upward comparisons on self-liking in particular, rather than the measures used by research cited in Gerber et al. (2018), which are at least as concerned with self-competence. . Heatherton and Polivy's (1991) State Self-Esteem Scale measures self-esteem across three dimensions; appearance, performance and social, and includes at least as many items measuring self-competence as self-liking. A short-form version of this scale was developed by Webster et al., (2022), but in my opinion, three of these items appear to focus on self-competence, while two focus very specifically on physical appearance. To reflect my focus on self-liking, I therefore, instead, adapted items from the Self-Liking subscale of Tafarodi and Swann's (2001) revised Self-Liking/Self-Competence Scale.

While I expected main effects of social comparisons on self-esteem, I expected these effects to be stronger at higher levels of attachment anxiety. Not only is attachment anxiety related to a higher frequency of social comparisons (as found in Study 1), but certain findings indicate that this association is not merely due to an increased concern with self-image, and in fact attachment anxiety may cause people to see self-worth in more zero-sum terms. Examining Facebook use, Tobin et al. (2020) found that attachment anxiety predicted greater levels of envy as well as social comparison on the platform, even when controlling for the effect of self-image goals.

Ideally, I would have measured the effects of both an upward comparison and a downward comparison on state self-esteem, against that of a control condition. In fact, I developed such a downward comparison manipulation to use for this purpose. However, I dropped this condition due

to statistical power concerns. Each new level of a factor decreases the degrees of freedom in a model and therefore increases the number of participants needed for adequate power (Doncaster et al., 2014), and I decided I would not be able to recruit enough participants with three levels.

I retained the upward condition because people high in attachment anxiety tend to rate themselves as inferior to others (Irons & Gilbert, 2005), and individuals with low self-esteem tend to choose upward comparison targets (Schmuck et al., 2019). Additionally, SCO was negatively associated with trait self-esteem in Study 1. All of this suggested that it was likely that individuals high in attachment anxiety perform more upward than downward comparisons, and understanding the effect of these comparisons is therefore likely to be more pertinent to understanding their experience. Finally, I aimed to correct for the methodological shortcomings of a previous study which investigated whether attachment anxiety moderated the effect of an upward comparison on self-esteem (Alfasi, 2019), by increasing the sample size and providing a more valid comparison manipulation.

To expand on my choice of comparison paradigm, I chose to present participants with an individual constructed to represent an upward comparison target, i.e., one who displayed uniformly positive qualities, building on the methodology of Aspinwall and Taylor (1993). As I was interested in people's reactions to an upward comparison, I aimed to prime participants to perform this comparison. I therefore set up the procedure such that people would be asked to consider their own lives prior to the manipulation passage. However, I also wished to minimise the effect of demand characteristics, so I deceived people about the nature of the study and the reasons they were being asked to consider themselves and this target individual.

Ideally, I would have involved people in our participants' social lives as comparison targets, to whom they might customarily compare themselves. However, recruiting such people would have doubled the cost of the experiment and it would have been difficult to construct situations that

consistently induced a specific direction of comparison that would not have been obvious in its purpose to participants.

Methods

Design. Study 2 was an online experimental study hosted by the survey website Qualtrics and administered at a single timepoint. The details of the study measures, procedure and analyses were approved by the University of Sheffield Research Ethics Committee (07/02/2022) and preregistered via the Open Science Framework at: <https://osf.io/hy85p>. Participants were randomly allocated to one of two conditions. In the upward comparison condition, participants read a narrative supposedly written by a first-year undergraduate of the participant's own gender, about their experiences at University. The author had excelled academically and socially, become highly involved in extracurricular activities and adjusted well to independent living. In the control condition, participants read a passage of a similar length describing teaching and assessment practices in universities. In both cases, I asked participants to consider their own experiences in their first term prior to reading, such that the exceedingly positive narrative could stand in direct comparison to their own experiences.

Participants were deceived about the nature of the study; they were told that it investigates which mood and personality factors have the strongest effects on attitudes to university. This was because I wanted participants to perceive the comparison target as a real individual, and to report their self-esteem following an organic, self-generated comparison. I suspected that knowing they were undergoing a comparison manipulation would stop participants viewing the target seriously, making them much less threatening.

Participants. Participants were 338 first year undergraduate students at British universities, aged between 18-25. 18% were recruited via the University of Sheffield's Online Research Participation System, and participated in exchange for one course credit. The remainder were recruited through the research participation website Prolific, and were paid £1.25 for participation

(equivalent to £7.50/hour). To determine the necessary sample size to detect a moderation effect, I used the R package *pwr2ppl* (Aberson, 2019). The calculations used by this package require the values for the simple slope coefficients. Due to a lack of reported simple slopes in related studies, I estimated these values by comparing the effect sizes of two related studies (Alfasi, 2019; Hepper & Carnelley, 2012) to the nearest study that did perform simple slope analyses (Vogel et al., 2015). I resized the slopes found by Vogel et al. in proportion to the two overall interaction effects found in the other studies. From these values, the necessary sample size was estimated to be 140 or 350, depending on whether I used figures from Alfasi (2019) or Hepper and Carnelley (2012). As 350 participants was the upper limit of what I had time and resources to recruit, I utilised a sequential analysis (da Silva Frost & Ledgerwood, 2020), which involves pausing response collection and testing for effects at specified numbers of participants short of the maximum sample size, using a reduced significance level. I tested for effects at 33%, 67% and 100% of the maximum sample size (350). No significant results were found at the first two cut-offs, so I recruited up to the maximum sample size. My sample prior to screening (described below) was four-hundred and nine individuals.

It is worth noting that there are often problems with power in moderation studies (Giner-Sorolla, 2018), partly because moderation effect sizes are often quite small (Aguinis et al., 2005). However, while Aguinis et al. found the median effect size of interactions in published research to be $f^2 = .009$, Aberson (2019) points out that this includes mostly exploratory analyses, often using demographic variables as moderators, and that effects are larger when directional hypotheses are being tested, especially when one of the variables is manipulated. Still, moderation effect sizes tend to be smaller than main effects (Cohen, 1988). Rogers (2002) observes that the size of interaction effects are mathematically constrained by the size of the relevant main effects, such that small main effects preclude large interaction effects.

Measures. *Attachment Anxiety and Avoidance.* Experiences in Close Relationships – 12 (ECR-12; Lafontaine et al., 2015): a 12-item questionnaire measuring attachment orientation. Participants

rated statements about their behaviour and emotions within personal relationships generally (e.g., "I feel comfortable depending on others") on a 7-point Likert scale from Disagree Strongly (1) to Agree Strongly (7). The ECR-12 combines two 6-item subscales for anxiety ($\alpha = .83$) and avoidance ($\alpha = .85$).

Optimism. Life Orientation Test - Revised (LOT-R; Scheier et al., 1994) ($\alpha = .81$): a 10-item questionnaire in which participants rated statements about their outlook (e.g., "In uncertain times, I usually expect the best") on a 5-point Likert Scale from Disagree Strongly (1) to Agree Strongly (5). The LOT-R includes 4 distractor items.

Neuroticism. Neuroticism subscale of the Big Five Inventory (BFI; John et al., 1991) ($\alpha = .82$): an 8-item questionnaire in which participants rated attributes about themselves (e.g., "I am someone who worries a lot") on a 5-point Likert scale from Strongly Disagree (1) to Strongly Agree (5).

Mood. Mood Measure: a novel, 7-item questionnaire, in which participants measured the extent to which they currently felt specific emotions (e.g., "Enthusiastic") on a 5-point Likert scale from Not at all (1) to Extremely (5). This was included as a distractor measure only.

State Self-Esteem. State Self-Esteem Measure ($\alpha = .89$): an adapted, state version of the Self-Liking subscale of the Self-Liking Self-Competence Scale - revised (Tafarodi & Swann, 2001), a 5-item questionnaire measuring current feelings about the self. Participants rated statements about their liking of their self (e.g., "I am very comfortable with myself right now") on a 5-point Likert scale from Strongly Disagree (1) to Strongly Agree (5).

Manipulation. Aspinwall and Taylor (1993) developed a social comparison manipulation which involves student participants reading a bogus passage supposedly written by another student, discussing a very positive or very negative adjustment to university to act as upward and downward comparison targets, respectively. Building on this template, I developed my own manipulation by

gathering participant narratives from 20 individuals who had completed a first term at a British university within the last three years (but not during the 2020 Covid-19 lockdown period, which was judged to be too unique to reliably elicit social comparison). Each individual provided a brief narrative description of their first term, from which I extracted and combined positive elements to construct a single uniformly positive narrative, to act as an upward comparison target. I updated the manipulation in this way in order to make it more believable to this modern British sample, to prevent them from seeing through the deception and to make the manipulation as representative as possible of social comparisons they might perform in the rest of their lives.

I piloted the narrative for use in the upward comparison condition among fifteen first year undergraduate psychology students at the University of Sheffield. Due to some students seeing through the deception, I altered the study procedure by asking participants to reflect on their own experiences at the start of the procedure as opposed to directly before reading the narrative. I also decided to retain suspicion probes and manipulation checks in the study proper, to ensure I only included people who had experienced a valid upward comparison.

Procedure. Participants first completed demographic measures of age, gender, country of origin and country of residence. They were then asked to briefly reflect on their own experience at university, after which they completed the ECR, LOT-R and the BFI subscale in that order. Qualtrics then randomly assigned them into one of the two conditions. Participants were presented with one of the two passages and asked to read it carefully. The importance of reflecting on their experience at university was to prime participants in the manipulation condition to compare themselves to the passage author. However, to maintain the deception, they were also told that they would shortly be answering questions about their attitudes to university. After reading the passage they completed a mood measure, included as a distractor, and the state self-liking measure in that order.

After completing these scales, participants went through a funnel debrief, in which they were asked what they believed the purpose of the study to be. Participants in the upward

comparison condition were also given two manipulation checks; the first to rate the performance of the target in general, and the second to rate the performance of the target compared to their own performance in their first year. Finally, all participants were taken to a debriefing screen in which the true purpose of the study was revealed, and they were given a final chance to withdraw consent based on this new information, before being thanked for their time.

Analysis Plan

Data Screening. I screened out any participants who:

- guessed the purpose of the study or guessed that I was in some way measuring their response to the target's performance.
- showed evidence of careless responding, as measured by a minimum time threshold (< 2 minutes) and longstring analysis, followed up by visual assessment of response patterns.
- were in the upward comparison condition and rated the performance of the target as "Ok/Not Sure" or poorer on the first manipulation check.
- rated themselves as performing better than the target in the second manipulation check.

After screening using these criteria, I was left with three-hundred and forty-two participants. I made no decision prior to starting the study about what to do in cases where participants rated the performance of the target as equal to their own ("about as well as me") in the second manipulation check. Though this answer suggests participants have experienced a lateral comparison as opposed to the intended upward comparison, I was not certain that these self-reported responses would be wholly accurate. It was possible, for example, that in response to the ego threat of an upward comparison, people might defensively claim to be doing at least as well as the target (Alicke & Sedikides, 2009). In this case, they would have performed an upward comparison and their response to it would be relevant. I therefore decided to measure the self-esteem of these participants to

determine whether it was likely they had experienced an upward comparison and therefore whether or not to include them in my analyses.

Confirmatory Analyses. I first measured the effects of demographic variables (origin country, gender) on attachment anxiety and state self-esteem. Any that had a significant effect on both were included as covariates in my analyses. I next carried out an independent samples t-test, investigating whether state self-esteem was significantly lower among individuals in the upward comparison condition than among those in the control condition. This was a test of the basic self-esteem debate as to whether social comparisons have contrast-based main effects on state self-esteem (Brummelmann et al, 2016; Mahadevan et al., 2016). In this study, of course, I was using a self-liking measure of self-esteem, as opposed to one measuring self-competence, so if self-esteem was lower among individuals in the manipulation condition, this would more specifically indicate whether people's self-liking tended to follow zero-sum dynamics.

Hypothesis 1. Upward social comparisons will have a negative effect on state self-esteem. I tested this using an ANCOVA in R. Demographic variables were included if they were significantly related to both predictor and outcome variables.

The main test of this study was the moderating role of attachment anxiety, which was a test of path B of my hypothesised model linking attachment anxiety to zero-sum self-worth. I expected, consistent with the above theorising and past findings linking attachment anxiety to self-esteem instability (Foster et al., 2007), envy (Tobin et al., 2020) and jealousy (Besser & Priel, 2009), to find that attachment anxiety would moderate the effect of the comparison. *Hypothesis 2. Attachment anxiety will moderate the effect of an upward social comparison upon self-esteem, such that the effect will be more negative at higher levels of attachment anxiety.* To test this, I ran moderation analyses using PROCESS for R (Hayes, 2022), following the steps outlined by Aiken and West (1991); conducting progressive hierarchical regression analyses to determine how much additional variance is accounted for by each new block of predictors, and then plotting the simple slopes of any

interactions found. I also derived Johnson-Neyman outputs and confidence intervals for these effects. I first carried out these steps for a model that only included demographic variables and attachment dimensions, and then repeated them for the more complex model that included optimism and neuroticism as additional covariates.

Covariates. I included three covariates in this study: neuroticism, optimism and attachment avoidance. While I have presented a theoretical case for why attachment anxiety might act as a moderator on the effect of social comparisons on state self-esteem, a statistical relationship to this effect would also be consistent with alternative explanations involving neuroticism or optimism. I therefore controlled for these variables to test for this possibility.

I am interested in what traits dispose a person to base their self-worth upon social comparisons, even if attachment anxiety cannot account for variance in this between people. I therefore also conducted two exploratory analyses involving interactions between comparison condition and optimism and neuroticism, respectively.

Attachment avoidance has also been linked to social comparison, through suppression of intimacy effects. Researchers have found that, in general, social comparisons made with one's romantic partner do not predict increases in cortisol (stress hormone) levels (Campbell et al., 2019), possibly because the positive/negative effects for one's partner can attenuate the self-relevant effects of such comparisons (Beach et al., 1998). Construing another as part of the self also tends to reduce the self-esteem/self-evaluative costs of upward comparisons with them (Gardner et al., 2002), also observed when people are primed with an interdependent self (Cheng & Lam, 2007). In many cases people assimilate with close others after comparisons, rating themselves as more similar to these targets, as opposed to contrasting the self to them (Gabriel et al., 2005). However, individuals high in attachment avoidance do not tend to follow this pattern. Instead, more avoidantly attached individuals show stronger contrast effects in comparison, such that they rate themselves as less similar to comparison targets, even when these are close others (Gabriel et al.,

2005). Scinta and Gable (2005) found that at higher levels of attachment avoidance, the positive mood associated with a romantic partner's superior performance to the self is attenuated. For this reason, attachment avoidance might be thought to intensify the effects of social comparisons. Despite this, I expected attachment avoidance to exert at most a negligible effect on my results, as the aforementioned findings relate only to close relationship partners while my participants were invited to compare themselves to a stranger. Nonetheless, I included avoidance as a covariate to establish the extent of attachment anxiety's unique moderating effect, distinct from the effect of attachment insecurity in general.

Table 4

Means, Standard Deviations and Zero-Sum Correlations Between Study 2 Variables (N = 338)

| Variable | Mean | SD | 1 | 2 | 3 | 4 | 5 |
|-------------------------|------|------|---------|---------|---------|--------|---|
| 1. Attachment Anxiety | 4.64 | 1.26 | | | | | |
| 2. Attachment Avoidance | 3.72 | 1.26 | .06 | | | | |
| 3. Neuroticism | 3.38 | .74 | .61*** | -.20*** | | | |
| 4. Optimism | 3.03 | .80 | -.45*** | .31*** | -.55*** | | |
| 5. State Self-Esteem | 3.22 | 1.01 | -.49*** | -.28** | -.54*** | .53*** | |

** significant at $p=.01$ *** significant at $p = .001$

Results

Descriptives and Demographics. Table 4 shows that almost all variables were significantly correlated, potentially due to the large sample size. The only pair that were uncorrelated were attachment anxiety and attachment avoidance, confirming past findings using the ECR-12 (LaFontaine et al., 2015).

I next investigated the differences in self-esteem scores by how participants responded to the second manipulation check (which assessed the participants' perception of the performance of the target relative to the participant's own performance) Thirty-five participants (23%) in the upward comparison condition reported performing a lateral comparison, which is to say rating the target as performing "about as well as me". There was a significant effect of comparison rating on self-esteem ($F(3, 148) = 8.37, p < .001$). Pairwise contrasts (Bonferroni-corrected) revealed that self-esteem was significantly lower at each rating point, ascending. This means that the higher that a

participant rated the target compared to themselves, the lower their self-esteem was likely to be after reading the passage. Given the consistency of this effect, I took the manipulation check as accurate evidence of the comparisons made with the target and excluded the participants who reported lateral comparisons from my main analyses, leaving 306 participants.

There were no significant differences between individuals originating in or outside the UK on any of the study variables, so country of origin was not included in any further analyses. Table 5 shows the means and pairwise contrasts in study variables between genders.

Table 5

Means of all Study 2 Variables by Gender

| Variable | Male (<i>N</i> = 130) | Female (<i>N</i> = 198) | Non-binary/other (<i>N</i> = 14) |
|----------------------|------------------------|--------------------------|--------------------------------------|
| Attachment Anxiety | 4.16 ^a | 4.93 ^b | 5.40 ^b |
| Attachment Avoidance | 3.76 | 3.65 | 4.25 |
| Neuroticism | 3.03 ^a | 3.58 ^b | 3.86 ^b |
| Optimism | 3.06 ^a | 3.05 ^a | 2.44 ^b |
| State Self-Esteem | 3.43 ^a | 3.15 ^a | 2.34 ^b |

Note. Means with different subscripts across rows differ from one another at $p = .05$.

There were significant gender differences in self-esteem: $F(2, 299) = 8.79, p < .001$, neuroticism: $F(2, 299) = 26.36, p < .001$, optimism: $F(2, 299) = 4.04, p = .019$, and attachment anxiety: $F(2, 299) = 17.24, p < .001$. The most substantial differences were between participants identifying as male, and those identifying as non-binary/other. Participants outside the gender binary had higher attachment anxiety and neuroticism than men, as well as lower optimism and state self-esteem following the reading task. It is worth noting that only fourteen participants identified as non-binary/other, so scores for this group may not be representative. However, I will discuss patterns of results among participants outside the gender binary in the general discussion chapter.

Women differed from men in having higher neuroticism (as found by Goodwin & Gotlib, 2004) and attachment anxiety (consistent with Weber et al., 2022), but did not differ significantly from men in optimism. Differences in state self-esteem between men and women were not found using the more conservative Scheffe test, but an independent-samples found men to have higher self-esteem ($t(259) = 2.42, p = .017$), consistent with past research (Zuckerman et al., 2016), though at odds with my finding in Study 1. As gender was associated with both attachment anxiety and state self-esteem, I included gender as a covariate in my main analyses.

Confirmatory Analyses. I first examined the effect of comparison condition on state self-esteem. Gender had a significant effect on self-esteem, so I conducted an ANCOVA testing the effects of comparison condition on state self-esteem with gender included as a covariate. Hypothesis 1 was supported; there was a small, but significant main effect of social comparison condition on state self-esteem ($t(257) = -2.14, p = .033$): individuals in the upward comparison condition had significantly lower self-esteem ($M = 3.07$) than those in the control condition ($M = 3.32$). Upward comparisons therefore appear, on average, to be slightly detrimental to people's self-esteem at least in the short term. Gender also had a significant main effect ($F(2, 296) = 9.59, p > .001$). There was, however, no interaction between gender and comparison condition ($F < 1$).

I next examined whether attachment anxiety moderated the effect of comparison condition in predicting state self-esteem. Model 1 consisted of the effect of this interaction term and its component main effects without other trait variables, while Model 2 included covariates. In both cases, I followed the guidance of Aiken and West (1991), conducting sequential multiple regression analyses which built up hierarchically from the most simple model. The first step only included the main effect of comparison condition, while ensuing steps introduced the effect of gender, main effects of both attachment dimensions and finally, the interaction of attachment anxiety and comparison condition. Overall model statistics for each of these steps can be seen in Table 6.

Table 6

Model Statistics From Hierarchical Regression Analyses Predicting State Self-Esteem

| Model | R² | R² Change | F | df1 | df2 | p |
|--------------------------------|----------------------|-----------------------------|----------|------------|------------|----------|
| Condition | .02 | – | 4.91 | 1 | 300 | .027 |
| + Gender | .07 | .05 | 7.62 | 3 | 298 | <.001 |
| + Attachment Anxiety | .30 | .23 | 24.70 | 5 | 296 | <.001 |
| + Attachment Avoidance | | | | | | |
| + Attachment Anxiety*Condition | .30 | .003 | 20.8 | 6 | 295 | .269 |

Final Model Residual R² = .68

Note. This model did not include covariates of neuroticism or optimism.

Table 7*Regression Effects Predicting State Self-Esteem in Model 1*

| Variable | B | SE | β | t | p | LCI | UCI |
|-------------------------------|----------|-----------|---------------------------|----------|----------|------------|------------|
| Comparison Condition | -.10 | .03 | .31 | -3.06 | .002 | -.51 | -.11 |
| Attachment Anxiety | -.11 | .02 | .46 | -7.22 | <.001 | -.59 | -.38 |
| Attachment Avoidance | -.20 | .05 | .20 | -4.38 | <.001 | -.31 | -.12 |
| Attachment Anxiety* Condition | .03 | .03 | .10 | 1.11 | .269 | -.09 | .31 |

Individual regression effects for Model 1 are presented in Table 7. Gender was included as a covariate, but its regression effects are not included in the table. Consistent with my initial ANOVAs, there was no significant effect when only men and women were included in the analysis, and there were insufficient non-binary/other participants to test contrasts. There was a significant main effect of attachment anxiety, but no significant moderating effect. The moderation effect size was $f^2 = .004$ (.003/.68), which this study was insufficiently powered to detect.

Figure 9

The Effect of Comparison Condition on State Self-Esteem by Level of Attachment Anxiety, (N = 306)

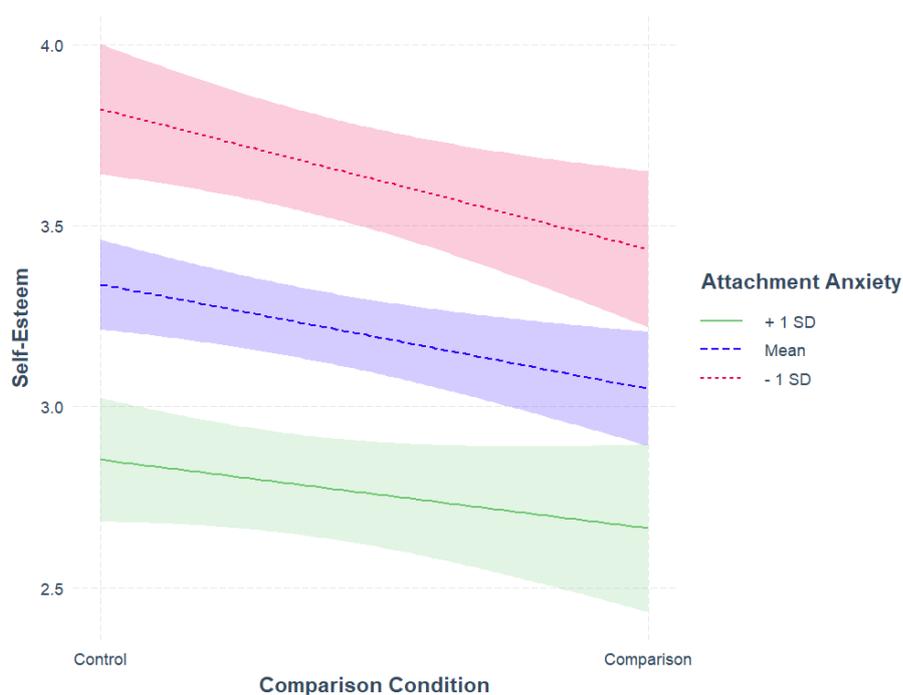


Figure 9 shows the simple slopes for this analysis, and appears to confirm that there is no meaningful difference in the effect of social comparisons across different levels of attachment anxiety. Next, I ran Model 2, by including the covariates of neuroticism and optimism in the third step with the main effects of the attachment dimensions. The R^2 value for this model rose to .44. Main effects were found for optimism ($B = .11$, $SE = .02$, $t = 5.23$, $\beta = .29$, $p < .001$) and neuroticism ($B = -.11$, $SE = .03$, $t = 4.02$, $\beta = -.25$, $p < .001$). Main effects for attachment anxiety and avoidance were substantially smaller than in Model 1, but were still significant. The interaction of attachment anxiety and condition was still non-significant in Model 2, and even smaller than before ($f^2 = .0007$).

As exploratory analyses, I also ran two additional versions of the full model. In the first, neuroticism was specified as the moderator in place of attachment anxiety (which was included as a covariate), and the second was the same, except with optimism in place of neuroticism (itself now

included as a covariate). Neuroticism did not moderate the relationship between comparison condition and state self-esteem ($B = 0.03$, $SE = .04$, $p = .379$), and neither did optimism ($B = 0.03$, $SE = .04$, $p = .510$).

Discussion

In this study, I found evidence that upward social comparisons have a negative main effect on state self-esteem, at least among undergraduates in British universities. This is contrary to the findings of Gerber et al. (2018), who found no evidence of such an effect, but in support of social rank theories of self-esteem which claim that zero-sum information is fundamental to self-esteem processes (e.g., Barkow, 1975; Hill & Buss, 2013; Mahadevan et al., 2016). In line with these theories, I assume that participants were contrasting themselves with the comparison target, rating themselves downward because their own performance is contextualised by a higher reference point (Mussweiler, 2003). Indeed, in an exploratory analysis I found a linear effect of comparison direction on self-esteem, such that the more a person felt the comparison target had outperformed them, the lower their self-esteem tended to be. However, the main effect was small, only accounting for 2% of the variance in state self-esteem, so it does not seem that people's self-esteem is being strongly affected by this upward social comparison.

It is also worth noting that I used a different measure of state self-esteem to the one used most frequently in the studies reviewed by Gerber et al. (2018), which was Heatherton and Polivy's (1991) State Self-Esteem Scale (SSES). The items in my measure were drawn solely from the *self-liking* subscale of the SLSC-S, notably indicating that the effect of the social comparison manipulation on self-esteem related to people's immediate senses of value and worth in themselves, and not to evaluations of personal competence and ability (Tafarodi & Swann, 2001). As such, this study shows upward social comparisons lead individuals to generally see themselves less positively, separate to changes in self-perceived competence. This is noteworthy because Gerber et al. did find that social comparisons tend to exert a contrast-based effect on self-evaluations of ability and performance.

I did not find, however, any moderating effect of attachment anxiety on the relationship between social comparison and state self-esteem. People who were high in attachment anxiety experienced no greater effect on their state self-esteem from this social comparison than people lower in attachment anxiety. How can this be reconciled with the finding in Study 1, that attachment anxiety predicts people performing more social comparisons, or with the findings of Gilbert et al. (2009), which suggested that more anxiously attached people see their own worth as relying on competitive success?

One reason might be that my theorising was incorrect. The lack of moderating effect for attachment anxiety in this study replicates Alfasi's (2019) findings regarding social comparisons on Facebook. Additionally, Scinta and Gable (2005) found that, when asked to imagine being outperformed by a romantic partner or by an acquaintance, attachment anxiety did not moderate the effect of these situations on people's mood. Attachment avoidance did have a moderating effect - attenuating the positivity associated with being outperformed by a romantic partner. Insecure striving, meanwhile, involves more than just a need to compete; it has an equal if not greater focus on the need to achieve (Gilbert et al., 2007). Associations between attachment anxiety and insecure striving might reflect a perceived need to achieve rather than competition, as individuals with low self-esteem tend to associate failure with rejection (Baldwin & Sinclair, 1996). These results also offer some support for the interpretation that self-reports of competition CSW reflect an awareness of how much one depends on the approval of others rather than the genuine extent to which one's self-worth relies on this contingency.

If attachment anxiety does not lead to upward comparisons in general being experienced as threats to one's own value, this is evidence against my hypothesis that attachment anxiety encourages a more zero-sum model of self-worth. Indeed, this may suggest, as I mentioned in the discussion to Study 1, that attachment anxiety does not increase the felt diagnosticity of social comparisons on self-worth, but that self-image goals encourage those higher in attachment anxiety

to measure their worth more (Crocker et al., 2009). I argued in this chapter, and in Chapter 1, that attachment anxiety would dispose people to view others as rivals in the search for interpersonal acceptance from others, and therefore to self-worth. In particular, this was because attachment anxiety would increase the extent to which acceptance appeared to rely on the proximity and positive attention of an attachment figure (Mikulincer & Shaver, 2016). Though this had some theoretical backing, I have not found direct evidence in the literature that anxious attachment increases the importance of attention in forming self-esteem. Given the self-worth of anxiously attached individuals tends to rely heavily on approval from others (Brennan & Bosson, 1998; Park et al., 2004), my results in this study may also indicate that they do not perceive social comparisons to have much impact on the perceived regard or acceptance of others. However, it is also worth considering methodological problems in this study. Contrary to previous research (e.g., Jonkmann et al., 2012; Liu et al., 2017), neither optimism nor neuroticism were found to moderate the effect of the social comparison. This suggests that there could be limitations in my research design. In particular, my results may not perfectly reflect the process of comparisons in people's real lives. Arigo et al. (2020), argue that experimental studies "reduce the extent to which the comparison reflects the type of target that individual would select or respond to in the real world" (p.3). If a manipulation is unrepresentative, people may only compare their own performance to that of the target when asked to by the manipulation checks, which in our case came after the outcome variables..

One of the chief advantages of experimental research is the ability to control the extraneous factors which may interfere with and confound the effects of interest (Bell, 2009). However, many researchers have pointed out that in cleansing experiences from any confounding influence, experimental studies often divorce phenomena from the real world contexts in which they occur (Sliwinski et al., 2018). My experimental results may not be generalisable across contexts; lab-based and online-based environments are only two specific contexts among many and people feel, think and behave differently in a lab compared to in their daily lives (Kane et al., 2017; Silvia & Cotter,

2021). Being asked to respond to a passage written by another person is not the same as encountering that other individual in-person.

People store a variety of different representations of self in memory, which are activated in different contexts (Ditzfeld & Showers, 2013). People may see themselves positively while with friends, attributing qualities to themselves such as being gregarious and fun, and on the other hand see themselves negatively in professional networking contexts, where they might perceive themselves as withdrawn and uninteresting. Different experimental contexts (lab-based and online) are therefore likely to elicit different self-representations. Events are also likely to have different implications in different settings, e.g., underperforming on a task might lead to one looking foolish in front of important others, but this will only occur in social contexts, rather than those where individuals are alone.

One specific way in which my comparison manipulation may have differed from comparisons in participants' daily lives is that they completed this study online and not in the presence of other people. This is in contrast to other studies I have cited which measured self-esteem reactivity among individuals higher in attachment anxiety (Hepper & Carnelley, 2012; Srivastava & Beer, 2005) or which measured the effect of social comparisons on state self-esteem (Vogel et al., 2015). Prior research into eating behaviour, appearance and weight-based social comparisons found the majority were performed when others were present, beyond the comparer and their target (Fitzsimmons-Craft, 2017). There is evidence to suggest that status considerations weigh heavier when others are watching (e.g., Willer, 2009), and public environments tend have been found to lead to more intense responses to downward social comparisons (Webster et al., 2003). In particular, individuals high in attachment anxiety pay more attention to social information (Mikulincer, 1997) and respond to it with greater arousal (Vrticka et al., 2012), indicating a greater focus on social relationships. Prompting a social comparison which had no direct relevance to their personal relationships may have specifically obscured effects that upward comparisons would have in their lives. It is possible

that attachment anxiety only heightens the salience of relative performance in public situations in which valued or threatening consequences could occur.

Another possible concern is that the purported target of the comparison I manipulated would have been a stranger to my participants, and comparisons with strangers tend to be less common than with people the comparer knows better (Wheeler & Miyake, 1992). Closeness to comparison targets is known to influence people's reactions to comparison (e.g., Pinkus et al. 2008; Tesser et al., 1988). Whether this effect is positive or negative is disputed and sometimes ambiguous; individuals can identify with the successes of close others to make them less threatening (e.g., Gardner et al., 2002), or alternatively, the performance of close others can seem more relevant to self-evaluation and therefore more threatening (e.g., Tesser et al., 1988). In any case, closeness is unlikely to be irrelevant to people's responses to comparison, and so the divergence from everyday social comparisons may well mean that my results are unrepresentative of the comparisons people perform in daily life.

The potential divergence between my comparison manipulation and comparisons that occur in people's daily lives was one limitation of this study. Other research has examined the effects of naturalistic social comparisons, by using experience sampling methods (ESM) (see Arigo et al., 2020, for a review). Such methods remove the possibility of the social comparisons under study being unrepresentative, as the comparisons under study are those made by participants without prompting from researchers. To investigate the comparisons that take place in people's daily lives, and the influence that attachment anxiety may have on them, I conducted a study using experience sampling methods. This study is reported in Chapter 4.

Another possible methodological limitation relates to the deception I used to obscure the purpose of the manipulation. When I examined responses to the suspicion probe in detail, many participants reported feeling more hopeful for the remainder of their university experience after reading the manipulation, as it gave evidence of someone having a very positive experience. This

was probably aided by my deception paradigm, in which I told participants that they would be asked about their attitudes to university. This might well make the quality of university experience more salient than the competence and performance of the purported passage author, suppressing people's tendency to perform comparisons and could explain why the main effect of the comparison condition on self-esteem was fairly small. This reflects a point made by Buunk and his colleagues three decades ago when thinking about the affective consequences of social comparisons, saying: "Learning that another is better off than yourself provides at least two pieces of information: (a) that you are not as well off as everyone and (b) that it is possible for you to be better than you are at present" (Buunk et al., 1990, p1239). It should be instructive for future researchers to remember that individuals can be diverse in the way that they experience experimental conditions, and the design of these conditions should be considered very carefully for features that could influence these responses in unintended ways.

Another limitation was the lack of a downward comparison condition. The aims of this project were not specific to upward comparison; a zero model of self-worth should be sensitive to both high and low relative standing. However, human psychology does not always work on strict symmetrical schema. Our minds are, for example, attuned to pay more attention to negative than positive stimuli (Ito et al., 1998). Upward comparisons may affect self-esteem quite differently to downward comparisons, and moderator variables such as attachment anxiety may have different effects in each case. If self-regard is a motivated meaning system (Crocker & Park, 2004), then it is the extent to which one's traits/performance accomplish desired goals that lead to positive self-regard. If a person's motivation to compare with others is a fear of inferiority (Gilbert et al., 2007), rather than a hope for superiority, downward comparisons may not produce positive consequences for self-esteem. In the experience sampling study I report in Chapter 4, I will address this omission by examining the effects of downward comparisons on self-esteem and the potential moderating effect of attachment anxiety on this relationship.

Finally, an important distinction to note is that between the disposition to make a comparison, and the disposition to have a certain kind of reaction to a comparison, which this study may have conflated. I suggested that people high in zero-sum self-worth would react to hearing that another person in a similar position is doing very well for themselves by comparing their own achievements and performance with the target individual, reflecting a self-focused form of information processing, as discussed in the introduction to this chapter. Some of my participants in this study, however, reported feeling glad that another individual was having a positive time at University, and said that this gave them hope for their own time at University. These participants, though they may be comparing their experience at University with that of another person, do not appear to be performing a comparison regarding their achievements and performance. A social comparison study can specifically measure people's tendency to perform comparisons, by presenting a potential comparison scenario and then measuring their interest in available social comparison information (e.g., Schimel et al., 2001).

Separately, different individuals may compare their own performance and achievements with those of the other person, and yet experience different reactions to it. For instance, in this study, I proposed that individuals with more zero-sum self-worth would feel their self-worth threatened by this upward comparison target. Alternatively, individuals with a strong self-improvement focus might approach this comparison as an opportunity to improve, or, if they felt the standard to be out of reach, they might feel discouraged. A social comparison study can measure this specifically by explicitly asking participants to compare themselves to a target and studying reactions to this.

Zero-sum self-worth, as I have laid it out, concerns both the disposition to perform comparisons, but also one's habitual reactions to them. However, it is possible that this study conflated these two aspects, in that only some participants seem to be primed to perform a social comparison. The post-manipulation self-esteem of some participants may therefore not reflect their

reactions to an upward social comparison (in the form of resultant self-esteem), which it purported to measure. Future studies could correct for this shortcoming by separating these two aspects. One study could measure the extent to which people higher in attachment anxiety (or other trait-based variables) are likely to perform a social comparison in given situations. This could be done through a think-aloud procedure (Eccles & Aarsal, 2017), in which participants speak or record their thoughts as they read a passage like the manipulation passage in this study. Content analysis could then be employed to measure how many of their thoughts reflect comparisons between themselves and the passage author. Another study might be laid out similar to this one but in which participants are explicitly asked to compare themselves to the passage author and their reactions subsequently measured. The only concern with this method is that participants are highly likely to see through any cover story and researchers will have to judge for themselves how much of an issue demand characteristics will pose to their results.

Conclusion

The associations between attachment anxiety and zero-sum self-worth in these two studies were inconsistent. In Study 1, I replicated an association between attachment anxiety and social comparison orientation as a measure of social comparison frequency, which supported path A from Figure 2, that attachment anxiety would encourage people to compare themselves to others more frequently. Additionally, I found that these comparisons tend to have negative impacts on people's self-esteem. However, Study 2 found no evidence supporting path B, that attachment anxiety moderates the effects of social comparisons on state self-esteem. When participants were exposed to a manipulated social comparison, the strength of the impact of this comparison on self-esteem was unaffected by levels of attachment anxiety.

What does this tell us about how attachment anxiety affects people's self-worth?

Attachment anxiety does not seem to make people view upward social comparison information as more diagnostic of their self-worth. However, given upward social comparisons appear to exert

negative effects on self-esteem, we can conclude that the more often one performs upward social comparisons, the more one's self-esteem is likely to be threatened by them. To the extent that the comparisons performed by more anxiously attached individuals are with upward comparison targets, these individuals are likely to experience more comparison-related ego threat as they go about their lives. The threatening aspect of these comparisons may well be what particularly disposes more anxiously attached people to perform more comparisons.

If this is correct, it indicates that occasions in which others are experienced as rivals for a sense of self-worth are more frequent for people who are high in attachment anxiety. Attachment anxiety may therefore be considered as a risk factor for approaching others as rivals and enemies. However, further research is needed to establish the extent to which social comparisons change people's self-esteem over a given period of time, and how this process differs by attachment orientations. Moreover, we need to examine whether social comparisons are more likely to produce hostility felt towards others. In the next chapter, I will look at how differences in social comparison behaviours are reflected in dispositions to jealousy, and whether they act as mediators on the association between attachment anxiety and jealousy.

Chapter 3: Rivals and Threats: Attachment, Responsiveness and Social Comparisons in Jealousy

Abstract

Jealousy occurs when another person seems to pose a threat to one's relationship, and often, one's self-esteem (Sharpsteen, 1995). Attachment anxiety is a strong and consistent predictor of jealousy, and theorists have proposed this is due to expectations of others being unreliable and rejecting, as well as implicating attachment-based separation protest in the most extreme manifestations of jealousy - intimate partner violence. I propose that working models of self that treat others as rivals may also play a role. In this chapter, I review the ways that the search for responsiveness from partners can induce rivalry with others, for support and attention, but also for validation, and report a study into whether social comparison orientation mediates associations between attachment anxiety and romantic jealousy. In Study 1, an online, self-report study ($N = 163$), participants completed measures of attachment orientations, social comparison orientation and measures of emotional and cognitive jealousy. Attachment anxiety was positively associated with both forms of jealousy, but comparing oneself to others was not related to either. I did not find any evidence that SCO mediated the association between attachment anxiety and jealousy. I conclude by reviewing how this evidence affects a self-evaluation maintenance theory of jealousy, and also our understanding of the social comparisons associated with attachment anxiety. Finally, I discuss some methodological limitations and alternative methods to assess jealous dispositions.

Introduction

In Chapter 2, I found mixed evidence that attachment anxiety might foster a more zero-sum approach to self-worth. Attachment anxiety did seem to increase the frequency with which people compare themselves to others, but it did not change the effect that these comparisons had on people's self-esteem. I concluded that attachment anxiety most likely leads people to experiencing others as rivals for worth more often, even if it does not increase the experience of ego threat

following a given social comparison. In Chapter 1, I discussed how jealousy can arise in relationships when people experience self-esteem threat from comparing themselves to others. Better performing others can be seen as rivals, for the attention and investment of a relationship partner and in an absolute sense, for the chance to have a relationship with the partner. In this chapter I look at whether zero-sum self-worth might lead people to experience more jealousy in their personal relationships, and whether the frequently observed association between attachment anxiety and jealousy might be partly due to zero-sum self-worth. As I outlined in the last chapter, I operationalise zero-sum self-worth as the frequency with which people compare themselves to others, and the extent to which these comparisons impact their self-esteem.

Understanding Jealousy

Definitions and Distinctions

According to common definitions (Chung & Harris, 2018; Daly et al., 1982; Dijkstra & Buunk, 2002; Parrott & Smith, 1993; White & Mullen, 1989), jealousy occurs in the context of a threat to a valued relationship posed by a third party. Jealousy can occur in many different kinds of relationships, such as family, peer, work-related and romantic relationships. Jealousy in romantic relationships can be further subdivided into the kinds of target, e.g., a partner's friends, family or romantic rivals (Bevan & Samter, 2004; Gomillion et al., 2014). Some theorists include situations without target individuals in their concept of jealousy, e.g., jealousy of a partner's hobbies, work or other activities (Bevan & Samter, 2004; Hansen, 1991). I do not consider these situations in this thesis and focus instead on studying jealousy as a form of hostility and rivalry between people, which might theoretically result from seeking self-esteem.

A third party can threaten a relationship by raising the chance that one's partner will decide to terminate the relationship out of a desire to spend time with or have a relationship with the third party. In these cases, we can say that the third party is an *absolute rival*, a rival in a thoroughgoing sense; their involvement threatens the existence of the relationship. Yet relationship research

suggests that the continuation of relationships is not the only relationship outcome of value to an individual. Individuals strive for responsiveness within relationships (Reis et al., 2004; Reis & Gable, 2015), encompassing hopes that partners will: supportively attend to their needs (Bowlby, 1969/1997), understand them (Ickes & Simpson, 2001), support them in achieving their goals (Drigotas et al., 1999), and to value and validate them (Murray et al., 2000). A third party can also threaten a relationship by lessening a partner's ability or desire to be responsive to the individual. In these cases, the rival could be thought of as a *partial rival*; they are a rival to the extent that their involvement interferes with the satisfaction of the individual's needs and motivations in the relationship.

While absolute rivalry exists in only some contexts where jealousy can occur – it is clearly an issue in romantic relationships (e.g., Rusbult & Buunk, 1993), but almost certainly absent in most cases of sibling rivalry, where parents do not tend to abandon their children – partial rivalry can occur in any relationship in which the responsiveness of the relationship partner is important to the individual. For example, Gomillion et al. (2014) argue that individuals become jealous of their partners' non-romantic friends because these friends can detract from the partner's responsiveness to the individual. Similarly, Volling et al. (2010) find that sibling jealousy is brought on by differential treatment of siblings by parents. In this way, jealousy may function not just to maintain the existence of relationships, but also to compete for investment or responsiveness from the relationship partner. Dillon (2013, p. 14) characterises this as a common thread to all forms of jealousy, stating that “jealousy results after observing someone enjoy attention or advantage that one wants for him or herself” (also see Chung & Harris, 2018). There is evidence of self-esteem threat causing jealousy in romantic (Sharpsteen, 1995), sibling (Volling et al. 2010) and even acquaintance relationships (DeSteno et al., 2006). Similar associations are found for social comparisons (Hamwey & Whiteman, 2021; Parker et al., 2005; DeSteno & Salovey, 1996).

I previously identified jealousy as a process entailing hostility between people (Chapter 1). I can now give a bit more space to this idea. Chung and Harris (2018, p. 274) posit, based on neurological evidence showing that jealousy is associated with approach-based motivation (Harmon-Jones et al., 2009) that “at its core, jealousy involves an approach orientation aimed at breaking up threatening liaisons”. This means that jealousy inherently involves opposing some form of relationship between a relationship partner and the purported rival. McKeever and Brunning (2022), from a philosophical perspective, see the most common desire in jealousy as aiming at “setting back” the rival, depriving them of attention or affection. As such, jealousy is aimed at denying others of something for one’s own benefit, and so its occurrence implies competition and conflict between people. To the extent that one person has reason to be jealous of another, the two people are in competition with one another.

As noted previously, hostility is one of the characteristic emotions of jealousy (Parrott & Smith, 1993). The behaviours associated with this hostility range from derogation of the rival to others (Culotta & Goldstein, 2008), to physical violence (Pichon et al., 2020). For example, adolescents who experience greater friendship jealousy are more likely to be aggressive than their peers (Parker et al., 2005). Humphrey and Vaillancourt (2021) found that friendship jealousy predicted aggression longitudinally, although their measure of jealousy did not differentiate between jealousy and envy. People who are jealous of their siblings also exhibit more hostility towards their siblings (Volling et al., 2010). Anger following romantic infidelity is often most prominently directed at a partner - as seen by rates of intimate partner violence and homicide (Pichon et al., 2020; Spencer & Stith, 2020) - but people also tend to experience anger towards the rival (Paul et al., 1993) and Daly and Wilson (1988) identify this as a prominent cause of same-sex murders. Jealousy can therefore produce aggression, hostility and violence towards the partner and the rival. In itself, jealousy is a manifestation of competitive conflict. This may explain why people who are generally more hostile to others also tend to be more jealous (Barelds & Luteijn, 2002; Buunk, 1997). All forms of jealousy are therefore relevant to this project, as all are instances of

rivalry and hostility between people. Alongside this, all are related in a theoretical fashion to zero-sum self-worth.

Jealousy Among Young Adults

The changes in a person's social life which occur in young adulthood are likely to influence the frequency, intensity and forms of jealousy experienced. As discussed in Chapter 1, young adulthood is a time at which people's attachment networks are changing, with new relationships being formed, and taking on the attachment roles formally played by others. With the decrease in importance of parents as attachment figures among people of this age, sibling jealousy does seem to become less pronounced (Scharf et al., 2005). As romantic relationships become more prominent in people's lives (Hazan & Zeifman, 1994; Trinke & Bartholomew, 1997; Furman & Buhrmester, 1992), this makes romantic rivalries more salient. Dillon (2013) states that "beginning with adolescence, the function of jealousy shifts from being used to primarily protect one's parental and peer relationships to being used to guard one's budding reproductive interests brought about by puberty" (p. 18). This reflects the idea that the relationships in which people experience jealousy are likely to be those they value most highly, and those which fulfil more of their drives, be those attachment, affiliation or sexual.

However, as noted before, not all young adults turn to romantic partners to satisfy their attachment drives (Doherty & Feeney, 2004; La Guardia et al., 2000). Those who remain closer with friends most highly may be more likely to experience friendship jealousy, as a result of greater interdependence in these relationships (Kelley, 1979). There is still evidence of sibling jealousy into adulthood (Aune & Comstock, 2002; Rauer & Volling, 2007), which has been found to be related to differential treatment by parents (Hamwey & Whiteman, 2021; Stocker et al., 1997) and to upward comparisons made with the sibling (Hamwey & Whiteman, 2021). Siblings, especially those close in age, are often comparison targets whose successes may be seen as particularly diagnostic of how accomplished a person is (Tesser, 1980).

Factors Leading to a Jealous Disposition

I begin by reviewing some of the personality factors which may produce a more jealous disposition. Martinez-Leon et al. (2017) divide these into three categories; gender, attachment orientations, and self-esteem. Gender differences will be discussed in detail later, for now, I will review the role of self-esteem and attachment in turn.

Self-Esteem.

Trait self-esteem has been implicated in jealousy, with low self-esteem predicting higher jealousy among friends and in romantic relationships (Chin et al., 2017; Parker et al., 2005; Rydell & Bringle, 2007). However, Chin et al. (2017) found that self-esteem was unrelated to emotional jealousy, while romantic jealousy has been found to only relate to explicit self-esteem among men, and to implicit self-esteem among women (Stieger et al., 2012). Links between trait self-esteem and jealousy are therefore not wholly consistent.

Could different models of self-worth explain the tendency for some people to feel especially threatened by others, to experience jealousy with particular frequency and intensity? I have already reviewed evidence that self-esteem threat leads to the experience of jealousy (e.g., DeSteno et al., 2006; Sharpsteen, 1995). This suggests that the situations in which a person experiences threats to their self-esteem are relevant to their levels of jealousy. Indeed, DiBello et al. (2015) found that relationship-contingent self-esteem, the extent to which self-esteem is based upon relationship success, predicted higher levels of emotional, though not cognitive or behavioural jealousy. People higher in RCSE are likely to experience more self-esteem threat from negative relationship events.

It is uncontroversial to link this jealousy-evoking self-esteem threat with social comparisons. DeSteno and Salovey (1996) characterise the threat which constitutes a jealous situation as the sense that a partner may prefer the rival to oneself. Indeed, many authors simply assume that jealousy is a social comparison process. For example, Dijkstra and Buunk (2002, p. 829-830) state “It is assumed that feelings of jealousy are in part evoked through a process of social comparison, in

which jealous individuals compare their own characteristics with those of the rival. Only when individuals observe that their rival surpasses them on these qualities may the rival be perceived as a threat to the relationship, and, consequently, evoke feelings of jealousy". Similarly, Guerrero et al. (1995, p. 274) argue that "jealous individuals believe that their partners have compared them to the rival and that they have somehow failed to 'measure up.'" This links jealousy both to the individual's evaluation of themselves, and their perceptions of their partner's evaluations of them, and specifically implicates upward comparisons with rivals in jealousy. DeSteno and Salovey (1996) found that individuals react with greater jealousy when romantic rivals excel in qualities close to the individual's self-definition while Broemer and Diehl (2004) found that individuals are made more jealous when primed to consider their similarity with rivals, rather than their differences. Together, this evidence suggests that the rival's capacity to replace the individual, to outdo them at those traits which seem to make them valuable and appealing, makes the rival a threat to their relationship. Self-esteem threat from social comparisons, in the context of valued relationships, seems to lead people to experience jealousy.

The association between individual differences in social comparisons and jealousy are less well attested. Hamwey and Whiteman (2021) found that SCO was positively associated with sibling jealousy, but no research that I have found investigates the direct association between SCO and other forms of jealousy. Some studies have examined social comparison orientation as a moderating factor in romantic jealousy, potentially heightening the jealousy produced by certain characteristics of romantic rivals (e.g., Dijkstra & Buunk, 2002, discussed below). Buunk et al. (2011) found a moderating effect of SCO on jealousy in Argentinian, but not in Spanish individuals. Importantly, these studies have assumed a jealousy-evoking potential for specific rival characteristics, which SCO has the potential to heighten. However, the characteristics which a person finds threatening in a rival may be quite personal (DeSteno & Salovey, 1996), and so SCO may not consistently moderate the effects of any given characteristic across a sample.

Attachment

As discussed previously, there is a very consistent link between attachment insecurity and jealousy, especially among those high in attachment anxiety (Collins & Read, 1990; Elphinston et al., 2011; Knobloch et al., 2001; Richter et al., 2022). Harris and Darby (2010) suggest that attachment insecurity increases the sense that others are threats to one's relationship because they expect more rejecting behaviour from partners, suspecting that they might abandon the individual. I will now review what we know about the development of attachment anxiety to clarify why this should be. Past experiences in which close others have been unpredictable and inconsistent in their support tends to undermine people's confidence going forward that others will be invested in them, and leads them to doubt the trustworthiness and good intentions of these others (Collins & Read, 1990). Simultaneously, this attachment pattern is likely to lead a person to see themselves more negatively (Mikulincer & Shaver, 2016; Pietromonaco & Feldman-Barrett, 1997), less capable and more in need of support. They come to care deeply about maintaining relationships with others, but their underlying expectations and beliefs about other people leads them to read hostile, rejecting intentions into the actions of others (Baldwin et al., 1993; Collins et al., 2006; Li et al., 2023), ultimately making others seem apt to reject or abandon them (Feldman & Downey, 1994).

Thus, as it leads people to see maintaining supportive relationships as a vital imperative, attachment anxiety also undercuts their confidence in the security of these relationships. When individuals sense a threat to their ability to satisfy their attachment drives, they often react with protest at this threat, involving sadness and anger (Bowlby, 1973). Bowlby posits this as an evolved response, necessary at certain times, to maintain important relationships. As the stakes of keeping or losing a relationship get ever higher, the internal perception of relational threat which prompts this protest intensifies. Finkel and Slotter (2007) argue that this can help to understand why more anxiously attached individuals are more likely to perpetrate violence against their partners (Dutton & White, 2012; Rodriguez et al., 2015), as their escalating fears about losing the people important to them lead to maladaptive expressions of anger and protest.

However Finkel and Slotter (2007) observe that it is not just signs of outright rejection that attachment anxiety makes people sensitive to. While they are vigilant to the loss of relationships, which explains why anxiously attached individuals might be quicker to see other people as absolute rivals, they are also vigilant for the loss of investment and responsiveness from others (Finkel & Slotter, 2007). Attachment anxiety is also associated with jealousy with siblings (Hamwey & Whiteman, 2021), where partial rivalries are more likely than absolute rivalries. I propose that sensitivity to the dynamics of investment and responsiveness characteristic of attachment anxiety is likely to make people feel more threatened by others, and thus more jealous of them.

Responsiveness and Relative Investment

Reis et al. (2004) suggest that the perceptions of a relationship partner's responsiveness is an important organising concept in relationships, such that the quality of a relationship is associated, in a number of interrelated ways, with how responsive the partner is perceived to be. These are, as mentioned above, understanding and validation of one's self as well as provision of support with one's needs and goals. The felt lack of these conditions can therefore pose a threat to a relationship.

Though attachment insecurity results from lower levels of responsiveness (Feeney & Collins, 2001), attachment anxiety also predicts lower perceived partner responsiveness over time (Segal & Fraley, 2016). This partly relates to that heightened vigilance I discussed above, leading more anxiously attached individuals to read ambiguous cues in their most rejecting light, which increases their sense that their attachment figure is not committed to their needs (Feldman & Downey, 1994; N. Collins, 1996). However, perceived responsiveness is (partly) based on the support the partner gives relative to the needs that one feels oneself to have, such that the more one feels one's needs to be unmet, the less responsive one is likely to perceive a partner to be (Reis et al., 2004). More anxiously attached individuals tend to have a high degree of self-perceived needs (Hazan & Shaver, 1994), which means that a partner is likely to need to be more supportive in order to be perceived as

responsive. Attachment anxiety therefore appears to raise the demands and the stakes of partner responsiveness.

One cue that can indicate a lack of responsiveness from a partner can be responsiveness shown toward another person. This is because an individual's perceptions of their partner's responsiveness to them are relative to their position in that partner's social network (Reis et al., 2004). People tend to structure their social relationships in a hierarchy, such that they expect some people to be more responsive to them than others, with romantic partners often occupying the highest position in this hierarchy (Clark & Mills, 1993). A romantic partner must therefore do more in order to be perceived as responsive than would a casual acquaintance. Additionally, a partner's perceived level of responsiveness is relative to the scope of obligations they have in other relationships, especially those which are perceived to be more or similarly important.

This is what Gomillion et al. (2014) attribute jealousy of a romantic partner's friends to: the sense that a partner should be more responsive to the individual, their romantic partner, than to their friends. Investment, or value, that a partner shows for another person may detract from how responsive a partner seems to the individual, because the individual expects their partner to be more concerned about their needs than those of other people. If a partner invests time and energy in into another person, that person can be a threat to one's place in the partner's social network. There is evidence that people are sensitive to the dynamics of relative over absolute investment. For example, Hart and Carrington (2002) found that infants are more distressed at a mother's lack of attention to them when their mother is instead paying attention to a lifelike doll than when the mother engages in other non-social activities.

The dynamics of responsiveness are likely to be of particular importance in our population of young adults. As different people turn to different members of their social networks to meet their relationship/attachment needs, the levels of investment that people are looking for in their relationships at this age are likely to vary quite substantially. This could give rise to significant

relationship uncertainty (Knobloch & Solomon, 1999), especially with regards to asymmetries of relationship investment. Feeling uncertain about the value that a partner places in the relationship, or their desire to maintain it, is associated with higher levels of jealousy, felt towards both romantic rivals and friends of a romantic partner (Knobloch et al., 2001; Worley & Samp, 2014).

Highly anxiously attached individuals have a confluence of factors which may dispose them to feel this sense of rivalry towards others. They are likely to perceive themselves to be in need of more support and investment from partners (Hazan & Shaver, 1994), and at the same time, will be particularly vigilant for the possibility that this responsiveness might be lost (Finkel & Slotter, 2007). As discussed in previous chapters, they are more likely to depend on direct proximity, attention and active reassurance from partners to maintain a sense of relationship security (Mikulincer & Shaver, 2016; Shaver et al., 2002), which are contingencies that rely on greater exclusivity from the partner. If a partner cannot invest time and energy into another person without seeming to take time and energy away from oneself by doing so, this other person can quite easily become a rival. Infants assessed as more anxiously attached tend to show greater distress by investment shown to others (Murphy et al., 2020), supporting the idea that attachment anxiety sensitises individuals to the dynamics of relative investment.

As mentioned above, responsiveness not only encompasses support for one's needs and concerns, but also validation and valuation of oneself. Murray et al. (2006) suggest that people treat perceptions of a partner's regard as signals of how willing the partner is to be supportive in response to one's needs in future. An individual may well also read a partner's unwillingness to be supportive as a lack of perceived regard for the individual. Indeed, Overall and Sibley (2009a) observed that individuals tend to feel that their partners value them less in moments of conflict, in particular those in which they experience high situational dependency, i.e., a lack of control. These authors identify moments in which the individual perceives their partner to be unresponsive to their needs as a characteristic of many such instances of conflict. More anxiously attached individuals also tend to

exhibit this effect more strongly than most, such that conflict has a more strongly negative effect on their perceptions of a partner's regard (Overall & Sibley, 2009b). Thus, perceptions of a partner showing differential investment might well give rise to partial rivalries in self-worth; if a lack of responsiveness to oneself is an indicator of a loss of perceived regard, responsiveness given to another can be a signal of regard given to them. To put it another way, one reason why a third party might cause a partner to invest less time and attention in an individual is that they would prefer to invest time and attention in the third party instead.

Therefore, how much a partner likes another person in comparison to oneself is intimately related to important relationship contingencies, especially as people perceive support to be indicative of regard, and vice versa. I propose that a more zero-sum sense of self-worth should increase the sense that important relationship outcomes are on the line when one's loved ones come to value other people. Given the links between comparison-based self-esteem threat and jealousy, I believe there is a strong case that zero-sum self-worth would mediate the association between attachment anxiety and jealousy.

Studying Romantic Jealousy

Rationale

The evidence cited above shows that the factors, both intrapersonal and interpersonal, which lead to a more jealous disposition are common across all forms of jealousy in personal relationships. This project aims to understand the roots of jealousy in general. However, there are reasons to give special attention to romantic jealousy. Higher expectations of responsiveness in romantic relationships (Reis et al., 2004) may heighten the sense that investment given to others is a threat to oneself. This may be particularly strong among more anxiously attached individuals, who tend to prize romantic relationships above others (Knee et al., 2008). The second reason to focus on romantic jealousy is one of intensity. I have discussed the extreme outcomes that romantic jealousy can lead to, including violence and homicide (Pichon et al., 2020; Spencer & Stith, 2020). It is

especially important to understand what leads people to commit such extreme acts against other people. These consequences may be explained, in part, by the strong evolutionary advantage quality romantic jealousy is supposed to confer, in facilitating successful reproduction and gene replication (Buss & Shackelford, 1997). However, as previously mentioned, the existence of couples who practise consensual nonmonogamy, apparently contentedly, suggests that this cannot be the full story. This then, is the third reason to focus on romantic jealousy; as younger people are more likely to engage in consensual non-monogamy (Hauptert et al., 2017; YouGov, 2023).

For these reasons, I measure romantic jealousy in particular in this chapter. Studying what underlies individual differences in romantic jealousy among young adults may help us to resolve the aforementioned puzzle of why some people respond so differently to purportedly jealousy-evoking scenarios.

Measuring Romantic Jealousy

It is important to clarify which aspects of romantic jealousy I am investigating in this project. Modern research into romantic jealousy tends to treat it as a multidimensional construct (Buunk, 1997; Pfeiffer & Wong, 1989; though see Chung & Harris, 2018; for a notable exception). Besides emotional reactions, describing someone as having a jealous disposition can also mean that they are particularly likely to suspect romantic partners of extradyadic romantic involvement, or that they act in ways so as to prevent the possibility of relationship threat. These three categories form the basis of two of the most common typologies of jealousy: Buunk's categories of *anxious, reactive* and *possessive/preventive* jealousy (Buunk, 1997) and the Multidimensional Jealousy Scale's (MJS) subscales of *cognitive, emotional* and *behavioural* jealousy (Pfeiffer & Wong, 1989). These two typologies overlap considerably, with both cognitive and anxious jealousy measuring a person's tendency to anxiously suspect/anticipate extradyadic romantic involvement and behavioural and preventive jealousy measuring a person's tendency to act in controlling ways which are aimed at restricting their partner's ability to engage in extradyadic involvement. Low to medium

intercorrelations between the dimensions of these scales (Buunk, 1997; Elphinston et al., 2011; Pfeiffer & Wong, 1989), as well as differing personality and relationship correlates (Knobloch et al., 2001; Rydell & Bringle, 2007), indicate that these dimensions are distinct from one another. Even assuming that jealous emotions always follow jealous cognitions, there is no implied link between *frequency* of jealous cognitions and *intensity* of jealous emotions if specific situations arise.

My research questions concern why people are disposed to experience others as rivals and enemies, which appears to implicate the cognitive aspects of jealousy. Indeed, the sense that a partner might be interested in conducting a relationship with another person is a fairly clear example of this person being a rival for a partner's affections. However, measuring effects on cognitive/anxious jealousy alone would be too narrow a focus. Pfeiffer and Wong (1989) separate explicit worries and suspicions of infidelity from the immediate appraisal of threat from others, which they maintain acts as antecedent to jealous cognitions, emotions and behaviour. All these elements can therefore indicate experience of threat.

Past empirical findings linking jealousy to social comparison and self-esteem threat have largely concerned the intensity of emotional responses (Besser & Priel, 2009; Broemer & Diehl, 2004; DeSteno & Salovey, 1996; DiBello et al., 2015). My intention is to extend these findings, so I study emotional jealousy as well as cognitive jealousy. Another reason for this is that emotional jealousy better accounts for the role of partial rivalries with others. The situations participants are asked to respond to on the emotional jealousy subscale vary in how likely people are to consider them direct relationship transgressions; from one's partner smiling in a friendly way at a member of one's own gender, to them flirting with this third party, hugging and kissing them or dating them (Pfeiffer & Wong, 1989). These situations can constitute relationship threats either because the individual suspects they are signals of absolute rivalry, or because they constitute partial rivalries for the partner's investment and attention. This is also why I use the MJS typology instead of Buunk's typology; Buunk's concept of reactive jealousy is explicitly intended to only examine emotional

reactions to infidelity (Bringle, 1991; Buunk, 1997). This focus makes it difficult to extrapolate from this measure to non-romantic jealousy, as infidelity is quite specific to romantic relationships. Scores on this measure also cannot indicate threat detection, as, *ex hypothesi*, the threat has already occurred.

Behavioural/preventive jealousy also reflects a sense of threat, but importantly, the behaviours involved aim to generally control a partner's behaviour to prevent any possible infidelity. In this sense, there does not need to be any specific individual or event that one feels threatened by in order for behavioural jealousy to be triggered. My theory therefore connects social comparison to both cognitive and emotional manifestations of jealousy, but not specifically to behavioural manifestations, so I included measures of cognitive and emotional jealousy in the study reported in this chapter.

The Role of Gender

Gender differences in romantic jealousy are not usually thought to relate to the overall levels of jealousy that a person experiences, but instead the form of jealousy that they find most distressing, with men thought to be more distressed by sexual infidelity while women are thought to be more distressed by emotional infidelity (Edlund & Sagarin, 2017). Importantly, people of both genders are thought to find both forms of infidelity troubling (Harris, 2003; Edlund & Sagarin, 2017), the differences are only thought to be matters of degree.

I do not expect that these gender differences are likely to imply strong differences between men and women in the extent to which zero-sum self-worth influences their dispositions to jealousy. Emotional infidelity, which is to say a partner directing investment to another person (Buss et al., 1992), is paradigmatic of partial rivalries. However, either form of infidelity can arouse partial rivalry, if the relationship continues alongside it, or absolute rivalry, if this infidelity is a sign that the partner intends to terminate the relationship. Social comparisons and self-esteem threat could play a role in either case, though this dichotomised model of jealousy might lead us to expect that jealousy would

be related to self-esteem threat across different domains for men and women. Indeed, previous research has found sex differences in the characteristics of a romantic rival that provoke jealousy (Dijkstra & Buunk, 2002). However, all these characteristics appear to represent appealing characteristics in short-term mates; dominance in male rivals and physical attractiveness in female rivals (Buss, 2019), most likely because the situation described (flirting) suggests the partner is likely to engage in a more short-term relationship with this individual.

One interesting finding from Dijkstra and Buunk's (2002) study is that SCO was likely to make female participants more jealous of their potential rival's characteristics, but this relationship was inconsistent for male participants. This could indicate that jealousy is related to social comparisons for women but not men, and so I test to see whether gender influences the relationship between comparisons and jealousy in this research.

Attachment Anxiety, Romantic Jealousy and The Self: Past Research

As discussed in Chapter 1, there are studies which have found that the association between attachment anxiety and romantic jealousy is mediated by effects related to comparisons and self-esteem threat. Besser and Priel (2009) found that self-esteem threat mediates the association between attachment anxiety and jealous reactions. However, this self-esteem threat does not necessarily have anything to do with social comparisons. The participants in this study were presented with a manipulation which consisted of imagining their romantic partner engaging in sexual intercourse with another person. The authors did not test for whether any of their participants were engaged in consensual non-monogamy, but we may assume that most of them were not⁶. As such, this imagined action would have been a clear relationship transgression for most of the participants, and a breach of their trust (Blow & Hartnett, 2005). Furthermore, the partner ends the hypothetical encounter by confessing love for the third party. By the norms of

⁶ I base this, in part, on the personal account of a polyamorous individual attesting to monogamous values being prevalent in Israel, where that study was conducted, around that time (Milana, 2021).

monogamous relationships, they could not maintain a committed romantic relationship with both the participant and the third party, and so this statement is likely to appear as an indication that the partner is quite likely to terminate their relationship with the participant as a result. This is important, because people high in attachment anxiety tend to stake a great deal of their self-worth on success in romantic relationships (Knee et al., 2008). They are also more likely to attribute relationship problems to their own failings (N. Collins, 1996), and so might attribute this transgression to things that they have done wrong. With all this in mind, the self-esteem threat experienced by the participants could be related to comparison with the third party (though this individual is not described in any detail), especially in relation to the partner's affections, but it also seems likely to reflect other sources of self-doubt among anxiously attached individuals.

Karakurt (2012) found that feelings of inadequacy mediated the association between attachment anxiety and dispositional romantic jealousy. The author also points to attention given to others as a proximate cause of jealousy, due to the implications this has for the individual's self-esteem. Karakurt designed her own measure of inadequacy, which, in part, did measure feeling inferior, through the item "I think my partner deserves someone better than me". However, the generalised sense of one's partner deserving better does not imply comparison to any specific individual, and the overall measure seems to track a negative model of self more than one which is particularly defined by social comparisons.

To review then, there is abundant evidence that attachment anxiety is associated with heightened jealousy, and evidence that jealousy is brought on by self-esteem threat which comes from social comparisons. Individual differences in social comparison frequency do account for a more jealous disposition, though this has only so far been tested in sibling jealousy. Other research has found that the association between attachment anxiety and romantic jealousy is attributable to self-related processes. However, no study has yet examined the direct effect of social comparison

orientation on romantic jealousy, nor tested whether this effect might partially account for the tendency for more anxiously attached individuals to experience higher levels of romantic jealousy.

The Present Study

My arguments above suggest that a zero-sum form of self-worth is likely to lead individuals to more readily experience jealousy. Previous researchers have found evidence that social comparison processes and self-esteem threat are implicated in jealousy. However, when they have studied the role of self-esteem threat (e.g., Besser & Priel, 2009; DeSteno et al., 2006; Sharpsteen, 1995), they have not explicitly shown that this threat arises from social comparisons (often they simply assume this). Moreover, research has not sufficiently investigated associations between a jealous *disposition* and individual differences in social comparisons, either in terms of frequency of social comparisons, or the effect that social comparisons have on people's self-esteem. This is an important omission, because there seem to be important differences in how readily people experience jealousy and these aspects of zero-sum self-worth could help us to understand why this is. My first aim with this study then, is to investigate the differences in disposition to jealousy associated with the components of zero-sum self-worth.

In this study, I investigated the effect of SCO on emotional and cognitive jealousy. I predicted that similar dynamics would pertain to romantic jealousy as to sibling jealousy, in that the tendency to compare oneself to others would increase the extent to which one perceives others as rivals for the investment of relationship partners, but with the added threat of the loss of the relationship in its entirety. Additionally, I have presented evidence that attachment anxiety might increase the extent to which people do view others as competitors in their personal relationships, as attachment anxiety increases both fears of abandonment and sensitivity to the dynamics of attention and investment. Previous research has shown self-related variables to mediate the association between attachment anxiety and jealousy, but it has not made clear whether attachment anxiety leads to an increased tendency to jealousy by raising the extent to which people measure themselves against

others. The second aim of this study is therefore to investigate whether SCO mediates the relationship between attachment anxiety and jealousy.

This chapter reports findings from Study 1 (also reported in Chapter 2) that relate to jealousy. This was a cross-sectional survey study, and is therefore well-placed to study dispositions and personality traits. I included measures of SCO, attachment dimensions and jealousy, studying the association between SCO and jealousy as well as the overall mediation relationship between attachment anxiety and jealousy through SCO.

Methods

Design. This study was a mediation study drawn from online, self-report questionnaires, hosted by the online survey website Qualtrics and administered at a single timepoint. The details of the study measures, procedure and analyses were approved by the University of Sheffield Research Ethics Committee (16/02/2021) and preregistered via the Open Science Framework at: <https://osf.io/dme69>. Participants signed up on the website where they found the study, and were then directed to Qualtrics, the survey hosting website, to take part. Participants completed demographic measures, followed by questionnaires measuring SCO, attachment orientations and jealousy. After completion of these scales, the participants were debriefed and thanked for their participation.

Participants. I recruited 212 participants using the University of Sheffield's Online Research Participation System as well as through social media posts, and from research participation websites (SurveyCircle, CallForParticipants, Psychological Research on the Net and Social Psychology Network). Participants could be of any gender and from any country or culture, though they needed to be over eighteen years old and to have a fluent grasp of written English. Because participants were asked about romantic jealousy, they were required to have been involved in a romantic relationship at least once, either currently or in the past. Following data screening (see below), the

final sample consisted of 163 individuals (133 women, 26 men and 4 individuals who were outside the gender binary). This satisfied the sample size of 162, recommended by Fritz & Mackinnon (2007) to detect my two hypothesised half-sized effects in a bootstrapped mediation analysis.

Measures. *Attachment Anxiety and Attachment Avoidance.* Experiences in Close Relationships scale (Brennan, Clark & Shaver, 1998), a 36-item questionnaire measuring attachment orientation ($\alpha = .91$ for anxiety, $\alpha = .94$ for avoidance). Participants rate statements about their behaviour, emotions and tendencies within personal relationships generally (e.g., “I prefer not to show a partner how I feel deep down”) on a 7-point Likert scale from Disagree Strongly (1) to Agree Strongly (7). It combines two 18-item subscales for anxiety and avoidance.

Social Comparison Orientation. Iowa-Netherlands Comparison Orientation Measure (Gibbons & Buunk, 1999) ($\alpha = .86$), an 11 item measure, in which participants rate statements about comparisons they make (e.g., “If I want to find out how well I have done something, I compare what I have done with what others have done”) on a 5-point Likert scale from Disagree Strongly (1) to Agree Strongly (5).

As I found that a two-factor model of the INCOM fit this data better than a one-factor model (see Chapter 2), and I was only interested in comparisons on ability, in this study SCO refers to the ability factor (items 2-6 and 11) only.

Emotional and Cognitive Jealousy. Short Form - Multidimensional Jealousy Scale (Elphinston, Feeney & Noller, 2011), comprising 11 items in total ($\alpha = .85$ for emotional jealousy, $\alpha = .90$ for cognitive jealousy). The emotional jealousy scale asks participants how they would feel in reaction to potentially jealousy-provoking situations (e.g., “Your partner comments to you on how great looking a particular member of the opposite sex is”) on a 7-point Likert scale from Very Pleased (1) to Very Upset (7). The cognitive jealousy scale asks participants how often they worry about infidelity (e.g., “I suspect that [my partner] may be physically intimate with another member of the opposite sex

behind my back.") on a 7-point Likert scale from Never (1) to All the Time (7). As the Multidimensional Jealousy Scale was designed for heterosexual men and women, I modified some items to make them suitable for all genders and sexual orientations. Specifically, I replaced the words "member of the opposite sex" with "another man/woman/person of your gender" for male, female and non-binary/other participants respectively.

I did not require the participants to be in a romantic relationship at the time of participation. As a result, some participants could not think about a current partner for the items of the MJS. Participants were instructed that, if they were not currently in a romantic relationship, they should imagine their partner in their most recent romantic relationship.

Analysis Plan

Data Screening. I screened out participants who had completed <80% of the overall survey or who showed evidence of careless responding, as measured by overly rapid response times (under 4 minutes) and longstring analysis (>6 consecutive identical responses). Forty-nine participants were removed in this manner. One case was identified as a univariate outlier on emotional jealousy based on a z score cut-off of 2.56 (equivalent to $p = .01$). As emotional jealousy had already been substantially transformed, the score was reduced to the nearest non-outlier value. Two cases were identified as outliers in emotional jealousy using the Mahalanobis distance ($p = .01$), and so were removed for relevant analyses.

Emotional jealousy was positively skewed, so I transformed this variable by reversing it and then square-root transforming the resultant scores. Cognitive jealousy was heavily positively skewed and no transformation of the data returned a normal distribution. I therefore recoded it into a dichotomous variable, split between low cognitive jealousy (scores below 2) and high cognitive jealousy (scores 2 or above).

Confirmatory Analyses. *Hypothesis 1: Attachment anxiety will positively predict emotional and cognitive jealousy, when controlling for attachment avoidance.* This specific relationship has

been attested in numerous previous studies across different countries (Elphinston et al., 2011; Knobloch et al., 2001; Rodriguez et al., 2015), while other studies have replicated this using different measures (Buunk, 1997; Richter et al., 2022). I tested this using two hierarchical multiple regression analyses in SPSS, one for each form of jealousy (emotional and cognitive). Demographic variables associated with both predictor and outcome variables were included in the first block of predictors to control for potential confounds. As cognitive jealousy had been recoded as a dichotomous variable, the regression analysis predicting this variable was a logistic regression.

Hypothesis 2. Ability SCO will positively predict emotional and cognitive jealousy, when controlling for attachment avoidance. To assess this, I used two hierarchical multiple regression analyses, one for each form of jealousy. Any demographic variables which were associated with both predictor and outcome variables were included in the first block of predictors, with both attachment variables included as covariate predictors in the second block, thus controlling for the effect of spurious correlations due to demographic characteristics, and the overall effect of attachment insecurity. As cognitive jealousy had been recoded as a dichotomous variable, the regression analysis predicting this variable was a logistic regression.

Hypothesis 3. Ability SCO will mediate the effect of attachment anxiety on emotional and cognitive jealousy, when controlling for attachment avoidance. To test this, I ran two mediation analyses (one for each jealousy outcome variable) using PROCESS for SPSS (Hayes, 2022). I calculated confidence intervals for the indirect effect using 2000 bootstrapped samples. Demographic variables were included as covariates if they were related to either a) predictor and mediator variables or b) predictor/mediator and outcome variables. PROCESS automatically calculates a logistic regression if the outcome variable is dichotomous.

Table 8*Means of Study 1 Variables by Demographics (N = 163)*

| Demographic Variable | | <i>N</i> | Attachment Anxiety | Attachment Avoidance | Ability SCO | Cognitive Jealousy | Emotional Jealousy |
|----------------------|----------------------------|----------|--------------------|----------------------|-------------------|--------------------|--------------------|
| Gender | Female | 133 | 3.92 | 2.85 ^a | 3.64 | 2.29 | 5.75 |
| | Male | 26 | 4.13 | 3.34 ^b | 3.69 | 2.28 | 5.27 |
| | Non-Binary/Other | 4 | 4.50 | 3.24 | 3.79 | 2.30 | 4.25 |
| Sexual Orientation | Heterosexual | 123 | 3.83 ^a | 2.90 | 3.56 ^a | 2.21 | 5.71 |
| | Non-Heterosexual | 35 | 4.39 ^b | 2.94 | 3.94 ^b | 2.29 | 5.38 |
| Relationship Status | In a romantic relationship | 84 | 3.77 ^a | 2.47 ^a | 3.60 | 1.92 ^a | 5.81 ^b |
| | Single | 79 | 4.17 ^b | 3.43 ^b | 3.70 | 2.68 ^b | 5.46 ^a |
| Age | 18-25 | 115 | 4.08 ^b | 2.96 | 3.80 ^c | 2.25 | 5.71 |
| | 26-34 | 22 | 3.93 ^a | 3.09 | 3.77 ^b | 2.18 | 5.55 |
| | 35-49 | 12 | 3.78 ^a | 2.78 | 3.07 ^b | 2.52 | 5.68 |
| | 50+ | 13 | 3.16 ^a | 2.68 | 2.65 ^a | 2.63 | 5.14 |

Note. Means with different subscripts within column subdivisions differ from one another at $p = .05$. Non-binary/other participants were not included in mean comparisons due to insufficient numbers. Some *Ns* do not add up to 163 as participants could indicate that they preferred not to respond to these questions

Results

Demographics and Descriptives. Table 8 reports the associations between demographic variables and the variables of interest in this study. These associations (excepting those involving jealousy variables) are reported and reviewed in Chapter 2. As can be seen in Table 8, relationship status affected all variables under analysis except for SCO. Findings for jealousy were mixed. Consistent with past research (Southard & Abel, 2010), people in current romantic relationships were higher in emotional jealousy than single people ($t(161) = 2.17, p = .032$). However, contrary to past research where no differences were found (Southard & Abel, 2010) single people were higher in cognitive jealousy than those in relationships ($t(161) = 4.06, p < .001$).

Table 9*Descriptive Statistics and Zero-Order Correlations between Variables (N = 163)*

| Variable | Mean | SD | 1 | 2 | 3 | 4 | 5 |
|---------------------------|------|------|-------|--------|-----|-----|---|
| 1. Attachment Anxiety | 3.96 | 1.09 | | | | | |
| 2. Attachment Avoidance | 2.93 | 1.14 | .13 | | | | |
| 3. Comparison Orientation | 3.66 | .73 | .34** | -.03 | | | |
| 4. Emotional Jealousy | 5.67 | .94 | .16* | -.28** | .15 | | |
| 5. Cognitive Jealousy | 2.29 | 1.25 | .34** | .25** | .01 | .02 | |

* significant at p = .05 ** significant at p = .01

Note. Correlations involving cognitive jealousy are Spearman's rank correlations.

Overall descriptive statistics and bivariate correlations between all variables are shown in Table 9. While the SDs of these variables appear to vary considerably, it is important to note that these measures use different scales; ECR scores range from 1 to 7, MJS from 1 to 10, and INCOM from 1 to 5. Comparably, the highest SDs relative to their range were observed in the attachment variables, indicating that people varied most widely in their scores in these variables.

Confirmatory Analyses. My first hypothesis was that attachment anxiety would predict cognitive and emotional jealousy, for which I ran separate regression analyses, beginning with emotional jealousy. Both attachment dimensions and emotional jealousy were related to a person's relationship status, so I included relationship status as a predictor in the first step of the regression analysis, with attachment dimensions included in the second step. In this analysis, 3% of the variance in emotional jealousy was explained by relationship status, with a further 7% explained by attachment dimensions. Table 10 shows the coefficients from this analysis. The coefficient for relationship status shows the effect of being in a relationship, compared with being single. The associations between the attachment dimensions and emotional jealousy were inverse to each other, with attachment anxiety having a medium-sized positive association with emotional jealousy while attachment avoidance had a medium-sized negative association. Hypothesis 1 was therefore supported for emotional jealousy. As I removed emotional jealousy outliers based on a Mahalanobis significance value of $p = .01$, as opposed to $p = .001$, as specified in my preregistration, I also ran the analysis using this original procedure. This had no substantive effect on the associations.

Table 10

Multiple Regression Predicting Emotional Jealousy from Attachment Dimensions (N = 161)

| Variable | B | SE | β | t | LLCI | ULCI |
|----------------------|-------|-----|---------|-------|------|------|
| Relationship Status | -.11 | .07 | .15 | -1.74 | -.24 | .02 |
| Attachment Anxiety | .07** | .03 | .20 | 2.62 | .05 | .36 |
| Attachment Avoidance | -.06* | .03 | -.18 | -2.21 | -.35 | -.02 |

* significant at $p = .05$

** significant at $p = .01$

I also ran this analysis on a subset of the sample – those participants in romantic relationships. This was most similar to the samples used in previous research (Elphinston et al., 2011; Knobloch et al., 2001). There was very little impact on the effect of attachment avoidance, but the effect of attachment anxiety was stronger than in the overall sample ($\beta = .28, t = 2.56, p = .012$).

Next, I conducted a logistic regression predicting high or low cognitive jealousy scores from attachment anxiety and avoidance. Again, relationship status was included as a predictor in the first step of the model, with attachment dimensions included on the second step. With no predictors, 53.4% of cognitive jealousy cases were correctly predicted, with a -2LL of 215.57. When relationship status was added, predictions rose to 62%. The -2LL of the model fell to 203.91, a change of 9.65 ($p = .002$). When attachment dimensions were included, the fit of the model improved again ($X^2(2) = 11.67, p = .003$). The Hosmer-Lemeshow test was non-significant ($X^2(8) = 7.68, p = .465$), suggesting the model fits the data well. Examining the predictor coefficients (Table 11), only attachment anxiety was uniquely associated with cognitive jealousy. Though attachment avoidance was bivariately correlated with cognitive jealousy (Table 9), when entered into the equation with attachment anxiety and relationship status, its effect was non-significant.

Table 11

Logistic Regression Predicting Cognitive Jealousy from Attachment Dimensions (N = 163)

| Variable | B | SE | Wald | Exp(β) | LLCI | ULCI |
|----------------------|-------|-----|------|----------------|------|------|
| Relationship Status | -.70 | .37 | 3.64 | .50 | .24 | 1.02 |
| Attachment Anxiety | .51** | .16 | 9.82 | 1.67 | 1.21 | 2.31 |
| Attachment Avoidance | .16 | .16 | .90 | 1.17 | .85 | 1.61 |

** significant at $p = .01$

Note. As cognitive jealousy was a dichotomous outcome, coefficients are expressed in a log-odds metric

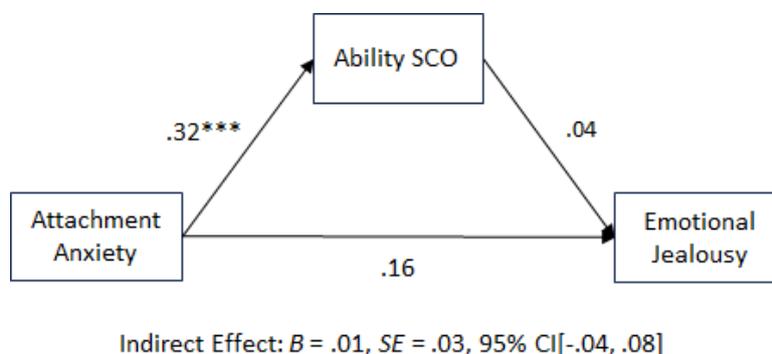
The second half of hypothesis 1 was also supported; a 1-unit change in attachment anxiety made a person 1.67 times more likely to show high levels of cognitive jealousy.

Next, I tested the effect of Ability SCO on jealousy. Ability SCO was unrelated to emotional jealousy ($B = .07, SE = .04, \beta = .15, t = 1.87, p = .067, 95\% \text{ CI } [-.01, .30]$). Furthermore, compared to the attachment variables, very little (2%) of the variance in emotional jealousy was explained by SCO. Once again, I also ran this using my originally proposed outlier procedure. The effect was in the same direction, slightly smaller, and still non-significant ($B = .04, SE = .03, \beta = .10, t = 1.29, p = .198, 95\% \text{ CI } [-.02, .11]$). Ability SCO did not appear to be related to cognitive jealousy either ($B = -.04, SE = .18, Wald = .05, p = .833$). The Hosmer-Lemeshow test was non-significant ($\chi^2(8) = 8.12, p = .422$), suggesting the model fits the data well, but there was no increase in predictive power from the addition of SCO. Both these analyses had similar results whether effects were tested across men, women, or the whole sample. Hypothesis 2 therefore received minimal support; Ability comparisons did not have a significant effect on emotional jealousy or cognitive jealousy. Results were very similar when I ran these analyses treating SCO as a single factor (as specified in my preregistration), with SCO failing to predict both forms of jealousy.

My main hypothesis for this study was that comparison orientation would mediate the link between attachment anxiety and jealousy. To test this, I conducted two mediation analyses (one for each form of jealousy) using 2000 bootstrap samples in the PROCESS Macro for SPSS. In both, ability SCO was specified as a mediator on the relationship between attachment anxiety and jealousy. Two demographic variables were included as covariates: relationship status, as people in relationships differed from single people in attachment anxiety and both forms of jealousy, and age, as older people showed less attachment anxiety and ability SCO.

Figure 10

Mediation Model Predicting Emotional Jealousy ($N = 161$)

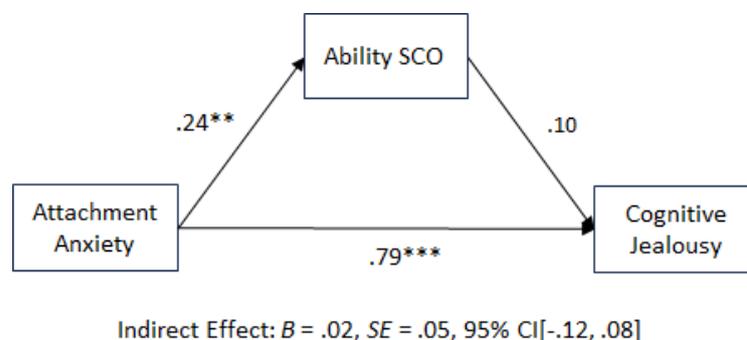


Results from the emotional jealousy analysis are shown in Figure 10. Consistent with the effects observed in the last chapter, attachment anxiety positively predicted ability SCO, while attachment avoidance did not ($B = -.03$, $SE = .06$, $\beta = -.04$, $t = -.54$, $p = .589$).

There was no significant effect of SCO on emotional jealousy once the effects of attachment dimensions were accounted for. However, the direct effect of attachment anxiety was reduced and now non-significant when ability SCO was included ($B = .06$, $SE = .03$, $\beta = .16$, $t = 1.85$, $p = .066$, 95% CI [.02, .32]). The effect of attachment avoidance, however, remained significant ($B = -.06$, $SE = .03$, $\beta = -.19$, $t = -2.26$, $p = .025$, 95% CI [-.35, -.02]). The indirect effect of attachment anxiety on emotional jealousy through comparison orientation was small and had a confidence interval which crossed 0. Social comparison orientation does not mediate the association between attachment anxiety and emotional jealousy, and the bivariate association between these variables might be the result of mutual covariance with attachment anxiety.

Figure 11

Mediation Model Predicting Cognitive Jealousy (N = 163)



Results from the cognitive jealousy analysis are shown in Figure 11. As cognitive jealousy was a dichotomous outcome, these coefficients are expressed in a log-odds metric. Ability SCO comparison orientation did not mediate the effect of attachment anxiety on cognitive jealousy. Attachment anxiety once again positively predicted cognitive jealousy ($B = .72$, $SE = .19$, $Z = 3.76$, $p < .001$, 95% CI [.35, .1.10]), and this effect was largely unchanged after SCO was included. Attachment avoidance had no effect on cognitive jealousy when included alongside attachment anxiety ($B = .17$, $SE = .17$, $Z = .962$, $p = .336$, 95% CI [-.17, .51]). Ability SCO had no effect on cognitive jealousy and the indirect effect of attachment anxiety through SCO was negligible, with a confidence interval that crossed zero. Hypothesis 3 was therefore not supported by my results; the association between attachment anxiety and disposition to jealousy was not accounted for by the tendency of more anxiously attached people to compare themselves to others with greater frequency.

Discussion

In this study, I replicated previous findings linking attachment anxiety with emotional and cognitive jealousy. At a bivariate level, both attachment anxiety and attachment avoidance led to higher levels of cognitive jealousy, but it was only anxiety that had a unique predicting effect. Those who are less secure in their attachments tend to suspect their partners of infidelity more frequently,

and this effect appears to be specifically due to anxieties about abandonment. It is important to stress the relational nature of this phenomenon. Anxieties about the security of one's relationships do not arise in a vacuum (Bowlby, 1973), and attachment anxiety is in fact positively associated with having experienced a partner's infidelity in the past (Burchell & Ward, 2011). When a person is trying to maintain relationships with partners who may be prone to infidelity, it makes sense to be vigilant for possible present infidelities, and it is easy to understand why this would increase anxieties about their investment. Indeed, jealous suspicions seem to increase the likelihood that individuals will successfully detect real infidelity (Apostolou & Antonopoulou, 2022).

Consistent with previous research, both attachment dimensions were significantly related to emotional jealousy, though in opposite directions. Participants who were uncomfortable with intimacy in their relationships tended to feel less upset about extradyadic intimacy, while anxieties about love and support made people more likely to be more upset. The effect of attachment anxiety was smaller than seen in past studies (e.g., Elphinston et al., 2011; Knobloch et al., 2001), but when I ran a separate analysis which only included participants in romantic relationships, I found an effect size consistent with these past findings. Romantic jealousy is thought to be a part of the attachment system (Sharpsteen & Kirkpatrick, 1997). It is possible that hyperactivation of the attachment system occurs in the face of (real or imagined) threats to an existing relationship, i.e. the individual's current source of security, which causes an individual to both experience and report greater distress (Mikulincer & Shaver, 2016) but that once the relationship no longer provides this security role, no hyperactivation occurs, and the individual is less able to call to mind the distress such an experience might bring them.

It is important to consider response bias in interpreting these jealousy findings, especially in the links with relationship status. People imagining their current partner appearing interested in potential romantic rivals were more likely to report being upset than those imagining a previous partner. This could mean that the former group is higher in levels of emotional jealousy, or it could

simply mean that they are more able to call to mind the emotional impact of such situations (see Wilson & Gilbert, 2005). People were more likely to report beliefs about infidelity from previous partners than current partners. Past relationships, of course, may have broken down due to infidelity (e.g., Amato & Previti, 2003), so people who are no longer in romantic relationships may have been more likely to have suspected a partner of infidelity because that partner genuinely engaged in infidelity. They may also retroactively attribute suspicions to themselves, to confirm that they “knew it all along”. Alternatively, having chronically high levels of cognitive jealousy may contribute to the breakdown of romantic relationships.

I hypothesised that those who compare themselves to others more frequently would be more likely to view other people as rivals, and thus experience more jealousy. My data gave very little support to this view. The tendency to compare one’s abilities and characteristics to those of others had no effect on emotional jealousy. SCO also had no effect on cognitive jealousy; those who compare more frequently were no more likely to suspect their partners of infidelity. This held even when SCO was treated as a single factor measuring frequency of ability and opinion comparisons.

Given the research cited above linking jealousy to social comparisons and self-esteem threat, it is somewhat surprising that a tendency to perform social comparisons did not have an effect on jealousy. Lennarz et al. (2017), using an idiographic measure of propensity to experience jealousy, found that SCO was correlated with the amount of jealousy adolescents had experienced in the two weeks prior to their study. However, it is worth noting that they did not find evidence that SCO increased the amount of state jealousy individuals experienced across the study period.

Ability SCO might not capture the comparisons which produce jealousy. Earlier in this chapter I suggested that attachment anxiety might sensitise people to the effects of differential investment, which is a comparative process. However, such comparisons do not necessarily concern one’s abilities and characteristics. Indeed, the most important element of this process is the relative investment, attention or responsiveness a partner gives to oneself compared with the third party.

Chung and Harris (2018) suggest that this process will involve questioning one's own worth, but this need not be the case for jealousy to be triggered, as jealousy can be seen as a response to differential investment among infants (Hart, 2016), who are not able to reason about their worth and abilities.

There was also no evidence of SCO mediating the relationships between attachment anxiety and either form of jealousy. The reasons why attachment anxiety led to greater feelings of jealousy and greater jealous suspicions seemed to have nothing to do with a tendency to perform social comparisons. Once again, this was surprising given findings that self-esteem threat and inferiority mediate the effect that attachment anxiety has on jealousy (Besser & Priel, 2009; Karakurt, 2012). This raises the possibility that this heightened tendency to perform social comparisons does not equate to a more zero-sum form of self-worth. If the comparisons performed by people high in attachment anxiety do not lead to self-esteem threat, they would not be likely to heighten jealousy. This is, however, at odds with previous evidence associating comparison frequency with self-esteem threat from comparisons (Vogel et al., 2015; and to some extent: Alfasi, 2019).

It may be that the association between attachment anxiety and a more jealous disposition is mediated by only a tendency to compare oneself with romantic rivals, and not to perform comparisons in general. As I will discuss further in the general discussion chapter, it is possible that zero-sum dynamics in self-worth should be considered separately for different domains and context of self-worth, with different predictors and different outcomes. Above, I proposed that being disposed to compare oneself to others might lead people to experience greater relationship threat. However, we can also conceive of this relationship in the opposite direction. It is possible that in many cases, people are only motivated to compare themselves to third parties *because* they already have cause to view these individuals as threats to their relationships. Chung and Harris (2018) point to this possibility with the idea of *elaborated* jealousy, in which relationship threats lead to people to ask whether there is something wrong with them. If a person is more sensitive to relationship threat

than other forms of threat, they might compare themselves to romantic rivals very frequently, but not perform a high number of comparisons in other circumstances.

Social comparisons could even be unrelated, at least to cognitive jealousy. Social comparison orientation did not make any contribution to predicting cognitive jealousy. Cognitive jealousy does not necessarily require a specific individual to be experienced as a rival; instead, it mostly focuses on partners themselves, and the likelihood that they would be unfaithful to the participant.

Theoretically, cognitive jealousy reflects suspicions of people's intentions and trustworthiness, and so differences between people in a disposition to this may not reflect the extent to which they are threatened by a specific other. Congruent with this, cognitive jealousy has been found to be related to low levels of trust in a romantic partner (Rodriguez et al., 2015). Such poor trust is seen among people high in attachment anxiety (Mikulincer, 1998). In particular, attachment anxiety moderates the effect of trust on jealousy, such that low levels of trust are more strongly linked to cognitive and behavioural jealousy among people who are high in attachment anxiety, as these people are more likely to read ambiguous cues as indicating infidelity (Rodriguez et al., 2015). Indeed, while one can suspect a partner of infidelity for reasons relating to lack of value for a partner, there are many other motivations for infidelity, which range from feeling neglected or wronged by a partner, to simply satisfaction of sexual desires (Selterman et al., 2017). It is worth noting, however, that cognitive jealousy is negatively related to self-esteem (Chin et al., 2017), suggesting a role for a sense of inadequacy. Additionally, contingencies of self-worth can influence people's distress at sexual and emotional infidelity (Ellis & Kleinplatz, 2018).

We should consider possible methodological limitations as well, however. Scores on both jealousy variables showed substantial skew, especially on cognitive jealousy. Cognitive jealousy scores were skewed to the point where I had to recode scores into binary data with a cut-off that was not guided by previous research. Very few individuals reported suspecting their partners of infidelity with any meaningful frequency. This may indicate that the items were overly extreme;

three of them asked if the participant suspected an illicit romantic or sexual relationship was currently being concealed from them. Other research has found a similar issue; Elphinston et al. (2011) found that scores on the cognitive subscale showed moderate to severe skew, though not all studies have found this (e.g., Brauer et al., 2020; Knobloch et al., 2001). Elphinston et al. (2011) point out that cognitive jealousy is likely positively skewed in the population, which is supported by other research which finds positive skew across items measuring jealousy (e.g., Gubler et al., 2023). An alternative, which might reduce the issue of skew, would be to use Buunk's (1997) measure of *anxious* jealousy in studies which assess jealousy in the general population. Buunk's items are less extreme; asking, for example, about the worry that an extradyadic relationship might be *forming*. Buunk's measure might therefore allow better discrimination between the varying levels of suspicion genuinely present in the population. Descriptive data appear to support this, in that average scores in anxious jealousy are near the midpoint of the scale in Buunk's original study (Buunk, 1997), while the mean scores on cognitive jealousy were about one-third of the way up the scale in the study that tested the MJS short form (Elphinston et al., 2011). Some research, however, has found scores on this measure to be positively skewed (Carpenter & Spottswood, 2021), though they are not clear about the extent of this.

I also believe that the response anchors of Buunk's reactive jealousy measure (*Not at all Upset to Extremely Upset*) are preferable to the emotional jealousy anchors (*Very Pleased to Very Upset*). Skew in emotional jealousy reflected the fact that very few participants indicated that they would be pleased by their partner engaging positively with a third party of the participant's gender. Chung and Harris (2018) note a similar problem with studies using the MJS which did not find an association between jealousy and relationship satisfaction (e.g., Guerrero & Eloy, 1992; Sidelinger & Booth-Butterfield, 2007). I believe that reactive jealousy is sufficiently related to emotional jealousy that it would be justifiable to use the anchor points from the former when administering the latter. This should better discriminate between varying levels of upset about the situations mentioned and might therefore attenuate the issue of skew.

Another important methodological consideration is that items on the emotional jealousy subscale provide very little opportunity for participants to compare themselves with these individuals. Only one item mentions a quality of these individuals (regarding their physical attractiveness). Therefore, even if social comparisons are involved when people experience jealousy of specific others, emotional jealousy tracks reactions involving an abstracted third party, and so might reflect only one side of a disposition to jealousy. However, even if this argument holds, *part* of my argument remains incorrect. I suggested that SCO would account for greater emotional jealousy among people high in attachment anxiety because it would reflect a person's tendency to experience other people as rivals in general. The lack of an indirect effect through SCO suggests that SCO did not make anxiously attached participants more likely to see non-specific people as rivals.

As a self-report measure, the INCOM may not be wholly accurate about the degree to which people engage in social comparison. As mentioned in the previous chapter, it may reflect a person's tendency to engage in self-criticism, as many people have negative attitudes towards social comparisons (Schlechter et al., 2023). Additionally, there are many elements of social comparisons beyond frequency which might influence jealousy levels. For example, given some research has found that most social comparisons tend to be in a downward direction (Wood et al., 2000), it may be that a general social comparison tendency is not as relevant as a tendency to upward comparison, which is the direction mostly implicated in jealousy (DeSteno & Salovey, 1996; Lennarz et al., 2017).

As this was the same study as Study 1 in Chapter 2, a number of the limitations that I discussed there also apply to these findings. Firstly, the sample was not restricted to young people, such that the conclusions reached are not specifically in relation to this population. As with the SCO analyses from the last chapter, I have since performed these analyses with only participants aged 18-25, and can confirm that the results were effectively unchanged. This does not apply to the mediation analyses, which I was underpowered to study with 115 individuals.. Again, future research

could correct for this by limiting the sample to a specific age group. Furthermore, these results are vulnerable to bias in a similar way. I used a combination of retrospective measures - the frequency with which participants perform social comparisons and the frequency with which they have suspected their partners to be engaging in extradyadic romantic involvement - and prospective measures - the emotional reactions they would have to hypothetical situations involving their romantic partner. I discussed recall biases in the last chapter; highlighting recency, salience and self-enhancement biases (Cameron et al., 2004; Gorin & Stone, 2001), as well as the fact that memories tend to match existing beliefs and cultural theories (Maier & Richter, 2013; Ross, 1989). Recall biases have been found in research on personal relationships as well, e.g., people in love overestimate their prior feelings of love (McFarland & Ross, 1987).

While recall biases could affect memory of cognitive jealousy, especially if some people are more distressed by possible infidelity and are therefore more likely to remember such events, I propose the most concerning bias is in ratings of emotional jealousy. The relationship between SCO and emotional jealousy in this study at least approached significance, such that methodological limitations or nuances that were missed by these measures could obscure a relationship between social comparisons and jealous emotions, while this does not seem plausible for cognitive jealousy. The theories of jealousy cited above, those that implicate social comparisons or self-esteem threat, concern jealous emotions rather than suspicions (DeSteno et al., 2006; Salovey & Rodin, 1986). The link between differential investment and jealousy among infants (Hart & Carrington, 2002) also measured emotional responses, while measures of sibling jealousy (as used by Hamwey & Whiteman, 2021; and Rauer & Volling, 2007) more likely concern emotions than suspicions due to the kinds of jealousy that are possible among siblings (though measures tend to ask about *being* jealous of siblings, non-specifically). There is no clear analogue for cognitive jealousy in non-romantic contexts; the notion of infidelity is specific to romantic settings which have norms of exclusivity.

To deal with the possible biases that could occur in the MJS emotional jealousy subscale; prospective ratings of emotion tend to rely on memory of past occurrences (Schwarz, 2012), because people assume that the ways they remember acting and feeling in the past will be reflected in their psychology in future (Ross, 1989; Schwarz, 2012). This explains why prospective and retrospective accounts of emotions often align with one another. Unfortunately, both diverge substantially from the emotions that people actually experience (Schwarz et al., 2009).

People are often inaccurate in predicting their emotions in hypothetical situations, especially those which involve infidelity (Wilson & Gilbert, 2005; Harris, 2002). People sometimes underestimate the impact of an event due to being in a relatively unemotional state at the time of measurement, such as when taking part in a survey-based study. Conversely, they more often overestimate the emotional impact that events will have on them due to being unable to take contextual factors or factors which aid coping into account (Wilson & Gilbert, 2005). If people based their prospective ratings of jealousy on past events, participants may also have recalled those events when they were most jealous more easily than less intense events. ,.

People might also be influenced by cultural theories of when jealousy occurs. There appear to be cultural values which circumscribe the situations in which jealousy is acceptable, as well as appropriate responses to them, as evidenced by cultural differences (Croucher et al., 2011; Hupka, 1981; Zammuner & Fischer, 1995). People, across a wide range of cultures, often equate jealousy with love (Buss, 2000). If this means that people in love overestimate their likely feelings of jealousy, this could account for the negative associations between attachment avoidance and jealousy, as attachment avoidance suppresses memories relating to relationship closeness (Edelstein, 2006).

These issues with the study methodology suggest that the use of a different methodology could be beneficial. However, there is a problem with experimental research into jealousy. This is because inducing genuine jealousy, in which a person feels an important relationship to be under threat, would not be considered ethically acceptable in most cases. As such, if researchers wish to

provoke actual jealousy in the lab, they tend to provoke threat to new, lab-based relationships, e.g., with confederates (DeSteno et al., 2006). This is hampered by involving relationships which are of relatively low importance to the participants, in which they are far less likely to experience jealousy naturally (Kelley, 1979; Rusbult & Buunk, 1993). As such, to avoid studying jealousy in purely hypothetical situations, researchers must study jealousy as it occurs in people's daily lives. This does not have the same ethical problems, as researchers are not inducing jealousy, but simply studying it when it occurs. Studying social comparisons as they occur in daily life could both reduce the extent to which people report self-enhancing memories and capture a broader range of processes which can encourage jealousy in people.

Conclusion

To conclude, in this study, I did not find evidence that zero-sum self-worth accounts for jealousy as a form of rivalry and hostility between people, contrary to evidence seen in other studies. I only tested associations between comparison frequency and jealousy, so it remains to be seen whether the same will apply to the intensity of self-esteem threat from social comparisons. I have also noted that studying reactions to hypothetical situations involving abstract individuals omits the most likely ways in which people would compare themselves with the targets of their jealousy. To resolve this issue, I would need to employ a methodology which studies jealousy as it actually occurs within people's lives. As such, in the next chapter I turn to my final study, in which I used experience sampling methods to study the associations between social comparisons, self-esteem and jealousy, and examined the way in which attachment anxiety affected these associations.

Chapter 4: Social Comparison in Daily Life: An Experience Sampling Study

Abstract

There are stark differences between people in how readily they experience others as threats to themselves and their relationships. I proposed an individual difference in zero-sum self-worth to account for these differences, arising from attachment anxiety. My prior self-report study found no association between the frequency of social comparisons and a more jealous disposition, contrary to past research linking jealousy and social comparisons. Meanwhile, the associations I investigated between attachment anxiety and zero-sum self-worth were at odds with one another. Reliance on self-report and experimental studies, however, can hamper the capacity for researchers to draw conclusions about how people actually experience social comparisons and jealousy. In this chapter, I review research which has used experience sampling methods to investigate the effects of social comparisons on self-evaluations and jealousy. This approach also allows measurement of individual differences in the strength of effects. In Study 3 ($N = 87$), participants responded to experience sampling surveys three times per day, reporting their social comparisons, state self-esteem and jealousy over the course of seven days. I found a divergence in results for state jealousy and self-esteem. Contrary to my Study 1 findings, no personality variables were associated with social comparison frequency. All social comparison directions positively predicted state jealousy, though there was evidence of substantial differences between people in the strength of the effect of upward comparisons on jealousy. The effect of upward comparisons on jealousy was partially mediated by reductions in state self-esteem, but there was no evidence of substantial differences in the effects of social comparisons on self-esteem. Upward comparisons were more likely to produce jealousy among people high in attachment anxiety, but attachment anxiety did not moderate their effect on state self-esteem. I conclude that attachment anxiety may not lead to a more zero-sum form of self-worth, but it can help to explain the potential for social comparisons to provoke jealousy.

Introduction

In this project, I proposed that people vary in the extent to which they determine their own sense of worth as a person through comparisons with other people, that this tendency would be heightened by attachment anxiety, and that it would in turn partly account for the association between attachment anxiety and jealousy. In the previous two chapters, I investigated whether attachment anxiety predicts elements of a zero-sum form of self-worth and whether this increases people's disposition to experience jealousy. In Chapter 2, I found mixed support for my hypothesised link between attachment anxiety and zero-sum self-worth. Study 1 showed that anxious attachment appears to be related to a greater readiness to use social comparisons, but Study 2 did not find that attachment anxiety moderated the effect of social comparisons on state self-esteem. While attachment anxiety did not lead people to weight social comparison information more strongly in their self-evaluations, given the main effect of upward social comparisons on self-esteem, it is likely that more frequent social comparisons implies more zero-sum changes in their self-esteem. In the last chapter, I reviewed past evidence that jealousy is provoked by zero-sum self-esteem threat. Despite this, I did not find that social comparison orientation mediated the relationship between attachment anxiety and romantic jealousy, and ability SCO was unrelated to emotional jealousy. This means that my evidence largely contradicts the idea of a link between attachment anxiety and a zero-sum form of self-worth which might account for heightened jealousy, but the lack of consistent findings from these studies necessitates further exploration.

In Chapter 2, I found that upward social comparisons had a negative main effect on state self-esteem, which could suggest that zero-sum self-esteem is the norm among young adults. However, I did not test the effect of downward comparisons, due to power considerations in that study. Among the most strident statements of self-esteem as a zero-sum enterprise is that of Barkow (1975, p. 554), who maintained that "To evaluate the self as higher than others is to maintain self-esteem". This implies that the failings of other people are an advantage to oneself,

helping as they do to maintain and advance one's own value. This is clear evidence of the kind of rivalry which I aimed to investigate through this project, and gives a clear motivation for people to denigrate others who they are jealous or envious of (Parrott & Smith, 1993). As such, understanding how people tend to respond to downward comparisons is as relevant as how they respond to upward comparisons, for understanding zero-sum self-worth and the hostility to others that might accompany it. Just as with upward comparisons, I anticipated that attachment anxiety could help to explain the tendency to base self-worth on downward comparisons.

Individual Differences in Zero-Sum Self-Worth

The second major question that has not yet been addressed in this project is the extent of variation in zero-sum self-worth. This breaks down into two questions: to what extent do people vary in the number of comparisons they perform, and to what extent do they vary in the effect these comparisons have on their self-esteem? As an addendum to this, we can also ask whether people differ substantially in the extent to which comparisons make them feel jealous of others, thus showing an individual difference in the tendency for relative standing to generate conflict between people.

Past Research

The first part of this question has been examined, to some extent. Gibbons and Buunk (1999) found that participants varied substantially in how frequently they report comparing themselves to others; Buunk et al. (2019) note that in that study, the highest and lowest scores possible on the measure were both within three standard deviations of the mean. We have already seen that social comparison orientation (SCO) is associated with more contingent and less stable self-esteem (Neff & Vonk, 2009), self-esteem that appears to be more vulnerable to social comparisons, at least in an online context (Vogel et al., 2015). Variation in Insecure Striving (perceiving the world to be a competitive arena) are also reasonably large, with 3 *SDs* covering scores of 20-70 on a factor whose possible values range from 20-80 (Gilbert et al., 2007). However,

no studies that I have found have investigated the extent of between-person variation in the effect that social comparisons have on self-esteem. If the effects of social comparisons on self-esteem and jealousy do differ across individuals, failing to model this variation can lead researchers to incorrectly infer main effects (Bell et al., 2019).

As I outlined in the Introduction chapter, there are a variety of processes by which people seek and achieve a sense of self-worth, and therefore variation in the ways that self-worth can be bolstered or threatened. For instance, people can seek status, by being respected or dominating others (Cummins, 2015; Henrich & Gil-White, 2001), or people can seek belonging (Leary et al., 2014; Mahadevan et al., 2019). Individuals higher in narcissism seem to be more preoccupied with social status (Mahadevan et al., 2019), and this appears to make them more focused on doing better than others (Brummelman et al., 2016). We have seen that the dynamics of relative investment can make even achieving self-worth through acceptance from close others a competitive enterprise. However, through all this, there are ways in which competitive concerns can be reduced even in receiving validation from others (Schimel et al., 2001), and while people in some societies seem to have a greater prevalence of competitive concerns than others (Davidai, 2023; Wilkinson & Pickett, 2018), changes in levels of economic equality can change the competitiveness that people see in their worlds (Sommet & Elliot, 2022).

Multilevel modelling studies have revealed meaningful between-person variation in the effects of social comparisons on other outcomes, such as depressive symptoms (Steers et al., 2014). The association between social comparisons and depression has been found to be mediated by low self-esteem (Ozimek & Bierhoff, 2020). This suggests that people are likely to meaningfully differ in the effect that social comparisons have on their self-esteem.

In order to answer this question directly, I needed to use methods which would give individual coefficients for the effect of social comparisons on self-esteem and jealousy, in order to assess variance in the size of these coefficients. This meant that I needed a number of datapoints for

each participant in order to gain a stable estimate of the effect of social comparisons on their levels of self-esteem or jealousy. This is usually not practical in an experimental context due to the time to experience and respond to multiple manipulations. Beyond this, the effect of each comparison is not independent of its place in the sequence and so this approach would not give multiple datapoints for a single effect, but instead many different but related effects, which could not be compared.

Participants therefore needed to be sampled on a number of separate occasions, requiring the use of a longitudinal design.

Experience Sampling Methods

As I was not interested in the manner in which jealousy, social comparison behaviour or self-esteem would change over time, but rather the effect of multiple occurrences drawn from a single time-period, I chose to use an intensive longitudinal design, in which individuals are sampled repeatedly over a short period. Specifically, I used experience sampling methods (ESM), otherwise known as ecological momentary assessment (EMA) (Stone et al., 2007). This methodology contrasts with the experimental methods of Study 2, as it directly investigates occurrences in participants' daily lives by surveying them in real-world settings. As well as surveying participants through repeated measures, it also contrasts with Study 1 by assessing the effect of events as close as possible to when they took place; Silvia and Cotter (2021) refer to this as 'near-term assessment'. I intended for these features of ESM to correct for some of the methodological shortcomings with my two previous studies.

In the past two chapters, I discussed shortcomings with prospective and retrospective self-report studies. Specifically, that they can be affected by recall biases reflecting self-enhancement, cultural theories, pre-existing beliefs as well as the influence of recent or extreme events (Cameron et al., 2004; Gorin & Stone, 2001; Maier & Richter, 2013; Ross, 1989). Additionally, people can be inaccurate in predicting their own future emotions (Harris, 2003; Wilson & Gilbert, 2005). I also outlined the ways in which these issues could have affected scores in SCO and jealousy measures in

particular. Experience sampling methods, which assess people's reactions to events in the near-term, i.e., close to when they actually occurred, reduce the effect of recall biases (Stone & Shiffman, 2002), hopefully giving more accurate ratings of the intensity and frequency of psychological phenomena (Nezlek, 2020).

In Chapter 2, I outlined possible issues with treating experimentally-induced social comparisons, and people's reactions to them, as representative of their social comparison behaviour in daily life. The comparison target may not be the sort of person that members of our population tend to compare themselves to (Wheeler & Miyake, 1992). These comparisons may not reflect the preoccupations of our population, or those with higher attachment anxiety (Mikulincer, 1997), or people's responses in a psychological study context may simply differ from their responses in their daily social interactions (Silvia & Cotter, 2021). Finally, it is difficult to induce jealousy in a way that would be both representative of the issue in people's lives and ethically acceptable (see DeSteno et al., 2006).

Experience sampling studies give researchers the ability to study phenomena in a more ecologically valid way, by surveying people in naturalistic settings. Moreover, participants report the social comparisons that took place in their lives, ensuring both that these occurrences are at least somewhat representative of their daily life, and actually involve comparisons. Finally, experience sampling methods allow researchers to assess the impact of real events on jealousy without having to interfere with personal relationships in ways that could be damaging, because the events measured take place independent of the research.

The major disadvantage of experience sampling methods compared with experimental methods is the inability to control contextual factors which could influence the outcomes. All social comparisons in people's real lives come with an unpredictable array of contextual factors. This means that it might be inappropriate to aggregate effects of individual social comparisons into an overall effect, as changes in self-esteem might reflect very different effects in different cases, even

within a single individual. While contextual factors cannot be made wholly uniform in experience sampling studies, this potential problem can actually be an advantage. In an experience sampling study, a researcher can ask participants to report on the presence/absence of these contextual features in their everyday comparisons, and control for their influence in their analyses. Not only does this mitigate against confounding effects, but it also allows researchers to study the very important role of these contextual effects (Trull & Ebner-Priemer, 2009), especially on the intraindividual level, which provides a much richer picture of social comparison processes in daily life than experiments or survey methods tend to allow.

ESM research therefore comes with advantages not shared by most of the research which has been reviewed in this thesis. Some research, however, has used experience sampling methods to investigate social comparisons, self-esteem and jealousy, and I will now turn to a discussion of relevant findings from this research.

Past Findings in ESM Research

Despite the evidence from Gerber et al. (2018), that social comparisons did not have a main effect on self-esteem, I found a negative main effect of social comparisons on state self-esteem in Study 2 (Chapter 2). Prior experience sampling studies have tended to support my findings. In body image studies (mainly involving female participants), comparisons on appearance, weight and eating behaviour consistently have contrast effects on body dissatisfaction (Fitzsimmons-Craft, 2017; Fuller-Tyszkiewicz et al., 2019; Leahey et al., 2011; Thøgersen-Ntoumani et al., 2017), including when dissatisfaction was measured using the appearance-based self-esteem scale (Fardouly et al., 2017; Myers et al., 2012). These contrast effects are seen for both upward and downward comparisons. Diel et al., (2021) found that comparison direction had a linear negative effect on self-esteem, such that upward comparisons led to lower self-esteem while, importantly, downward comparisons led to higher self-esteem. The much shorter intervals between comparison and reporting in these studies relative to the studies reviewed by Gerber et al. (2018) substantially reduces the issue of recall bias.

Despite the aforementioned issues with self-report and experimental research into jealousy, seemingly little research has been conducted investigating jealousy through daily life methods. One notable exception is Lennarz et al. (2017), who found that adolescents experienced more jealousy in situations where they rated themselves as performing less well to those around them. This is consistent with the self-evaluation maintenance theory of jealousy, in which jealousy results from the sense that a relationship partner prefers a rival to oneself (DeSteno & Salovey, 1996) and other findings implicating inferiority and self-esteem threat in jealousy (DeSteno et al., 2006; Karakurt, 2012). Interestingly, Lennarz et al. (2017) also found that participants experienced more jealousy when online than in person, which may reflect a greater opportunity for contrastive social comparisons (e.g., Lee, 2014).

There are certain limitations to these experience sampling studies, however. Lennarz et al. (2017) asked participants to rate their relative performance at every timepoint, regardless of whether they had performed a social comparison prior to the signal. This again raises the question of whether organic social comparisons had taken place, and/or whether the study was inducing participants to perform social comparisons in circumstances where they usually would not. At worst, this method therefore equates explicit social comparisons with imagined comparisons, and also equates personalised comparisons with generalised comparisons, which are known to produce different effects (Locke, 2007). Additionally, both these researchers and Diel et al. (2021) study social comparison direction as a unitary, linear scale from strongly downward comparisons to strongly upward comparisons. This approach assumes that upward and downward comparisons will have equivalent, inverse effects. While some studies have found this (e.g., Aspinwall & Taylor, 1993; Blanton et al., 2000; Morse & Gergen, 1970), others have not (Ozimek et al. 2021, Bardel et al., 2010), and it is necessary to test for linearity before making this assumption. Effects found in this way could reflect a strong effect of upward comparisons with a weak/non-existent effect of downward comparisons or the inverse (Wheeler & Suls, 2007). While it might be tempting to use lateral comparisons as a reference category, this is not legitimate, because instead of being

equivalent to instances without social comparisons, lateral comparisons are specific acts performed for their own set of motivations, e.g., self-evaluation (Helgeson & Mickelson, 1995) and with their own distinctive effects (e.g., Finlay & Lyons, 2002).

I have not found many daily-life studies which examine the links between attachment anxiety and self-esteem dynamics in daily life. Consistent with links between attachment anxiety and trait self-esteem, Pietromonaco and Feldman-Barrett (1997) found that preoccupied individuals tended to have lower self-esteem following social interactions. One exception already mentioned is that of Hepper and Carnelley (2012) who found that the self-esteem of people high in attachment anxiety decreased on days following rejecting feedback from romantic partners, but not following other forms of feedback.

In summary, there are gaps in the existing literature and this project which could be addressed by studying the links between attachment, social comparisons, self-esteem and jealousy in daily life. While questions relevant to individual differences in zero-sum self-worth have been explored in prior research, the extent of variance in the self-esteem effect of social comparisons has not been adequately investigated. So far in this project, I have found mixed results for the association between zero-sum self-worth and attachment anxiety. Given some of these findings may have been affected by recall biases on the one hand or lack of representativeness to people's lives on the other, there is a need for an ecologically valid, near-term investigation of this association.

Situational Moderators

As I indicated above, one advantage to ESM is the ability to model within-person variation in effects, as situational features of each social comparison may modulate the effects they have on self-esteem and jealousy. There are two factors that I have identified as possibly relevant to the effects of social comparisons and which I was unable to measure in the two previous studies. These

are the type of target that the individual compares with, and the presence of other people who may also observe the discrepancy between oneself and the target.

I have already noted that the comparison target being a stranger to my Study 2 participants might have affected the results. Closeness to a target is thought to make one more likely to assimilate one's self-evaluations to them (and thus lessen the extent to which comparison outcomes reflect contrast effects), by increasing the accessibility of information which implies similarity with the target (Mussweiler, 2001). There are disagreements whether this is a social comparison process, though. Mussweiler (2001) considers this to result from similarity testing during a comparison and Locke (2003) found that comparing oneself with close targets engendered more ratings of similarity/difference and less ratings of better/worse than with distant targets. On the other hand, Pelham and Wachsmuth (1995) maintain that assimilation is an automatic process which occurs when individuals are not motivated to perform direct comparisons.

A similar disagreement exists for the effect of closeness on threat levels. Tesser's (1988) Self-Evaluation Maintenance model suggests that being close to a target can reduce the threat their successes pose; the individual can "bask in reflected glow" (BIRG), leading to heightened positive affect. While BIRG is sometimes treated as an aspect of social comparisons (e.g., Kimmelmeier & Oyserman, 2001), it is in fact thought to be a substitute for comparisons (Wheeler & Suls, 2007), occurring when the individual is unmotivated to compare because the domain of performance is irrelevant to their self-concept. If the domain is self-relevant, closeness to the target makes them a more relevant model for self-evaluation, encouraging comparisons, which leads to increased threat (Tesser, 1988). This suggests that when comparisons actually occur closeness would increase threat; if an individual has engaged in assimilation or BIRG, they are unlikely to have performed a comparison. However, there are cases in which closeness does seem to mitigate the threat posed by social comparisons. For example, it has been found that in satisfying romantic relationships, the

positive impacts of outcompeting the other person and the negative impacts of being outcompeted are attenuated (Beach et al., 1998; Pinkus et al., 2008).

The second relevant situational factor was the presence of other people, aside from oneself and the comparison target. In the previous chapters, I have suggested, in different ways, a role for the views of other people in shaping self-esteem and jealousy. One of the reasons that the question of whether one is a person of value and worth is meaningful is because one's standing could affect relationship-based contingencies in one's life, ranging from social acceptance/interpersonal value (Leary et al., 1995; Macdonald & Leary, 2012), interpersonal investment (P. Gilbert et al., 1995) to care and support (Bowlby, 1973). Indeed people's self-esteem appears to be reactive to the perceived valuation of others, especially those one has a valued relationship with (Murray et al., 2003; Shrauger & Schoeneman, 1979). Given this, we might expect self-esteem to shift most strongly when others are present to perceive the discrepancy between the individual and the target. Gilbert et al.'s (2007) measure of insecure striving includes items about others performing comparative judgements. As discussed in Chapter 2, status concerns seem to be more forceful when other people are present (Willer, 2009). It is also possible, though, that the presence of others might affect the self-esteem of some individuals but not others, i.e. following how strongly their self-esteem is based on the approval of others (Crocker & Wolfe, 2001). Even if the presence of others does increase the impact of social comparisons, it is unclear whether this would be restricted to when the others are close to the participant (i.e. family members, romantic partners or friends).

Jealousy is thought to occur from both relationship and self-esteem threat, and previous researchers have raised the possibility that it is the viewpoints of one's relationship partner that links the two (DeSteno & Salovey, 1996). Indeed, Lennarz et al.'s (2017) found that adolescents were more likely to experience jealousy when among peers than alone. However, Uink et al. (2017), who also studied an adolescent population through daily life measures, found the opposite; that being with peers decreased the effect of negative events on adolescents' emotional state, on worry,

sadness and jealousy. They attribute this to the ability of peers to offer emotional resources and support, which buffer against the impacts of negative events (Cohen & Wills, 1985; Lakey & Socobria, 2005).

All these points suggest that the closeness of a target, and the presence or views of others are likely to affect the way that social comparisons impact self-esteem and jealousy, but it is unclear exactly what effects they will have. In this final study, I wanted to test for the effects of these situational variables so that their influence could be controlled for, but also to use this added detail to get a clearer picture of how different self-evaluative styles would actually play out in our participants' lives.

The Present Research

Aims

I designed an experience sampling study in which participants reported both on social comparisons they performed in the course of their daily lives, situational features of those comparisons (their relationship to the target and the presence of other people), as well as their level of state self-esteem and jealousy at each timepoint.

This study had four aims. Firstly, to assess the extent of variation in zero-sum self-worth and comparison-induced jealousy. Consistent with the random slopes found by Steers et al. (2014), in the effect of social comparisons on depression (), I hypothesised that random slopes would be found in the effect of social comparisons on state self-esteem. Following the self-evaluation maintenance model of jealousy (DeSteno & Salovey, 1996), this would further imply meaningful differences in the extent to which upward (but not downward) social comparisons would induce jealousy. I therefore hypothesised significant random slopes in both cases. If random slopes were not found, this would tend to discredit the concept of “zero-sum self-worth” as a meaningful individual difference.

Secondly, to investigate how the effects of downward and upward comparisons might differ, both in their main effects on self-esteem and jealousy and their interaction with attachment anxiety. This study's design was relatively similar to that of Diel et al. (2021), as both investigated the self-esteem effect of non-domain-specific social comparisons among young people. I therefore expected to replicate their findings, and those in other recent ESM studies, that self-esteem following ability-based social comparisons would exhibit contrast effects. This is consistent with my results from Study 2, that upward comparisons would have a negative effect on state self-esteem, but I also expected that downward comparisons would have a positive effect on state self-esteem. I had no hypotheses about the effect of lateral comparisons.

If upward social comparisons do lead to lower state self-esteem, the self-evaluation maintenance model of jealousy (DeSteno & Salovey, 1996) would predict that this self-esteem threat would heighten the likelihood of jealousy. At least one experience sampling study found upward social comparisons to predict heightened jealousy (Lennarz et al., 2017). Importantly, I did not find a consistent link between jealousy and social comparisons in Study 1 (Chapter 3). However, I suggested that this may reflect methodological problems with the INCOM as a measure of social comparisons, not least the failure to distinguish between upward, downward and lateral comparisons. Downward comparisons in particular are not usually found to lead to self-evaluative threat (e.g., Blanton et al., 2000; Morse & Gergen, 1970; though see Lockwood, 2002; Ozimek et al., 2021 for exceptions) and therefore would be unlikely to produce jealousy. As such, I predicted that upward, but not downward or lateral comparisons, would predict state jealousy. Additionally, I propose that upward social comparisons lead to higher levels of jealousy due to their capacity to threaten self-esteem, and so I tested a mediation model in which upward comparisons would predict state jealousy via their effect on state self-esteem.

Thirdly, to clarify conflicting findings regarding attachment anxiety's role in zero-sum self-worth from the past two studies through the use of a different methodology. Using experience

sampling methods allowed me to assess variation in both elements of zero-sum self-worth at once; the frequency with which people perform social comparisons in their daily lives and the ability of real-life social comparisons to predict changes in self-esteem and jealousy. This addresses the issue of the influence of subjective interpretations of the INCOM's response anchors, allowing us to study real frequencies as opposed to people's interpretations of them. Consistent with my Study 1 findings and prior research (Lev-Ari et al., 2014; Powell et al., 2018) I expected that the positive association between attachment anxiety and social comparison frequency would be borne out in episodic reports. I also believed that people high in attachment anxiety would be more likely to make more upward comparisons as a proportion of their total comparisons. This is partly because sensitivity to social threat should make upward targets more salient. Also, individuals with negative self-views are likely to perform comparisons congruent with initial hypotheses of inferiority (Mussweiler, 2003).

I also hypothesised that more anxiously attached people would tend to experience stronger contrast effects on self-esteem from social comparisons. I further believed this would apply to both upward and downward comparisons. Attachment anxiety is associated with vulnerable narcissism (Otway & Vignoles, 2006; Smolewska & Dion, 2005), which has been found to moderate the effects of social comparisons on state self-esteem (Ozimek et al., 2021). Ozimek et al. found that while vulnerable narcissism led to lower self-esteem following upward comparisons, it also led to lower self-esteem following downward comparisons, apparently indicating that individuals high in vulnerable narcissism tend to identify with those performing more poorly and thus to assimilate to them in comparisons. It is therefore possible that attachment anxiety could lead to lower self-esteem following downward social comparisons. Nevertheless, zero-sum self-worth implies that just as being outcompeted should lead to lower felt security, outcompeting others for positive attention and investment from relationship partners should tend to lead to greater felt security, increasing the sense of being worthy to these partners. I therefore expected attachment anxiety to heighten the contrast effects of downward comparisons as well.

If attachment anxiety intensifies the effect that social comparisons have on self-esteem, I also expect it to make them more likely to lead to jealousy. As discussed in Chapter 3, this is because people may expect their partners to leave them if they find favourable relationship alternatives, and because partners may simply choose to invest more time and support into people they find more appealing. As such, self-esteem threat should heighten the extent to which others are seen as both absolute and partial rivals.. I therefore predicted that attachment anxiety would increase the indirect effect of upward comparisons on jealousy via state self-esteem.

Finally, I aimed to investigate the sources of within-person variation in the effects of social comparison by testing the effects of situational moderators. Due to differing evidence as to how the presence of others and the type of comparison target would affect self-esteem and jealousy, I included these as covariates but also tested their interactions with social comparison directions.

A related benefit is the ability to derive a detailed picture of our population of young adults. When do comparisons arise in their lives, with whom and how do the effects of social comparisons differ across these contexts? Previous evidence on such frequencies and who people tend to compare with has been inconsistently measured and often poorly reported (Arigo et al., 2020a). If we learn these details from our population, future research can make use of this knowledge in designing relevant social comparison manipulations instead of making assumptions.

Design Considerations

In Study 1, I investigated romantic jealousy as, among our population of study, it is highly consequential (Johnson et al., 2015) and substantial variance is seen in its experience and expression (Mogilski et al., 2019; Pichon et al., 2020). However, I also emphasised that many of the processes which apply to romantic jealousy are likely to apply to all forms of jealousy, depending mainly on the importance of the relationship and its capacity to be threatened by others. In this study, I chose not to study romantic jealousy specifically, but instead to investigate effects on jealousy in general. This

was due to the makeup of the sample. Undergraduates made up the entire sample in Study 2, and a large proportion of the sample in Study 1, so I decided to sample from undergraduate populations for this study, to ensure comparability of effects. One recent study found that, at least among US undergraduates, less than 50% are in romantic relationships (Beckmeyer et al., 2023). Recruiting participants was likely to be a challenge without any further sampling restrictions, as it required a substantial outlay of time. I therefore chose not to solely recruit participants in romantic relationships, but to investigate whether romantic relationship status would affect the outcomes by including it as a covariate in the analyses.

As I mentioned in Chapter 3, there is no clear analogue for cognitive jealousy in non-romantic contexts. Additionally, my results from Study 1, reported in that chapter, indicate that there is likely no connection between zero-sum self-worth and cognitive jealousy. As I wanted to study all forms of jealousy in this study, I specifically asked participants to report on their jealous emotions rather than suspicions.

I chose to use signal-contingent reporting in this study (i.e., surveys completed at regular intervals) instead of event-contingent reporting (i.e., surveys completed following a social comparison). This allowed me to establish a meaningful dynamic baseline for self-esteem, to show how far it shifted following a social comparison. I also followed the majority of ESM studies into social comparisons in sending surveys to participants at multiple timepoints per day (Arigo et al., 2020a). Even daily reporting of social comparison, such as is used in daily diary studies (e.g., Arigo et al., 2020b), might lead to recall biases, because the affective impact of social comparisons can be neutralised very quickly if they are judged to be irrelevant (D.T. Gilbert et al., 1995). I chose to send participants three surveys per day. While numerous ESM studies into social comparison used a greater number of surveys (e.g., Leahey & Crowther, 2008; Lennarz et al., 2017), I wanted to minimise occurrences at which participants reported no comparisons. If participants answered “no”

too frequently, they might begin to pay less attention due to boredom and select “no” by default, even when they have performed social comparisons (see Bolger et al., 2003).

Yet it is also important to minimise the time between events and measurement. The longer the intervals between measurements, the longer self-esteem measurements will fall after the social comparisons which are proposed to be affecting them. This could be a problem given the ephemerality of some social comparison effects and compensatory processes which people can engage in to restore self-esteem (e.g., Vohs & Heatherton, 2004), which mean that a person’s self-esteem could change between comparison and survey. One previous signal-contingent study (Diel et al., 2021) addressed this problem by asking participants to report what their self-esteem *had been* following the comparison, a more direct measure of immediate post-comparison self-esteem. However, asking participants to recall their level of self-esteem reintroduces some of the aforementioned recall biases (Cameron et al., 2004; Gorin & Stone, 2001). By contrast, measuring self-esteem which is current at the time of the survey gives participants direct access to the information they are reporting on, and I believe this makes it more valid than asking about self-esteem in the past. My study therefore complements that of Diel et al. (2021); being less likely to detect more ephemeral effects, but more validly measuring slightly longer lasting effects. If my results match those of Diel et al., the convergence in findings across different methodologies divergence will give greater certainty about the effect that social comparisons have on state self-esteem.

There was a possibility that taking part in this study could impact people’s behaviour/responses, a process known as measurement reactivity (Barta et al., 2012; MacIntyre et al., 2021). For example, ability to recall social comparisons might improve or decline across the course of the study week, because individuals get better at something if asked to do it repeatedly, or alternatively, interest may wane and individuals may recall social comparisons less well (Bolger et al., 2003). Being part of the study might make individuals notice social comparison information more in

their daily lives than they usually would and thus perform more comparisons, or they might spend more time evaluating themselves. Effects like these weaken one benefit of ESM, that of capturing life as it is lived. . Measurement reactivity often manifests in people behaving differently for the first few days of the study before they become accustomed to it. I therefore tested for measurement reactivity by contrasting self-esteem and jealousy on days 1 and 2 with self-esteem and jealousy on other days.

Methods

Design. This was an experience-sampling study using the survey app SEMA3. SEMA3 was designed by researchers at the University of Melbourne (Koval et al., 2019), and details about it can be found at <https://sema3.com/>. The study was approved by the University of Sheffield Research Ethics Committee (07/11/2022) and pre-registered on the Open Science Framework and details can be found here: <https://osf.io/bdp4x>. Participants completed measures of attachment anxiety and avoidance, neuroticism and trait self-esteem at baseline. They then completed signal-contingent episodic surveys across the course of one week, detailing their state self-esteem, social comparisons and state jealousy. I used multilevel modelling to study the within-person effects of social comparisons upon self-esteem and jealousy, individual differences in these effects, and cross-level interactions to identify whether any trait-level variables could explain these differences.

Participants. Participants were eighty-seven undergraduates at British universities. 48% of these participants attended the University of Sheffield, were recruited through the university research participation tool SONA and received 4 study credits for participation. The remainder were recruited through the online research participation site Prolific, and were paid £10 for taking part. The necessary sample size was based on a power analysis conducted using the simr package in R to detect a cross-level interaction between attachment anxiety and social comparisons in predicting state self-esteem. I derived model parameters from previous published studies (Diel et al., 2021; Fleischmann et al., 2021; Lennarz et al., 2017), except descriptive values for attachment anxiety,

which were taken from my own prior research. A sample of one hundred participants was found to provide power of .80 for a medium effect size for moderation ($f^2 = .01$; Kenny, 2018), which is also very similar to the median sample size (105) used in previous ESM studies into social comparison, as compiled by Arigo et al. (2020a). My final sample fell slightly short of this number, as I lacked the necessary time and resources to collect more data. However, the N exceeded the minimum number of level-2 units (participants, in this case) needed to estimate effects without bias (Maas & Hox, 2005). Since the initial submission of this thesis, I have collected more data and rerun these analyses with a sample size of $N = 97$. My results were essentially unchanged, but more detail can be found in the manuscripts I have prepared for publication.

Procedure. Participants initially read an information sheet, completed consent forms and screening questions (age, country of residence and education status) on Qualtrics to confirm they were willing and eligible to take part in the study. After this, they signed up for and attended an online briefing session via Zoom. During this session, I explained the study rules and procedure as well as how to use the SEMA3 app, which they downloaded at the same time. I emailed guidance documents to supplement this information, and gave participants the chance to ask any questions they had about the study. One of the guidance documents gave clarifications on the measures participants would be completing throughout the study. Specifically, it outlined which situations participants should report as social comparisons and jealousy. Details can be found in the measures section and Appendix 6.

One day prior to the study week, participants completed demographic measures (age, gender, relationship status/length and country of origin) and baseline measures on SEMA3. During the study week, SEMA3 sent participants three notifications per day asking them to complete episodic surveys. These notifications were pseudorandomised; each could come at any time during a pre-specified time window (11am-12pm, 2.30-3.30pm, 6-7pm). Once they received a notification, participants had fifteen minutes to complete the survey before it expired. If surveys expired before

they could be completed, this timepoint would be logged as missed. Participants reported the following details, in this order: their current state self-esteem, how much jealousy they had experienced since the last survey and whether they had performed any social comparisons in that time. If they answered “yes” to this latter question, they were asked details about the most significant social comparison they performed, including how much better/worse they considered themselves to be doing compared to the target, who the target was and who else was present at the time. If they reported not performing any comparisons, they were asked questions about where they spent time since the last survey, who else was present during that time and their conflict with others. These questions were included to make sure participants answered the same number of questions no matter which answer they selected, removing the potential incentive to choose “no” to save time.

At the end of the study, participants completed a brief evaluation survey asking how difficult and disruptive they found it to take part and then were debriefed, thanked and credited for their participation. If a participant missed six or more surveys through the week, they were not credited for participation, which they were informed of prior to the study.

Baseline Measures. *Demographic measures.* These included *gender* (with options of “Male”, “Female” and “Non-binary/Other”), *relationship status* (with options of “Single”, “In a romantic relationship”, “Married” and “Divorced”), *current relationship length* (with options of “Less than three months”, “3-6 months” “7-11 months”, “1-2 years”, “3-5 years” and “6+ years”) and *country of origin* – a free-text response which could be the country they were born or raised in. Due to extremely uneven frequencies of certain categories, relationship status was collapsed into a dichotomous variable with levels of 0 (Single/Divorced) and 1 (In a romantic relationship/married), while country of origin was collapsed into a dichotomous variable with levels of 0 (outside the UK) and 1 (UK).

Attachment Anxiety and Avoidance. Experiences in Close Relationships – 12 (ECR-12; Lafontaine et al., 2015): a 12-item questionnaire in which participants rated statements about their behaviour and emotions within personal relationships generally (e.g., “I feel comfortable depending on others”) on a 7-point Likert scale from Disagree Strongly (1) to Agree Strongly (7). It combines two 6-item subscales for anxiety ($\alpha = .83$) and avoidance ($\alpha = .85$).

Neuroticism. Subscale of the Big Five Inventory (BFI; John et al., 1991) ($\alpha = .82$): an 8-item questionnaire in which participants rated attributes about themselves (e.g., "I am someone who worries a lot") on a 5-point Likert scale from Strongly Disagree (1) to Strongly Agree (5).

Trait Self-Esteem. Rosenberg Self-Esteem Scale (Rosenberg, 1965) ($\alpha = .90$): a 10-item measure assessing people’s evaluations and attitudes towards themselves, on a 4-point Likert scale from Strongly Disagree (1) to Strongly Agree (4).

All trait measures (attachment orientations, neuroticism and trait self-esteem) were grand-mean centred for ease of interpretation.

Episodic Measures. *State Self-Esteem.* State Self-Esteem Measure ($\alpha = .89$): an adapted, state version of the Self-Liking subscale of the Self-Liking Self-Competence Scale - revised (Tafarodi & Swann, 2001), a 5-item questionnaire measuring current feelings about the self. Participants rated statements about their liking of themselves (e.g., "I am very comfortable with myself right now") on a 5-point Likert scale from Strongly Disagree (1) to Strongly Agree (5).

State Jealousy. A single item measure of the levels of jealousy the participant had experienced since the last notification they received, on an 11-point slider scale from 0 (None at all) to 10 (A great deal). Participants were instructed to report only occasions which were triadic, i.e., involving the participant, the target of their jealousy and a person they had or wanted a relationship with, which the target posed some form of threat to. This specifically excluded instances of envy, which is often colloquially conflated with jealousy (Parrott & Smith, 1993), but included jealousy in

any relationship context, e.g., romantic, sibling and peer relationships. Full details of these instructions can be found in the Measures Clarifications (Appendix 6).

Comparison Occurrence. A single item measure asking participants if they made any social comparisons since the last notification they received. Participants were instructed to only report comparisons made on abilities, personal attributes and performance, and not on opinions or life circumstances. Full details of these instructions can be found in the Measures Clarifications, (Appendix 6).

Measures following a “Yes” response to the comparison occurrence measure:

Comparison Frequency. A single item measure asking participants how many social comparisons they made with others since the last notification. I intended to calculate social comparison frequency as the sum of participant scores on this comparison frequency measure. However, participants were given a free-text box to respond, and some responded with narrative descriptions of comparisons, while others reported extremely high numbers (e.g., sixty) of comparisons performed since the last timepoint. Participants were instructed to only report comparisons they had specific memories of, and it seemed implausible that any participant had specific memories of sixty social comparisons, so I concluded that, at best, some participants were estimating numbers post-hoc against the instructions of the study. Based on these two problems, I concluded that the comparison frequency measure was unusable, and instead measured frequency as a count of the number of timepoints in which participants responded yes to the comparison occurrence measure. All such timepoints were counted as one, regardless of the number of comparisons a participant reported making. As participants had completed a varying number of surveys, overall frequency was divided by the number of surveys each participant had actually responded to.

Comparison Direction. A single item measure of how much better or worse participants believed themselves to be doing compared to the target of their most significant social comparison

since the last notification, on a 5-point Likert scale from -2 ("much worse") to 2 ("much better"). For analyses, this was split into upward comparisons (-1/-2), lateral comparisons (0), mild downward comparisons (1/2).

Target type. A single item measure of how the comparison target was related to the participant, with options of "family member", "friend", "romantic partner", "stranger", "acquaintance", "colleague" and "other". Targets were coded as close targets (friends, romantic partners and family members) or distant targets (stranger, acquaintances, colleagues or others).

Others present. A single item measure of who else was present (beyond the comparison target) when the comparison was performed, with options of "family member(s)", "friend(s)", "romantic partner(s)", "stranger(s)", "acquaintance(s)", "colleague(s)", "other" and "no one". Participants could select multiple options. Others present were additionally coded as close others or distant others present using the same criteria as the target type question. If both close and distant others were present, this was classified as close others present, as I hypothesised that the presence of close others in this case would have the strongest impact on comparison effects.

Measures following a "No" response to the comparison occurrence measure (Distractors):

Conflict. A single-item measure of the amount of conflict experienced with others since the last notification, on a 10-point slider scale from 0 (None at all) to 10 (A great deal).

Context. A single-item measure of where participants spent most of their time since the previous notification, with options of "home", "university", "outside", "work", "social setting", "gym" and "other".

Company. A single item measure of who the participant spent time with since the last notification, with options of "family member(s)", "friend(s)", "romantic partner(s)", "stranger(s)", "acquaintance(s)", "colleague(s)" and "no one". Participants could select multiple options.

Analysis Plan

Data Screening. For analyses involving comparison frequency: Social comparison frequency was square-root transformed due to non-normality. One comparison frequency score was found to be an outlier and winsorised to the nearest non-outlier value. Two cases were removed from the analysis as multivariate outliers, while one was removed for exercising a high degree of leverage on the results ($> .18$).

For multilevel analyses (see below for details of this procedure): I found substantial heteroscedasticity, such that residual variance in both state self-esteem and jealousy was noticeably larger at factor levels indicating that a comparison had taken place, compared to levels indicating no comparisons. I corrected for this heteroscedasticity by weighting observations by social comparison occurrence (Yes/No). All results shown below reflect models adjusted in this manner. Missing data were imputed using multiple imputation in the mice package in R. Models were therefore pooled datasets, and analyses were run as functions across each dataset before pooling the coefficients.

Models involving state jealousy were found to have non-normal residuals, so jealousy was square-root transformed for these models which resolved the issue. This means that the actual observed effects are likely to be quadratic - as values of the predictors increase, the raw jealousy scores increase in a quadratic fashion. This can be understood as reflecting the reactive nature of jealousy - such that when situations do not provoke it, levels are likely to be very low, but these levels are likely to rise substantially in the face of jealousy-evoking stimuli.

I first reported frequency statistics on social comparisons, targets and directions of comparisons, and who else was present when they were performed. Demographic variables were included in future analyses if they were significantly associated with both predictors and outcome variables.

Hypothesis 1. Attachment anxiety will predict a greater frequency of social comparisons

a) *Attachment anxiety will predict a greater proportion of upward social comparisons relative to their overall number of social comparisons*

To test this, I performed two multiple regressions in R, predicting comparison frequencies from attachment anxiety, neuroticism, attachment avoidance, timepoint and demographic variables. One predicted overall social comparison frequency, while the next predicted the proportion of social comparisons which were upward comparisons. Upward social comparison proportion was calculated as a participant's overall frequency of upward social comparisons, divided by their overall social comparison frequency.

Multi-level Modelling. I investigated the effects of social comparisons on self-esteem and jealousy using multilevel modelling in the lmer package in R. I tested three different forms of multilevel models in turn: a) random-intercepts, b) random-intercepts-and-slopes and c) intercepts-and-slopes-as-outcomes (Bolger et al., 2003). Here I explain what each added to standard regression and moderation models.

With a least-squares regression equation, variance is partialled out into systematic and error-based variance. This is represented in Equation 1 below, where X_i represents a given individual's score on the predictor variable (X), Y_i represents a given individual's score on the outcome variable (Y), β_0 is the intercept, β_1 is the predictor slope and ϵ is the error variance.

$$Y_i = \beta_0 + \beta_1 X_i + \epsilon_i \quad (1)$$

For clarity, in the current study, Y represents self-esteem (or jealousy), while X represents the effect of upward, or downward comparisons. For an experience sampling study, each participant has one X and Y value for each measurement occasion, so we introduce the subscript t to imply a given timepoint. Y_{it} now refers to a given person's value on the outcome variable at a given time.

$$Y_{it} = \beta_0 + \beta_1 X_{it} + \epsilon_{it} \quad (2)$$

In this model, there is one slope and one intercept for all participants, and any deviation from this effect must come in the form of error variance. This model is acceptable in predicting values in the outcome variable when these are thought to rely on the value of specified predictors or current situational factors. However, a participant's level of state self-esteem at time 1 is not thought to be independent of their self-esteem at other timepoints; each person is thought to have their own reasonably stable baseline of self-esteem (Hank & Baltes-Gotz, 2019). Consider a person who generally has very low levels of self-esteem, who experiences a social comparison which provides a small boost to their self-esteem. If their personal baseline is not considered, their relatively low level of self-esteem post-comparison may bias the slope or intercept of the comparison in a downward direction, even though it has actually raised their self-esteem. The alternative is that the effect stays as it is, but the error separating their observed score from the score the model would predict must be very large, which increases the overall standard error of the effect. Thus, the data violates the assumption of independence of observations (Snijders & Bosker, 2012).

In place of this assumption, *random-intercepts models* assume that each person has an intercept for their effect drawn from a random distribution of values centred around the overall intercept. This is shown in Equation 3 where γ_{00} is the overall intercept and U_{0i} is a random variance term.

$$\beta_{0i} = \gamma_{00} + U_{0i} \quad (3)$$

In the random intercepts model, then, equation 2 can be expanded into Equation 4.

$$Y_{it} = \gamma_{00} + U_{0i} + \beta_1 X_{it} + \epsilon_{it} \quad (4)$$

Here the individual with very low self-esteem would have a negative value associated with U_{0i} , which means that their relatively low score need not influence β_1 or ϵ_{ij} in a negative direction.

The next models I employed were *random-slopes models*. These allowed me to test whether the main effects differed substantially between participants by modelling random variance into the slope effect (Snijders & Bosker, 2012). As with the participant-specific intercepts in a random intercepts model, the random slopes model assumes each participants' slope (B_{1i}) is drawn from a random distribution of such slopes centring on the overall slope, shown in Equation 5. Here the overall slope is represented by γ_{10} .

$$B_{1i} = \gamma_{10} + U_{1i} \quad (5)$$

Again this means that Equation 2 can be expanded, giving equation 6:

$$Y_{it} = \gamma_{00} + U_{0i} + \gamma_{10}X_{it} + U_{1i}X_{it} + \epsilon_{it} \quad (6)$$

As stated above, if there is substantial variation in effects among participants, failing to model this can lead researchers to incorrectly estimate main effects (Bell et al., 2019). For example, in the current study, I hypothesise that people meaningfully vary in the effects of social comparisons on their state self-esteem. If the effect of upward comparisons on self-esteem is small for most people, but very strong for a small number of participants, this could result in a medium to large effect in a straightforward regression, despite the fact that it would not be accurate to assert that social comparison direction *generally* has a medium effect on state self-esteem. Instead, in the random slopes model (Equation 6), these participants would have a positive value associated with U_{1i} , leaving the overall slope or residual error unaffected. Thus modelling random intercepts and slopes may give more informative measures of main effects, as well as showing how much effects differ across participants.

Finally, my main aim with these models was to test whether attachment anxiety (a between-person predictor) would moderate the effects of social comparison direction (a within-person predictor). This is an example of an *intercepts-and-slopes-as-outcomes model*, in that the variance in slopes and intercepts discussed above are predicted by attachment anxiety as well as the overall

slope and a random error term, shown in Equations 7 and 8. Here A_i is a person's level of the between-person predictor (attachment anxiety in this study) and γ_{11} is the slope of that predictor. The overall intercept and slope and (γ_{00} and γ_{10}) function as intercepts in their respective models.

$$B_{0i} = \gamma_{00} + \gamma_{10}A_i + U_{0i} \quad (7)$$

$$B_{1i} = \gamma_{10} + \gamma_{11}A_i + U_{1i} \quad (8)$$

If there is a significant interaction, the error variances associated with the slope and intercept (U_{0i} and U_{1i}) should decrease. The final expansion of equation 2 is:

$$Y_{it} = \gamma_{00} + \gamma_{10}A_i + U_{0i} + \gamma_{10}A_iX_{it} + \gamma_{10}X_{it} + U_{1i}X_{it} + \epsilon_{it} \quad (9)$$

Predictors in these models can be divided into between-participant and within-participant predictors. Between-participant predictors are those which apply to participants across all timepoints, including their demographic information (gender, relationship status, relationship length and country of origin) and trait-level variables (attachment dimensions, neuroticism and trait self-esteem). Within-person predictors are those which assess features present for a given participant *only at a given* timepoint, such as social comparison occurrence, direction and the closeness of the comparison target. Below I detail my hypotheses for the effects of first within, and then between-person predictors. Per the recommendations of Snijders and Bosker (2012), I tested that my within-person models met residual assumptions before introducing between-person predictors.

Within-Person Predictors. Hypothesis 2: *Social Comparisons will lead to contrast effects on self-esteem. This breaks down into:*

- a) *Upward social comparisons will have a negative effect on state self-esteem*
- b) *Downward social comparisons will have a positive effect on state self-esteem*

Contrary to Diel et al. (2021), I included upward, downward and lateral comparisons as separate predictor categories, because I considered it necessary to contrast self-esteem following each form of comparison with that following control occasions (occasions without social comparisons), in order to test the differing effects of each direction. To resolve issues of collinearity, comparison directions were coded into a single interaction variable with comparison occurrence.

The above analysis relies on the covariance of self-esteem reported at the time of surveying - i.e., the end of the interval for a given timepoint - and social comparisons performed during the timepoint, i.e., the 3-4 hours prior to the survey. I assume that this covariance implies that changes in self-esteem occurred after any social comparison performed. However, this method does not allow me to identify exactly when changes in self-esteem took place., and therefore it is possible that the measured changes in self-esteem actually occur prior to measured social comparisons. There is some evidence that state self-esteem might make certain social comparisons more likely. For instance, accessibility effects could mean that people who are feeling positive about themselves are more likely to perform downward social comparisons (e.g., Wheeler & Miyake, 1992; Mussweiler, 2003). I therefore tested lagged effects to see whether current self-esteem was predicted by direction of social comparisons at T-1, supporting my initial interpretation, or if the likelihood of performing upward/downward social comparisons at the current timepoint was predicted by self-esteem at T-1, supporting the accessibility interpretation. It is entirely possible that both effects occur; Schmuck et al. (2019) showed that both occur over longer time periods. Finding evidence of one effect but not the other, however, would suggest that the significant effect has

primacy in daily life. However, this analysis could not falsify either effect, because the time lag between the predictors at T-1 and the outcomes at the current timepoint can be as high as 6-7 hours. Lagged effects could occur and yet dissipate too quickly for this analysis to capture them.

Hypothesis 3: Lagged (T-1) social comparisons will have contrast effects on current state self-esteem. This breaks down into:

a) Lagged upward comparisons will have a negative effect on current state self-esteem

b) Lagged downward comparisons will have a positive effect on current state self-esteem

I also tested the reverse effects, in which lagged self-esteem was included as a predictor of upward, downward and lateral comparison, using a logistic multilevel regression analysis.

Hypothesis 4: Upward social comparisons will positively predict levels of state jealousy.

These hypotheses were all tested using random-intercepts models. Separate models were run for predicting state self-esteem and state jealousy.

I also assessed the effects of lagged upward comparisons on current state jealousy levels. Self-esteem threat is not a sufficient condition for jealousy to occur. The rival individual must pose a threat to a valued relationship in order for the situation to be considered jealousy as opposed to envy (Parrott & Smith, 1993). Jealousy is therefore more likely to occur in situations which involve both the rival and the relationship partner. As such, a social comparison may not trigger jealousy itself, but instead make a person vulnerable to feeling jealous at future instances which involve their relationship partners. Only measuring the contemporaneous effect of social comparisons may obscure some of their effects on jealousy. I therefore tested whether upward comparisons at T-1 might also positively predict current jealousy levels.

Hypothesis 5: Lagged (T-1) upward comparisons will positively predict current state jealousy.

If the lagged effect was found to be stronger than contemporaneous effects, I would use lagged upward comparisons as the predictor in later analyses..

Autoregressive Self-Esteem and Jealousy. I noted above that the nonindependence of observations within participants could lead to incorrect interpretations of effects unless clustering was taken into account. This is also true for observations which are temporally close to one another. If a person is feeling unusually negative about themselves at 11.30am, we may reasonably expect them to have a reasonably low level of self-esteem at 3.30pm, given state self-esteem is relatively stable across time (Hank & Baltes-Gotz, 2019). The effect of episodic events on state self-esteem should be considered against the backdrop of the levels of these variables prior to the events occurring. If self-esteem returns to mean level after being low at the last timepoint, this could reflect a positive influence of events which took place during that time, or it could simply indicate regression to the mean, depending how strongly self-esteem at the current timepoint tends to be consistent with self-esteem at the previous timepoint (T-1). I was uncertain to what extent this would also apply to jealousy, as previous ESM studies into jealousy have not reported autoregressive effects (e.g., Lennarz et al., 2017; Rogers et al., 2018). However, it is also possible for jealousy effects to persist and thus confound the apparent effects of events at the current timepoint. I therefore tested autoregressive paths for both of these outcomes in their respective models, predicting current levels of self-esteem and jealousy from levels at T-1. Controlling for these paths would more precisely show the true effects of other predictors. I anticipated that this autoregressive effect would not apply when the prior timepoint was on the previous day, and therefore imputed mean level self-esteem and median-level jealousy as the T-1 predictors at the first timepoint of each day.

I centred each participant's T-1 self-esteem and jealousy scores by their personal mean, to differentiate the effect of the raw levels of these predictors from the mean-level effect (individuals

with higher self-esteem were likely to have higher self-esteem at all timepoints, meaning that high T-1 self-esteem might be associated with current self-esteem spuriously).

Situational Features. Alongside the effect of comparison direction, I also studied the effects of situational aspects of social comparisons - the closeness of one's relationship with a target, and who else was present at the time of a comparison - as predictors of state self-esteem and state jealousy. The type of target was only conditionally relevant (Dziak & Henry, 2017), as a target could only be said to be close or distant when a comparison had been performed. Moreover, I was investigating upward, downward and lateral comparisons as separate occurrences, so target type moderated the effect of each comparison direction separately; downward comparisons with close targets were not considered in the same category as upward comparisons with close targets. To test the role of target type, I constructed interaction variables which combined direction and target type, e.g. for upward comparisons this had levels of 0:0 (no upward comparison), 1:0 (upward comparison with distant target) and 1:1 (upward comparison with close target).

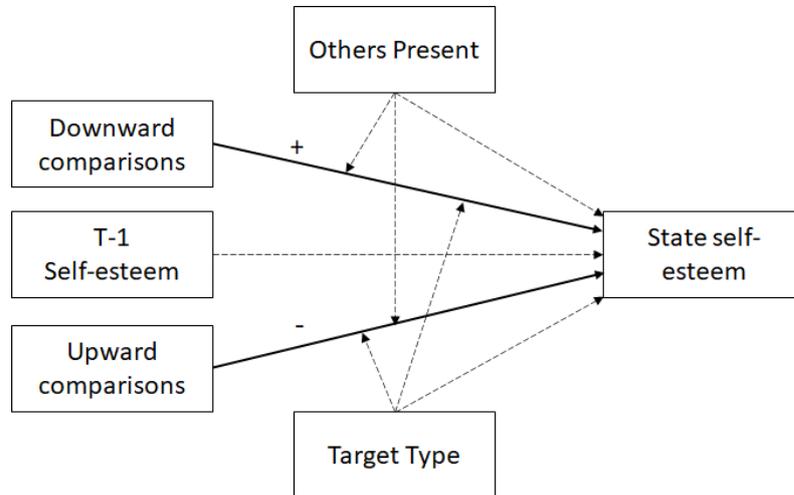
I treated the presence/absence of others differently to the treatment specified in my preregistration. In my initial plan, I asked participants who else had been present (beyond themselves and their comparison targets) when social comparisons had taken place, and I treated this a situational moderator of comparisons. However, I also measured who else was present/absent at occasions where participants did *not* perform a comparisons. I actually combined these into a single variable – the presence /absence of others during that timepoint. If another person was present for a comparison, this indicated that the individual was in their company during this timepoint, and the two measures were therefore equivalent.

Finally, it is important to consider the effect of time in longitudinal studies. I had no reason to suspect any substantive overall change in *average* self-esteem or jealousy from the start to the end of the week as participants did not undergo any treatment or manipulation. However, within a given week, self-esteem might fluctuate fairly randomly (e.g., by time of day or day of the week)

and/or differently across participants, and so the baseline at each timepoint can be considered one score from within a random distribution of baselines. I therefore included a random intercept for timepoint in my models. However, this was not vital to my investigations, so in places I dropped this parameter to aid model convergence. This is noted in the results section.

Figure 12

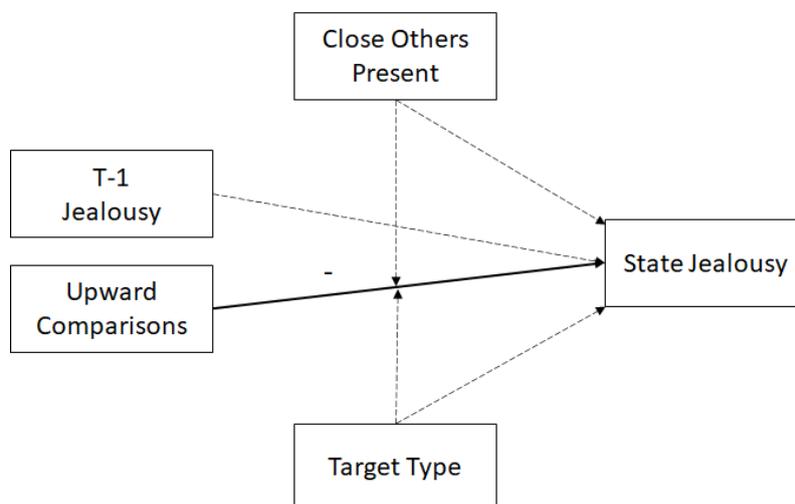
Full Within-Participants Self-Esteem Model to be Tested in Study 3



Figures 12 and 13 combine all these aforementioned predictors into models for predicting state self-esteem and jealousy, respectively. I lacked specific hypotheses for these situational features, so they were all included in an exploratory manner. All effects in the figures were tested for inclusion, with effects that were unrelated to self-esteem/jealousy omitted from the final models.

Figure 13

Full Within-Participants Jealousy Model to be Tested in Study 3



Random Slopes. I tested random slopes in the effect of social comparison directions on state self-esteem and jealousy. In the self-esteem models, this tested the extent of variation between people in the effects that social comparisons had on their self-esteem, i.e., a test of zero-sum self-worth. If random slopes explained a significant proportion of model variance, then people differ substantially in the effect of social comparisons on self-esteem/jealousy. If not, these effects could be treated as equivalent for all individuals in the sample.

Hypothesis 6: There will be significant random slopes for both effects of social comparisons (upward and downward) on state self-esteem.

Hypothesis 7: There will be significant random slopes for the effect of upward social comparisons on state jealousy.

These hypotheses were tested using random-slopes-and-intercepts models. I tested for the contribution that the random slopes made to these models using deviance tests (Snijders & Bosker, 2012). These tests involve measuring the -2 Log Likelihood of the model before and after the

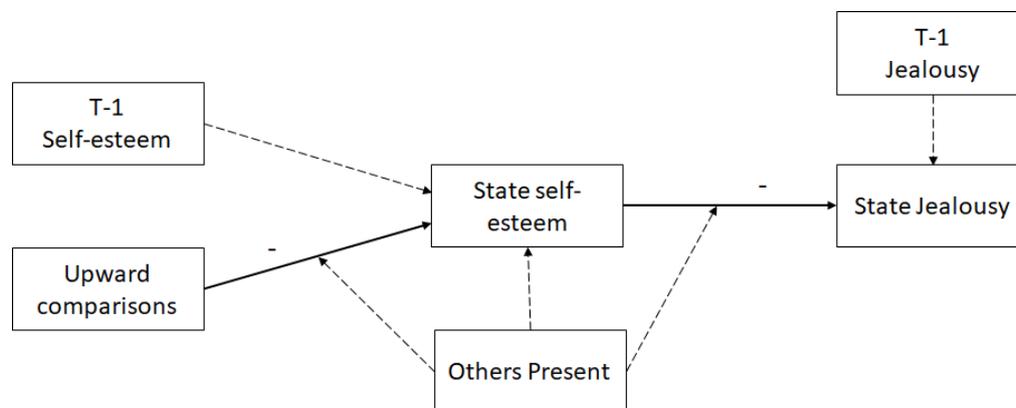
addition of random slopes and assessing this change through a chi-squared test based on the increase in degrees of freedom. Following the recommendations of Snijders and Bosker (2012), I ran this test using maximum likelihood (ML) estimation, with the chi-bar squared distribution to correct for the bias in variance that can occur using this estimation method. Critical values from the chi-bar squared distribution were supplied by Snijders and Bosker (2012).

Between-Person Predictors. *Hypothesis 8: Attachment anxiety will moderate the effects of social comparisons on state self-esteem such that the contrast effects will be stronger at higher levels of attachment anxiety.* To test this, I ran two slopes-and-intercepts-as-outcomes models predicting state self-esteem including cross-level interaction effects for attachment anxiety with each comparison direction variable in turn.

Hypothesis 9: Attachment anxiety will moderate the effects of upward social comparisons on state jealousy, such that the effect will be more positive at higher levels of attachment anxiety. To test this, I ran a slopes-and-intercepts-as-outcomes model predicting state jealousy, including a cross-level interaction effect for attachment anxiety with upward comparisons.

Figure 14

Full Within-Participants Mediation Model to be Tested in Study 3



Note: Bold lines indicate hypothesised effects, dashed lines indicate covariates or exploratory analyses

Mediation Models. I ran a 1-1-1 mediation analysis (a mediation using nested data with all variables at level 1, i.e., within-person) specifying an indirect relationship between upward social comparisons and state jealousy via state self-esteem. I proposed that upward comparisons would have a positive indirect effect on jealousy, through a negative effect of upward comparisons on state self-esteem and a negative effect of self-esteem on jealousy. Figure 14 indicates the full mediation model to be tested.

Hypothesis 10: State self-esteem will mediate the association between upward social comparisons and jealousy. I tested this hypothesis using a 1-1-1 mediation model through the mediate package in *R*, which combined my final within-person model predicting state self-esteem with my final within-person model predicting jealousy to calculate an indirect effect. Confidence intervals were derived by running 2000 Monte Carlo simulations.

Hypothesis 11: Attachment anxiety will moderate the mediated effect of upward social comparisons on state jealousy via state self-esteem, such that the effect of path A (the effect of

upward comparisons on state self-esteem) will be more negative at higher levels of attachment anxiety, leading to a stronger (more positive) indirect effect. I tested this hypothesis using a moderated mediation model through the *mediate* package in *R*. Confidence intervals were derived by running 2000 Monte Carlo simulations.

Covariates. I also measured potential confounds to ensure that any observed effect of attachment anxiety is a true and not a spurious effect. Similar to Study 2, I controlled for the role of attachment avoidance and neuroticism in the models predicting state self-esteem based on the same rationales as in that study. I ran two models, one with and one without the effect of neuroticism, to see if this substantially changes the role of attachment anxiety.

For the models predicting jealousy, I did not include neuroticism as a covariate. This was because recent research has found attachment anxiety to mediate the association between neuroticism and jealousy (Richter et al., 2022), which means that it would be inappropriate to partial out the shared variance between attachment anxiety and neuroticism in intensifying feelings of jealousy. This covariance would not indicate a spurious effect of attachment anxiety, but instead an indication of a single, complex process. Instead, I addressed the possibility that trait self-esteem could confound this relationship. People who chronically evaluate themselves negatively are likely to be more vulnerable to being made to feel inferior and inadequate by any given self-esteem threat, and thus more vulnerable to jealousy (Karakurt, 2012). Low trait self-esteem is often, though not wholly consistently, associated with higher levels of jealousy (Parker et al., 2005; Stieger et al., 2012), and also consistently associated with higher levels of attachment anxiety (Mikulincer & Shaver, 2016), so we must disambiguate the effect that attachment anxiety might have on jealousy through comparative dynamics of self-worth from the effect through overall levels of self-worth.

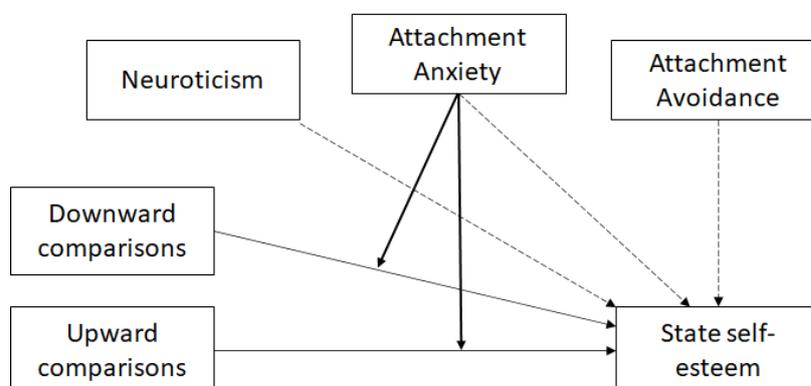
I also included demographic variables (*country of origin, relationship status/length and gender*) as between-person predictors, assessing main effects and interactions with comparison variables. These were included in an exploratory manner as I was unsure what role they would play

in these models. It was possible that the effects of upward social comparisons would be stronger among individuals in romantic relationships, because of the increased potential for relationship threat through mate-poaching (Schmitt & Buss, 2001). However, relationship threat occurs in other close relationships (Krems et al., 2021; Volling et al., 2010). In my previous studies, I did not find gender to predict social comparison orientation or jealousy (Study 1), or to moderate the effect of a social comparison on self-esteem (Study 2). However, some previous research suggests that gender would be relevant to social comparisons, such as that linking gender to interdependence (Cross & Madson, 1997; Schwartz & Rubel, 2005). With regards to the effects of social comparisons on jealousy, Dijkstra and Buunk (2002) found social comparison orientation to more reliably heighten jealousy of rivals among women than men.

There is evidence to suggest that beliefs about the competitiveness of the world and concerns with status differ across countries, based on economic equality (Davidai, 2023; Wilkinson & Pickett, 2018), or interdependence, though evidence here is equivocal (Baldwin & Mussweiler, 2018; Cheng & Lam, 2007; Cheung & Lucas, 2016; Gardner et al., 2002; Kimmelmeier & Oyserman, 2001). As previously mentioned, cultural differences in the appropriateness of jealousy may affect experiences or reporting of jealousy (Croucher et al., 2012; Hupka, 1981; Zandbergen & Brown, 2015), though these effects might be less pronounced in daily life research (Schwarz, 2012). As cultural differences were not the focus of this study, I did not recruit a balanced sample from across cultures, and I could not therefore be sure that there would be sufficient power to detect cultural differences.

Figure 15

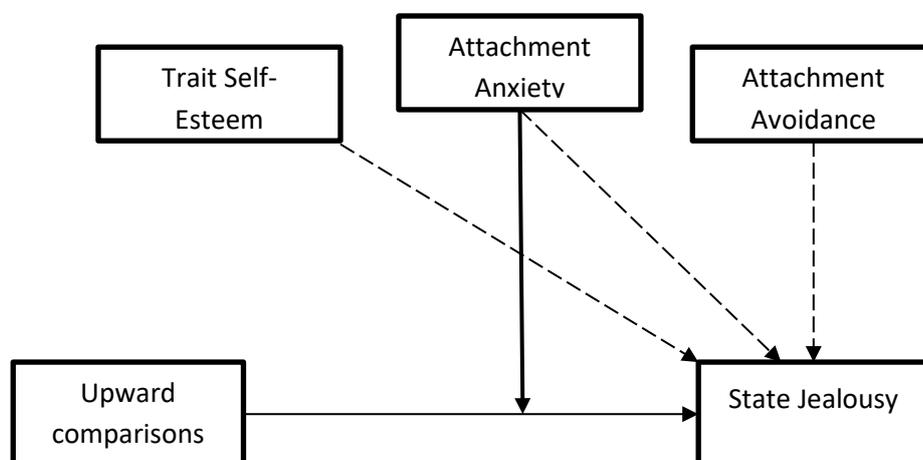
Multilevel Model Predicting State Self-Esteem to be Tested in Study 3



Figures 15 and 16 display the between-person models for predicting state self-esteem and state jealousy, respectively. Cross-level interactions are included between upward/downward comparisons (within-person variables) and attachment anxiety (a between-person variable). The actual between-person models will include situational features at the within-person level as in Figures 12 and 13, but these are omitted from the diagrams for simplicity.

Figure 16

Multilevel Model Predicting State Jealousy to be Tested in Study 3



Methodological Effects. Finally, I tested for the presence of measurement reactivity using a paired samples t-test, contrasting social comparison frequency, self-esteem and jealousy on the first two days against the same in the remainder of the study.

Results

Descriptives and Demographics. Table 12 shows the correlations between the between-person trait variables. In accordance with past findings, attachment anxiety was significantly positively associated with neuroticism (Nofle & Shaver, 2006) and negatively associated with trait self-esteem (Mikulincer & Shaver, 2016). Trait self-esteem was negatively associated with all other trait-level variables.

Table 12

Descriptive Statistics and Zero-Order Correlations Between Study 3 Variables (N = 87)

| Variable | M | SD | 1 | 2 | 3 | 4 |
|-------------------------|------|------|---------|--------|---------|---|
| 1. Attachment Anxiety | 4.19 | 1.17 | | | | |
| 2. Attachment Avoidance | 3.54 | 1.12 | .11 | | | |
| 3. Neuroticism | 3.31 | .77 | .63*** | -.06 | | |
| 4. Trait Self-Esteem | 2.72 | .55 | -.61*** | -.31** | -.56*** | |

***significant at p = .001

**significant at p = .01

Table 13*Means of Study 3 Variables by Demographics (N = 87)*

| Variable | Gender | | | Relationship Status | | Country of Origin | |
|----------------------|-------------------|-------------------|-----------------------|---------------------|-------------------------------------|-------------------|----------------|
| | Male (N = 32) | Female (N = 62) | N-B/ Other (N = 3) | Single (N = 57) | In a romantic relationship (N = 40) | UK (N = 81) | Other (N = 16) |
| Attachment Anxiety | 3.92 | 4.25 | 5.5 | 4.09 | 4.32 | 4.19 | 4.17 |
| Attachment Avoidance | 3.73 | 3.46 | 3.22 | 3.81 ^b | 3.18 ^a | 3.52 | 3.64 |
| Neuroticism | 3.00 ^a | 3.46 ^b | 3.29 | 3.20 | 3.45 | 3.27 | 3.49 |
| Trait Self-Esteem | 2.76 | 2.73 | 2.33 | 2.68 | 2.78 | 2.72 | 2.75 |
| Comparison Frequency | .23 | .30 | .71 | .38 | .38 | .30 | .26 |

Notes. Means with different subscripts within row subdivisions differ from one another at $p = .05$. Comparison Frequencies are expressed as a proportion of total completed measurement occasions

Table 13 shows how the between-participant variables differ by demographic groups. Gender differences were calculated between men and women, and excluding non-binary/other individuals, as there were insufficient participants identifying this way to achieve adequate power. Overall, there were few differences. Attachment anxiety, trait self-esteem and social comparison frequency did not differ between any demographic groups. Women were higher in neuroticism than men, but there were no other gender differences. Consistent with my results from Study 1,

attachment avoidance was higher among single individuals than those in romantic relationships, but relationship status had no other effects. Among participants in romantic relationships, relationship length was unrelated to levels of any trait-level variable.

Table 14*Descriptives of Situational Comparison Moderators (N = 87)*

| | Mean Proportion | SD |
|-----------------------------------|-----------------|-----|
| <u>Presence/Absence of Others</u> | | |
| Others Present | .53 | .34 |
| Close Others Present | .37 | .32 |
| Others Absent | .47 | .34 |
| <u>Target</u> | | |
| Close Target | .53 | .35 |
| Friend | .40 | .15 |
| Romantic Partner | .07 | .04 |
| Family Member | .06 | .05 |
| Distant Target | .47 | .35 |
| Stranger | .29 | .11 |
| Acquaintance | .13 | .07 |
| Colleague | .05 | .04 |

Note. Mean Proportions represent proportions of the total number of comparisons performed by an individual. A mean proportion of .53 for others present indicates that on average, 53% of the comparisons performed by a given individual were performed in the presence of others.

Table 14 shows descriptives of the comparisons that participants performed through the course of the week. Standard deviations represent the extent to which frequencies for individual participants differed from the mean frequency. Participants, on average, reported performing social comparisons on just under a third of completed measurement occasions (28%). They reported performing an upward comparison (as their most significant comparison within the last few hours)

on more than half of these comparison occasions (17% of all occasions), more than downward (6%) and lateral comparisons (5%) combined.

Consistent with the findings of Tesser (1988), the most common targets were friends, followed by strangers and then acquaintances. The low number of comparisons with family members and romantic partners must be taken in context, however. The study was conducted during university term-time so participants were likely to be spending less time among family than in the holidays, and I did not collect data on how many participants were living in the same areas as their romantic partners. Most participants were not in romantic relationships; comparisons with partners accounted for 16% of all comparisons performed by those in relationships. Consistent with past findings (Fitzsimmons-Craft, 2017), most comparisons were performed when others (besides oneself and the comparison target) were present, though this majority was only slight.

The distribution of social comparison frequency among participants was heavily positively skewed, with the highest frequencies being at the low end. This non-normality was reflected at group level in demographic variables, so Wilcoxon tests were used to compare groups in place of parametric *t*-tests. No significant differences in comparison frequency were found for any demographic variables, though it is noteworthy that my small number of non-binary/other participants reported performing a lot more social comparisons than my male or female participants.

Social Comparison Frequency. Table 15 shows the results of a multiple regression predicting social comparison frequency from my trait-level predictors. This analysis tested Hypothesis 1; that attachment anxiety would have a positive unique effect on comparison frequency. No demographic variables were associated with comparison frequency, so these were all omitted from the analysis. The table below shows that no association was found between attachment anxiety and social comparison frequency. In fact, no trait-level variable had any effect on the frequency with which people performed social comparisons. This finding is qualified by the fact that I could not use the original comparison frequency measure that I intended, and the count of yes responses to the comparison occurrence measure is only an approximate measure of comparison frequency.

Results were very similar for upward comparison frequency, with no between-person variable predicting the proportion of comparisons which were made with upward comparison targets.

Table 15

Effects of Between-Person Variables on Social Comparison Frequency (N = 85)

| | <i>B</i> | <i>SE</i> | <i>t</i> |
|----------------------|----------|-----------|----------|
| Attachment Anxiety | .01 | .03 | .37 |
| Attachment Avoidance | .01 | .02 | .64 |
| Neuroticism | -.02 | .15 | -.88 |
| Trait Self-Esteem | -.06 | .06 | -.95 |

*significant at p=.05

Multilevel Modelling (Self-Esteem). I first tested a compound symmetry model, including no fixed-effect predictors, but allowing intercepts to vary across individuals and timepoints. The variance in self-esteem intercepts across individuals was $\sigma^2 = 3.03$, while the variance across timepoints was much smaller ($\sigma^2 = 0.04$). The effect of time was retained in the models, but at this low level, it was not treated as a highly important effect. The residual (within-person) variance in scores was $\sigma^2 = 2.08$. This indicates that the majority of variance occurred at the between-person level, with an intraclass correlation coefficient of $3.03/(2.08 + 3.03) = 0.59$. This is a fairly high ICC, and indicates that self-esteem varies more between individuals than within them.

Measurement reactivity was discovered, such that self-esteem was lower on the first two days of the study than the ensuing days ($B = -.31, SE = .11, t = -2.95, p = .007$). As such, whether an observation was drawn from the first two days of the study or not was included as a covariate in these analyses, and all ensuing models include this effect.

Table 16*Within-Participant Effects of a Multilevel Model Predicting State Self-Esteem (N = 87)*

| Effect | B | SE | t | 95% CI | |
|----------------------|---------|-----|-------|--------|-------|
| | | | | Lower | Upper |
| Intercept | 7.13 | .20 | - | 6.74 | 7.52 |
| T-1 Self-Esteem | .21*** | .03 | 6.26 | .14 | .27 |
| Upward Comparisons | -.89*** | .12 | -7.23 | -1.13 | -.65 |
| Downward Comparisons | .04 | .20 | .21 | -.34 | .43 |
| Lateral Comparisons | -.09 | .25 | -.37 | -.57 | .39 |
| Others Present | .21* | .09 | 2.42 | .01 | .35 |

** significant at p=.01 *** significant at p = .001

Table 16 shows the results of my within-participant models. The autoregressive effect was modest but consistent, self-esteem showed a small level of consistency from one timepoint to the next. Hypothesis 2a was supported; upward comparisons had a contrast-based (negative, in this case) effect on state self-esteem. On average, participants rated their self-esteem slightly over a point lower following an upward comparison than at occasions without upward comparisons. However, Hypothesis 2b was not supported for comparisons with those perceived to be performing worse than oneself; downward comparisons had no overall effect on state self-esteem, and neither did lateral comparisons.

This table reports the effect of others being present, as this effect explained more variance in self-esteem scores than the presence of close others specifically. Consistent with past findings (Denissen et al., 2008) and congruent with the findings of Uink et al. (2017) that adolescents

experience lower levels of negative emotions when around other people, these participants had higher self-esteem when in the presence of others. Additionally, this effect did not interact with either of the comparison directions; participants did not feel any better or worse following upward or downward comparisons made in the presence of others compared to those made without them around.

The effect of target closeness was significant for upward comparisons ($B = -.87, SE = .22, t = -3.95, p < .001$); people tended to have lower state self-esteem following an upward comparison with a friend, family member or romantic partner ($B = -1.31, SE = .16, t = -8.07, p < .001$) than following a similar comparison with a stranger or acquaintance ($B = -.45, SE = .16, t = -2.75, p = .006$). The effects of downward and lateral comparisons were non-significant whether the target was close or distant. Comparing oneself to close others who are performing better appears to have a more markedly negative effect on the self-esteem of young adults than comparing with distant others.

The remaining within-person (residual) variance in this model was $\sigma^2 = 1.56$, with between-person variance of $\sigma^2 = 2.90$. 13% of the variance in the model was explained by the inclusion of these within-person predictors. When only the comparison-relevant variables were included (direction and target type), these predictors only explained 5% of the overall variance. This suggests that day-to-day social comparison occurrences play a relatively small role in determining people's state self-esteem.

As an exploratory analysis, I wanted to decompose the effect of close targets into the effects of the component targets (friends, family and romantic partners). However, the small number of comparisons made with family members or romantic partners precluded the obtaining of stable estimates for these effects. Instead, I examined the effect of upward comparisons with friends in particular. This effect was significant, such that upward comparisons with friends led to lower state self-esteem ($B = -.71, SE = .23, t = -3.14, p = .002$) than upward comparisons with others ($B = -.59, SE = .23, t = -3.83, p < .001$).

I next tested lagged models in which upward and downward comparisons performed at the previous timepoint (T-1) were included as predictors of current state self-esteem, adjusting for the effects of contemporaneous comparisons and T-1 self-esteem. These models only fit adequately once the random effect of time was removed. There was no lagged effect of upward social comparisons; upward comparisons had no effect on self-esteem hours later. However, in the reverse-lagged models in which self-esteem and T-1 self-esteem were included as predictors of upward social comparisons, there was an effect of lagged self-esteem, but in the opposite direction. While current self-esteem was negatively related to upward comparisons, lagged self-esteem had a positive effect, such that having high levels of self-esteem at the previous timepoint raised the likelihood of performing an upward comparison at this timepoint. Downward comparisons, however, were not made more or less likely by prior self-esteem levels. This meant that I was unable to determine the temporal order in which self-esteem changes and social comparisons occurred.

Next, I tested hypothesis 6, by introducing random slopes for upward and downward social comparisons. Models including both random effects did not converge. I then tested the effect of upward comparisons in a separate model which only included occasions without social comparisons and those where upward comparisons had occurred. The variance associated with this slope was $\sigma^2 = .44$. To illustrate what this means in real terms, I now show the size of the slopes at 1 *SD* above and 1 *SD* below the mean, indicating relatively high and relatively low values within the sample. The effect of upward comparisons was now $B = -.95$, and so an individual with a larger (more negative) effect would have a slope of $-.94 - \sqrt{.44} = -1.60$, meaning that their self-esteem would drop by an average of slightly over one and a half points on a scale of 0 to 10, while an individual with a smaller (less negative) effect would have a slope of $-.94 + \sqrt{.44} = -.28$, indicating that their self-esteem would only decrease very slightly. The covariance between the slope and intercepts in self-esteem is $-.42$, indicating that individuals with lower intercepts had more positive slopes, or rather, less strongly negative slopes. This could be evidence of a floor effect; if self-esteem was unlikely to fall beyond a given level following an upward comparison, having a lower baseline of self-esteem would tend to

lead to a smaller effect from the comparison. The residual variance in the model dropped from $\sigma^2 = 1.59$ to $\sigma^2 = 1.56$, but this did not represent an appreciable improvement to model fit ($-2LL$ change = 4.47, $df = 2$, *ns*)

For downward comparisons, the slope variance in slope was $\sigma^2 = .28$, such that an individual with a high slope (more positive) would have an effect of $.06 + \sqrt{.28} = .59$, while an individual with a lower slope (more negative) would have an effect of $.06 - \sqrt{.28} = -.47$. Some individuals appeared to be positively affected by downward comparisons, while others were negatively impacted. The covariance between intercepts and slopes was $-.33$, indicating again that the higher a person's intercept, the less positive their slope. The inclusion of this slope barely altered residual variance (1.57 in both models) and the fit of the model did not improve ($-2LL$ change = .99, $df = 2$, *ns*). There was no clear evidence that individual variance in this effect meaningfully changed predicted self-esteem scores.

I then introduced between-person effects. My first level 2 model included demographic variables (gender, relationship status and country of origin, now divided into UK and non-UK). Any models involving gender omitted observations from non-binary/other participants, as we did not have sufficient participants to derive meaningful coefficients. There were no main effects of gender or country of origin on state self-esteem across the week and no interaction effects were found between these variables and social comparisons. I therefore omitted these variables from further analyses. There was no main effect of relationship status, but it did interact with upward social comparisons ($B = -.60$, $SE = .25$, $t = -2.47$, $p = .014$). Simple slopes analysis revealed that upward comparisons had a stronger effect on state self-esteem among people in romantic relationships ($B = -1.22$, $SE = .20$, $t = -6.26$, $p < .001$), than among single people ($B = -.65$, $SE = .18$, $t = -3.56$, $p < .001$), though both effects were negative and significant.

Finally, I introduced trait effects. Snijders and Bosker (2012) recommend that cross-level interactions can also be investigated without evidence of random slopes if strong theoretical

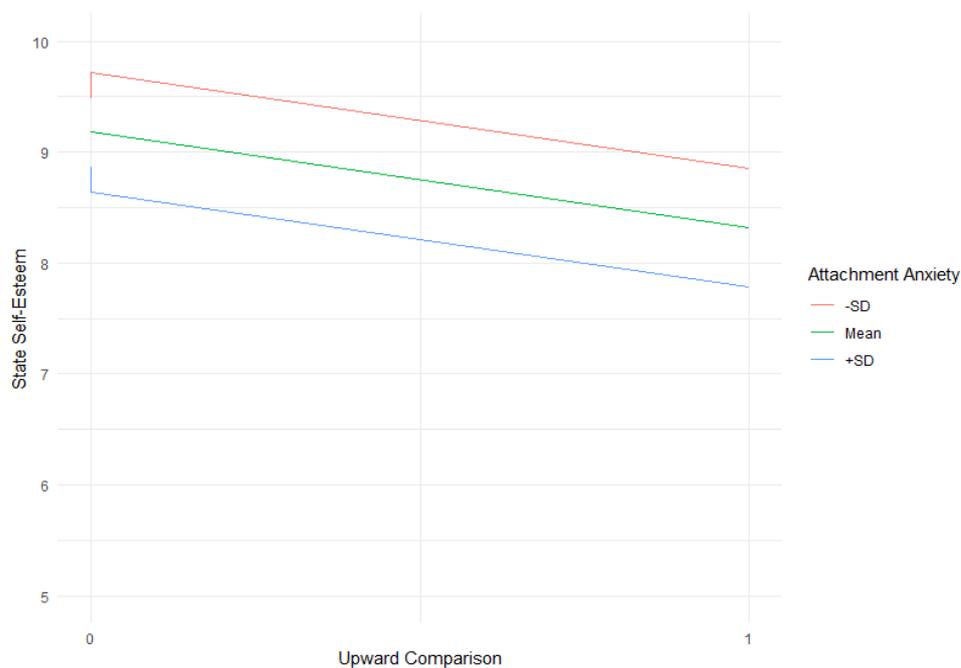
justifications exist for them as cross-level interactions have greater power than tests of slope variance. Once all between-person predictors were included, I inspected the residuals of the level-2 models and examined fit and leverage statistics for each individual (level 2 cluster). Due to a combination of poor fit and high leverage, three participants were judged to have a disproportionate influence on the analyses and were therefore removed. Error associated with participant intercepts showed approximate normality and linearity.

Attachment avoidance had a main effect on state self-esteem ($B = -.46$, $SE = .16$, $t = -2.87$, $p = .004$), but attachment anxiety did not ($B = -.37$, $SE = .19$, $t = -1.93$, $p = .053$). Surprisingly, neuroticism also had no overall effect on state self-esteem ($B = -1.40^7$, $SE = .94$, $t = -1.50$, $p = .135$).

⁷ Neuroticism was square-root transformed due to non-normality

Figure 17

Cross-Level Interaction of Attachment Anxiety and Upward Social Comparisons Predicting State Self-Esteem



The more important effects involving attachment anxiety were its interactions with upward and downward social comparisons. Contrary to my hypothesis, attachment anxiety did not moderate the effect of upward social comparisons ($B = -.10, SE = .12, t = -.89, p = .392$), or downward comparisons ($B = -.02, SE = .18, t = -.09, p = .931$). Simple slopes for the analysis involving upward comparisons are plotted in Figure 17.

I therefore found no support for hypothesis 8 using the analyses I specified in my pre-registration; attachment anxiety did not seem to make any difference to the self-esteem impact of social comparisons. These effects did not change substantially when neuroticism or relationship status were excluded from the model.

Attachment anxiety did, however, moderate the effect of upward comparisons with close others ($B = -.31, SE = .16, t = -1.98, p = .047$), such that self-esteem was lower following these comparisons among individuals who had higher levels of attachment anxiety. This analysis was not preregistered, and the unbalanced number of observations for each target type and direction combination may have weakened its power. This is especially relevant because the significance value was so close to .05. I cannot claim to have found direct evidence for this effect, but future research should look into the comparisons that people perform with friends, family and romantic partners specifically to examine how attachment anxiety may affect these.

Multi-Level Modelling (Jealousy). In contrast to my self-esteem models, variance in jealousy was predominantly seen at the within-participant level, with an intraclass correlation of .23. In the case of jealousy, scores vary more for each person across occasions than between people. Once again, jealousy intercepts differed very little across timepoints, with a variance of $\sigma^2 < .01$ (.09 in original jealousy scores).

As with my self-esteem models, measurement reactivity was discovered here, such that jealousy was higher on the first two days of the study than the ensuing days ($B = -.16, SE = .04, t = -4.09, p < .001$) As such, whether an observation was drawn from the first two days of the study or not was included as a covariate in these analyses, and all ensuing models include this effect.

Table 17*Within-Participant Effects of a Multilevel Model Predicting State Jealousy (N = 87)*

| Effect | B | SE | t | 95% CI | |
|----------------------|---------|-----|-------|--------|-------|
| | | | | Lower | Upper |
| Intercept | .98 | .03 | - | .91 | 1.04 |
| T-1 Jealousy | -.10*** | .02 | -4.00 | -.14 | -.05 |
| Upward Comparisons | .80*** | .06 | 20.82 | .73 | .88 |
| Downward Comparisons | .33** | .06 | 5.53 | .21 | .44 |
| Lateral Comparisons | .34** | .07 | 4.82 | .20 | .48 |
| Close Others Present | .04 | .03 | 1.44 | -.02 | .10 |

** significant at $p = .01$ *** significant at $p = .001$

I then introduced within-person predictors of social comparisons and T-1 jealousy. Table 17 shows the effects from this analysis. The autoregressive path was again small but consistent. Interestingly, this was in a negative direction, such that if a person had shown high jealousy at the last timepoint, they were more likely to show low jealousy at the current timepoint. Hypothesis 4 was supported, as upward social comparisons had a very strong positive effect on state jealousy. If a person had performed an upward comparison since the last time point, they were likely to feel substantially more jealous than if they hadn't. Interestingly, the same was true, though to a lesser extent, for downward and lateral comparisons, which both also had a positive effect on state jealousy.

I next tested the effect of situational features. The presence of others and the presence of close others were entirely equivalent in the variance they explained in the model. I chose to use the presence of close others in future models, as threats to valued relationships are more likely to lead to jealousy (Rusbult & Buunk, 1993). There was no main effect of (close) others being present during the occasion on experienced levels of jealousy. This runs counter to the results found among adolescents by Uink et al. (2017). However, the presence of close others did interact with downward comparisons ($B = .27, SE = .12, t = 2.249, p = .022$). Simple slopes analysis revealed that downward comparisons had a more strongly positive effect on jealousy when close others were present ($B = .48, SE = .13, t = 3.79, p < .001$) than when they were not ($B = .25, SE = .10, t = 2.51, p = .014$). Target type moderated the effect of upward comparisons ($B = .18, SE = .07, t = 2.75, p = .006$), such that upward comparisons with close others led to greater jealousy than with distant targets, but did not moderate the effects of downward or lateral comparisons. Upward comparisons were more prone to make people feel jealous if the target was a close other, while downward comparisons were more prone to do so if close others were present. However, the specific effect of upward comparisons with targets who were friends on state jealousy was non-significant ($B = .13, SE = .09, t = 1.24, p = .123$), raising the possibility that comparisons with romantic partners and/or family members actually drive this effect.

Again, I tested lagged models to determine temporal structure, this time of the associations between social comparisons and jealousy. In this case, upward comparisons at the previous timepoint (T-1) did significantly predict current state jealousy ($B = .11, SE = .05, t = 2.40, p = .017$) when controlling for the influence of contemporaneous comparisons. This appears to indicate that upward comparisons lead to jealousy, as opposed to the other way around, as there was no lagged effect of jealousy on upward social comparisons ($B = .10, SE = .06, t = -1.76, p = .078$). No significant effects were found in either direction for downward comparisons, so we were unable to determine whether jealousy follows downward comparisons or the other way around.

I investigated random slopes for the effects of upward and downward social comparisons on jealousy. The variance of the slope of upward comparisons was $\sigma^2 = .13$, meaning that $SD = .36$. A high slope of the effect of upward comparisons on jealousy would be $B = .81 + .36 = 1.17$ ($1.17^2 = 1.37$), while a low slope would be $B = .81 - .36 = .45$ ($.45^2 = .20$). The covariance was $-.02$, which indicates again that individuals with higher intercepts tended to have less positive slopes. This time, the inclusion of a random slope for upward comparisons did improve model fit ($-2LL$ change = 13.53, $df = 2$, significant at $p = .001$). Allowing the slope of social comparisons on jealousy to vary between participants did improve model fit in this instance. Models in which the slope of downward comparisons on jealousy were allowed to vary between participants could not be made to reach an adequate solution, so I do not report the variance here.

As slope variance was found for upward comparisons, I tested its interactions with demographic variables, which had been included in an exploratory fashion. For downward comparisons, theoretical justification only existed for their interaction with attachment anxiety, so interactions with demographic variables were not assessed. Relationship status had no effect on jealousy, suggesting that romantic jealousy was no more likely among our sample than any other form of jealousy. Country of origin also had no effect. Levels of jealousy were higher among women than men, but this effect was again non-significant ($B = .08$, $SE = .05$, $t = 1.59$, $p = .112$). None of these variables interacted with comparison variables, though the interaction between relationship status and upward comparisons approached significance, so relationship status was retained for my final models.

After including trait-based predictors, I investigated the model fit. Again, intercept residuals were approximately normal. Two participants were removed on the basis of high leverage and poor fit statistics. In the case of jealousy, neither attachment dimension had a main effect on state jealousy (Anxiety: $B = .04$, $SE = .03$, $t = 1.76$, $p = .079$; Avoidance: $B = -.01$, $SE = .02$, $t = -.49$, $p = .623$). The effect of trait self-esteem was larger and significant ($B = -.11$, $SE = .05$, $t = -2.06$, $p = .040$). The

effect of attachment anxiety was stronger when self-esteem was excluded ($B = .09, SE = .02, t = 4.03, p < .001$), but the effect of avoidance was still non-significant. Again, the most important effects were the interactions. Attachment anxiety did moderate the effect of upward social comparisons in predicting jealousy ($B = .09, SE = .04, t = 2.33, p = .020$).

Simple slopes analysis (plotted in Figure 18) revealed that upward comparisons had a stronger effect on jealousy at higher levels (+1 SD) of attachment anxiety : ($B = .88, SE = .06, t = 13.82, p < .001$), than at lower levels (-1 SD) ($B = .63, SE = .08, t = 8.24, p < .001$). Attachment anxiety did not moderate the effect of downward comparisons on jealousy ($B = .01, SE = .06, t = .13, p = .001$), yet it did moderate the effect of lateral comparisons ($B = .23, SE = .08, t = 2.85, p = .004$). Trait self-esteem did not moderate these effects.

Figure 18

Simple Slopes of the Cross-Level Interaction Between Attachment Anxiety and Upward Social Comparisons in Predicting State Jealousy

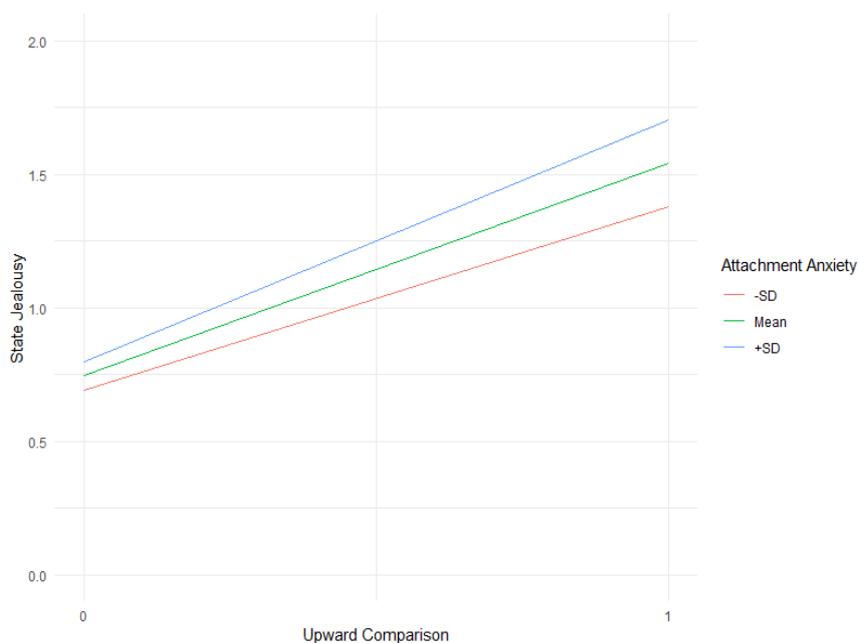
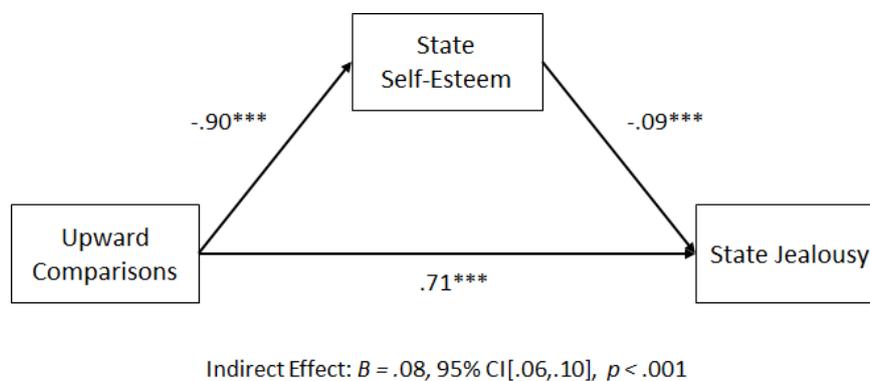


Figure 19

Results from Within-Person Mediation Analysis Predicting State Jealousy (N = 83)



Mediation Analysis. I next investigated the mediation model in which the effect of upward comparisons on jealousy was mediated by state self-esteem. This was achieved by combining the final level 1 model for predicting state self-esteem with the final level 1 model for predicting jealousy, retaining the covariates which reached or approached significance in each case. This meant that target type was included as a covariate in predicting state self-esteem, while the presence of close others was included as a covariate in predicting state jealousy. The results of this analysis can be seen in Figure 14. State self-esteem partially mediated the effect of upward social comparisons on jealousy, explaining 10% of the total effect.

This effect differed according to levels of attachment anxiety. State self-esteem mediated the effect of social comparisons on state jealousy among participants who were high (+1 SD) in attachment anxiety ($ab = .06$, 95% CI [.04, .09]). Among those low (-1 SD) in attachment anxiety, on the other hand, we could not be certain of this effect with 95% confidence, as the confidence interval crossed zero ($ab = .03$, 95% CI [-.00, .06]). As attachment anxiety increased, social comparisons had a greater capacity to induce jealousy via self-esteem threat.

Discussion

In this study, one of my main aims was to complement and extend the findings of my first two studies, studying similar questions by different methods. The findings of this study conflicted with my retrospective self-report study (Study 1). Most obviously, attachment anxiety did not predict a greater frequency of social comparisons, as I reported in Chapter 2. This is also inconsistent with results from previous retrospective self-report research (Bamford & Halliwell, 2009; Powell et al., 2018). As mentioned in Chapter 2, retrospective self-reports can be biased through a number of different mechanisms. Given cultural messages about social comparisons, some people's memories may be biased in a self-protective/self-enhancing fashion (Cameron et al., 2004) by downplaying the frequency with which they compare themselves. Attachment anxiety could interfere with this process, as it tends to encourage people to be more self-critical (Rogier et al., 2023), and one manifestation of this might be the belief that they perform undesirable actions more than other people. Thus, the bias in self-reports might reflect overestimation of comparison frequency by people high in attachment anxiety or underestimation by those who are less anxious.

My measure of comparison frequency was less valid than intended, as I was only able to measure occasions with comparisons as opposed to their raw numbers. However, the fact that people on average reported performing social comparisons about 40% of the time suggests that this measure reports frequency at an appropriate level of precision, effectively distinguishing between those people who compare themselves to others frequently and those who compare less frequently. I was concerned at the outset of this study that participants might struggle to recall social comparisons over the course of 3-4 hours, and this would give us reason to doubt even these near-term reports of comparison occurrence. However, out of one hundred and thirteen participants who completed the post-survey evaluation, only one reported finding this process difficult, compared to, for example, eight who complained about the difficulty of responding to the survey in time (see Appendix 7). I therefore suggest that this is likely to be a more valid measure of comparison frequency than we obtained from Study 1. This is partly because of the recall biases which could

affect retrospective self-report methods, but also because the items on the INCOM are subjective, and each person's judgement of whether they compare their life achievements with others "often" will not only vary unsystematically, but also depend on how often they believe it is normal, or appropriate, to perform these comparisons. This result therefore suggests that attachment anxiety does not increase the frequency with which people perform social comparisons, and further, counts against my initial conclusion that attachment anxiety disposes people to judge themselves in comparisons to others more frequently.

Previous social comparison research has found social comparison frequency to relate, not just to attachment anxiety, but also to interpersonal orientation, self-focus, neuroticism (Gibbons & Buunk, 1999), low self-esteem (Wayment & Taylor, 1995) and cultural context (Baldwin & Mussweiler, 2018). In this study, however, the frequency with which people performed comparisons did not appear to be associated with any between-person characteristic, whether demographic or personality-based. If social comparison frequency is genuinely unrelated to any of these personality variables, this might suggest that the causes of social comparisons are situational in nature and less personality-based than previously suspected. Reported differences in SCO might actually reflect less on how often people perform social comparisons and more on how they recall and report them. However, I did not measure all theoretically important predictors of SCO (interpersonal orientation, for example, was not measured), and the measure of cultural context was not precise enough to contrast, e.g., collectivist cultures with individualistic cultures. I therefore do not have definitive evidence for this conclusion.

Previous research has also found some individuals to be more disposed to perform upward social comparisons than others, for instance, those with low self-esteem (Schmuck et al., 2019), or high levels of neuroticism (Van der Zee et al., 1998). Again, I was unable to find any personality factors which predicted the frequency of upward comparisons as a proportion of all comparisons. I did find that, among this sample of undergraduate students, upward social comparisons were

performed substantially more frequently than downward comparisons. This is in contrast to previous findings (Lennarz et al., 2017; Wood et al., 2000). Also, given my findings about their effects on self-esteem, this suggests that the majority of social comparisons were not carried out to deliberately further self-enhancement motives.

Unlike its relation to Study 1, this study showed consistency with my experimental findings in Study 2. Firstly, that upward social comparisons tended to lead to lower self-esteem. Here my data offers some support for the idea that self-esteem inherently follows hierarchical dynamics (e.g., Barkow, 1975; Mahadevan et al., 2016). However, this conception predicts contrast effects in both directions, such that downward comparisons would lead to increased self-esteem, which was not supported. There was therefore nothing to suggest that having high self-esteem was identical to seeing oneself as better than others, as suggested by Barkow (1975). The asymmetry in effects between upward and downward comparisons may help to explain why Gerber et al. (2018) found no overall effect of comparison direction on self-esteem. Additionally, social comparison variables only accounted for 5% of the variance in state self-esteem. Over the course of a week, state self-esteem does appear to fluctuate, but most of these fluctuations seem to occur independently of social comparisons. Comparisons seem to play one small role in the dynamics of self-esteem.

Two caveats should be mentioned. Firstly, I stipulated that participants should only record comparisons which they performed with specific individuals. Downward comparisons therefore do not include the “better-than-average” effect, in which individuals rate themselves as better than most others (Zell et al., 2020). Secondly, the low frequency of downward comparisons might mean that this study was underpowered to detect their effect.

Consistent with the self-evaluation maintenance theory of jealousy (DeSteno & Salovey, 1996; DeSteno et al., 2006; Salovey & Rodin, 1986), jealousy did tend to be higher during time periods in which people had performed upward social comparisons. The sense that others might be performing better than oneself appeared to generate a sense of threat within people’s personal

relationships. Surprisingly, the same was also true of downward comparisons. From my state self-esteem results, it seems unlikely these comparisons lead to jealousy because they generate ego threat. In fact, I can find no theoretically supported reason why downward comparisons should lead to greater jealousy. However, there is theory to suggest that jealousy could induce downward comparisons. One form of jealous behaviour is derogation of rivals (Buss & Ledden, 1990; Parrott & Smith, 1993; Guerrero, 2014), which can take the form of downward comparisons with the target (e.g., Frampton & Fox, 2018). For oneself, this functions to diminish the ego threat the target poses, and interpersonally, it may function to “set them back” (Mckeever & Brunning, 2022) in the eyes of valued others, hopefully diminishing the threat that they pose to relationships.

To make sense of my findings, I have here interpreted the effects of upward and downward comparisons inversely, suggesting that upward comparisons produce jealousy, while downward comparisons result from jealousy. This of course raises suspicion about the validity of my method to directly support either conclusion, as the temporal order of both effects could be reversed. Chung and Harris (2018) for instance, suggest that self-esteem threat can occur as part of “elaborated” jealousy, in which jealousy-evoking situations lead people to question whether they are unworthy. However, the results from my lagged models indicate that upward social comparisons performed at one timepoint can lead to jealousy at the next timepoint, while lagged jealousy does not increase the likelihood of performing upward comparisons. We therefore have reason to suppose that upward comparisons produce jealousy rather than the other way around. I did not find any effect in either direction between downward comparisons and jealousy, so I am unable to offer primary empirical evidence as to which occurs first, and must rely on theoretical explanations.

The association between jealousy and social comparisons is once again in conflict with my findings from Study 1. In that study, I found that a tendency to perform ability comparisons, measured through the INCOM, was unrelated to a tendency to experience romantic jealousy. The INCOM does not differentiate between upward and downward comparisons, and I suggested, in

Chapter 2, that it might be only upward comparisons which go hand in hand with jealousy. The results I found in this study contradict that idea; comparisons of any type appear to be associated with increased jealousy. One would expect that those who perform many jealousy-associated actions would be people who experience high levels of jealousy. I will discuss this at greater length in Chapter 5.

It was particularly harmful to self-esteem (and particularly likely to produce jealousy) to perform upward comparisons with close targets (friends, family members and romantic partners). This effect could result, as Tesser (1988) argues, from close targets being taken to be more relevant models or standards for self-evaluation. This could be out of a desire to seem worthy to them as relationship partners. Another explanation is that close others are likely to play an ongoing role in a person's social life. If a person perceives themselves to be performing poorly compared to a stranger or casual acquaintance, that may not matter after the current interaction. The abilities and performance of friends, family members or romantic partners, however, is likely to be something that individuals have to face repeatedly, and this could lead them to ongoing feelings of inferiority. Those who play an active part in a person's social life are also probably more likely to be rivals for the investment and affections of relationship partners; siblings can compete for parental attention (Volling et al., 2010), mutual friends can occupy the time of romantic partners and other friends (Bevan & Samter, 2004; Gomillion et al., 2014; Parker et al., 2005).

A third explanation for the harmful effects of upward comparisons with friends is that individuals are less likely to engage compensatory or self-protective strategies that they would use following other threats. One such strategy is to deny the diagnosticity of the comparison (Kernis & Sun, 1994). This can be achieved, among other ways, by setting the higher performer up as in an entirely unattainable category, e.g., a genius (Alicke et al., 1997), so that they are not similar enough to you to act as a standard. This may be more difficult with close targets, as you are likely to know more about the overall abilities of friends and family members; one instance of high performance is

unlikely to justify proclaiming them to be a prodigy. Another self-protective strategy is to denigrate upward comparison targets, emphasising their negative aspects (e.g., Salovey & Rodin, 1984; Schaubroeck & Lam, 2004; Vohs & Heatherton, 2004). In one qualitative study of social comparisons (Wolsko, 2012), participants reported this form of derogation to lessen the threat of upward social comparisons. It may well be undesirable to denigrate one's friends, family members or romantic partners, as part of close relationships is to see the good in one's relationship partners, often more than they do themselves (Martz et al., 1998; Murray et al., 1996). Jealousy was not associated with downward comparisons any more strongly if the comparison target was close. This is consistent with the ideas that downward comparisons follow from jealousy and that people are probably less likely to want to derogate their friends and family.

Young adults tended to experience higher state self-esteem when around close others. This is consistent with previous findings (Denissen et al., 2008), in particular, that the more that people feel socially included, the better they tend to feel about themselves. Contrary to a symbolic interactionist model of self-worth (e.g., Mead, 1934; Shrauger & Schoeneman, 1979), in which negative self-views result from internalising the perceived negative views of others, the presence of others did not interact with upward social comparisons. Though upward comparisons seemed to harm a person's sense of self-worth, it did not appear to matter whether a close other was present to witness them.

In the introduction to this chapter, I outlined two possible roles for the presence of close others on jealousy; one in which their social support buffers young people against negative emotions, as found by Uink et al. (2017), and the other in which their presence exacerbates the jealousy-inducing effect of social comparisons, as found by Lennarz et al. (2017). I found that the presence of close others had no effect on jealousy, no matter whether the individual thought they were performing better or worse than their target. It was potentially quite surprising that the presence of others did not reduce jealousy, given that it did appear to bolster state self-esteem, and

self-esteem was inversely associated with jealousy. It could be that both the aforementioned effects occur, such that the presence of close others both raises the possibility of experiencing jealousy and offers some resources for protection against it, thus cancelling out any main effect.

My mediation results indicated that upward social comparisons did lead to jealousy by threatening state self-esteem. This is the thesis advanced in the self-evaluation maintenance theory of jealousy (DeSteno et al., 2006). When people perceive others to be performing better than them, they are more likely to feel threatened in their relationships, potentially because they feel unworthy, or because they suspect that their relationship partners will notice their inadequacies. Not only does this make relationships feel less secure, but it is also easier to feel hostile towards people who make one feel bad about oneself (Baumeister et al., 1996; Kernis et al., 1989). These results indicate that the extent to which self-esteem can be threatened by social comparisons will determine, in part, the level of jealousy that one feels towards others. This zero-sum contingency of self-worth is therefore a risk factor for the hostility and conflict which can threaten interpersonal relationships.

Another major aim of this study was to investigate the extent to which zero-sum self-worth is an individual difference (the extent to which the effect of social comparisons on self-esteem differs between individuals) and whether this variance can be explained by attachment anxiety. There was a fairly wide range of common effect sizes in the effect of upward comparisons on self-esteem; some individuals tended to evaluate themselves substantially more negatively following an upward social comparison, while others saw a much lesser decrease in self-esteem. However, all effects within 1 standard deviation either side of the mean were in a negative direction. Using deviance tests, it appeared that adjusting for this range of effects did not substantially reduce residual variance/improve model fit. This could suggest that the effects are not very consistent within individuals, thereby increasing the error associated with the random slopes. Alternatively, this may simply reflect the very small degree of variance in self-esteem that is explained by social

comparisons. Either way, the lack of a substantial degree of between-person variation here means that I did not find evidence of a trait-like individual difference in zero-sum self-worth.

Slope variance was observed in the effects of upward comparisons on state jealousy, and this did substantially reduce error variance. Not everyone is equally susceptible to social comparisons leading to the hostility and resentment which characterises jealousy, and this may well be a trait-like difference between people. Slopes of the effect 1 standard deviation above and below the mean were all positive though, meaning that it is not common for young adults to be immune to jealousy resulting from upward comparisons. Considering these results, it may be more appropriate to ask what *protects* certain people from the effects of upward social comparisons on self-esteem and jealousy, rather than what makes others particularly sensitive to them. Most young adults appear to have a somewhat zero-sum form of self-worth (at least in relation to upward comparisons) and to feel some level of jealousy towards those who seem to outperform them.

I hypothesised that attachment anxiety would intensify the effects of social comparisons on self-esteem, but I did not find this to be the case among young British adults. This, again, is consistent with my results from Study 2, that trait-level attachment anxiety does not make the outcome of upward comparisons more relevant to people's self-esteem. This lack of effect has therefore been observed in both experimental and daily-life contexts. In this study, attachment anxiety was also not found to moderate the effect of downward social comparisons. Unlike Ozimek et al.'s (2021) findings regarding vulnerable narcissism, attachment anxiety did not encourage greater assimilation with downward comparison targets, but nor did it lead people to feel better about themselves following these comparisons.

In fact, no trait-based variable moderated the effects of social comparisons on state self-esteem. The only between-person variable that I did find to moderate this effect was relationship status, such that being in a romantic relationship predicted lower self-esteem following upward social comparisons. To understand this better, it may be helpful to turn back to the idea of the self as

a motivated meaning system (Crocker & Park, 2004), in which self-evaluations are defined by the self's (in)ability to achieve important contingencies. If upward comparisons affected people's self-esteem merely by a reference point effect (causing people to rate their performance lower in the context of the other's high performance), then they should imply the same thing for single people and those in relationships. Yet those in romantic relationships might feel they have much more to lose if they perform poorly compared to others. In young adulthood, romantic relationships are formed and lost quite rapidly (Rhoades et al., 2011), and so losing a romantic partner's positive view of oneself may put the relationship in jeopardy. Low standing relative to others might play a much greater role in shaping the opinions that those in relationships have of themselves, as they might get the sense that they are failing to be something that they *should* be, especially if the comparison target is a potential rival. A lack of ability in one domain can then become a failing, and by extension, an indication of general inadequacy.

One important caveat to this, however, is the lack of any effect of the presence of others when comparisons are made. We might expect, if one's place in valued relationships is the important contingency which shapes self-esteem, that the greatest threat would occur when others, especially close others, are present to view one's relative shortcomings. This was not borne out in my results; the same level of ego threat seemed to occur whether the person is alone, in company or with loved ones in particular. The effect that upward comparisons have upon self-esteem therefore seems unlikely to be mediated through perceived regard. Instead, discrepancies between self and target seem to affect people's self-judgements directly. People may be perceiving themselves as not good enough and therefore more at risk of losing relationships in general. Knowing that self-esteem tends to positively predict perceived regard (Kenny & DePaulo, 1993; Murray et al., 2000), however, makes it likely that perceived regard will suffer as a result. This could account for the effect of upward comparisons on jealousy.

Though attachment anxiety did not exacerbate the effect of upward comparisons on state self-esteem, it did exacerbate their effect on jealousy. People who were higher in attachment anxiety were more likely to be made jealous when they perceived another person to be performing better than themselves. This is in line with my hypotheses. However, I proposed that this would result from a more zero-sum form of self-worth. My results are somewhat equivocal on this point. Attachment anxiety did not make self-esteem more reactive to upward comparisons. However, the indirect effect of upward comparisons on jealousy through state self-esteem was stronger among people who were high (+1 SD) vs. low (-1 SD) in attachment anxiety. In fact, the analysis was non-significant among people low in attachment anxiety.

One possible explanation for these equivocal findings is that, following the logic of distinguishing self-worth and self-esteem, attachment anxiety may alter the effects of social comparisons on perceived regard, not self-esteem. They may see the value of others as more precarious and apt to be lost because of favour given to third parties, thus threatening the relationship. Alternatively, the perceived regard of others may suffer equally from upward social comparisons for those both high and low in attachment anxiety. People high in attachment anxiety, though, tend to have lower self-esteem and may therefore perceive others' value to be lower at baseline (Murray et al., 2000), or because they perceive others as more rejecting (Collins & Read, 1990) they may believe that rejection can occur following even a modest loss of favour.

It may also be that the comparisons people perform reflect their specific preoccupations. A young adult in Wolsko's (2012) qualitative study of social comparisons reports this, saying that the comparisons they perform "vary depending on my own personal insecurities at that moment" (p. 337). People who are high in attachment anxiety are particularly concerned with personal relationships and stake their self-worth more strongly in this domain (Knee et al., 2008). This may make them more likely to compare themselves to relationship rivals. Their contingencies of self-worth reflect this, in that their self-esteem tends to be particularly reliant on the approval of others

and their attractiveness (Brennan & Bosson, 1998; Park et al., 2004), which seem to be relevant domains to maintaining personal relationships. People lower in attachment anxiety are likely to perform comparisons which reflect different preoccupations, e.g., in academic achievement, athletic ability or economic success, which nonetheless appear to have similar effects on their self-esteem. However, because jealousy in particular occurs from threats to close relationships, upward comparisons in this domain may be more likely to trigger jealousy.

My exploratory finding, that the effect of upward comparisons with close targets was stronger among those higher in attachment anxiety, may also shed some light on this. Upward comparisons with close targets were more likely to lead to jealousy; people are more likely to treat these others as relationship rivals. If attachment anxiety increases the self-esteem threat from these comparisons, these may also lead to a greater sense of rivalry with the kinds of people who would be more likely to pose a threat to one's relationship with others. This would be evidence of a zero-sum contingency in self-worth leading to interpersonal rivalry and identify attachment anxiety as a risk factor for this issue. It is therefore very important that further research examine whether this interaction effect can be replicated.

Limitations and Future Directions

This study was underpowered. My power analysis, on the basis of simulated data, recommended a minimum necessary sample size of one hundred participants to adequately detect my moderation effects. In my OSF preregistration document, I stated that I would recruit additional participants if my N was lower than 90. Counting only participants who passed the attention check in the baseline measures, I only recruited eighty-seven participants. Only eighty-three participants provided enough information for R to include them in my multilevel model analyses. However, as I stated above, my results were very similar when I reran these analyses on a sample of $N = 97$.

There were a few surprising results in this study, like the lack of association between social comparison frequency and any personality variable. We should, of course, be open to the possibility

that these surprising findings are genuinely representative of the population. However, there is also a possibility that methodological errors could have produced anomalous results. Most concerning is the possibility that participants might not have read instructions correctly. The surveys themselves had no indication of what participants should count as instances of jealousy or social comparisons. Instead, this information was emailed to participants in a guidance document. In this email, and during the briefing session, participants were informed what the document contained and instructed to read it. If some participants failed to do so, they might have answered questions based on an idiosyncratic understanding of these concepts, which would have distorted results. In the case of jealousy, there is the particular risk that participants might have included envy when reporting their levels of jealousy, as English speakers commonly conflate these two concepts (Parrott & Smith, 1993). In future studies of this kind, I will include build questions into the baseline studies that require information from the guidance documents checks to ensure participants have read them.

I consider it unlikely that the presence of others is irrelevant to social comparison processes, so it may be that I omitted analyses that would have clarified their role. Further research should be conducted to understand how, when and for whom the presence of others affects the outcomes of social comparisons. In particular, future work might examine the role played by perceived regard, especially linking this to the experience of jealousy.

In studying the main effects of comparison direction and their interactions with certain situational factors, I glossed over some complexities to social comparison processes. This could inadvertently give readers the impression that there is only one single process in social comparisons, based almost entirely on whether the comparison target is performing better or worse than oneself. This is not the case; much previous research has found that not all upward comparisons are equal to one another, and neither are all downward comparisons (e.g., Buunk et al., 1990; Lockwood & Kunda, 1997; Tesser, 1988). A large, multifaceted model of social comparisons has been drawn up to explain what effects social comparisons may generate in particular contexts and for particular

reasons (Morina, 2021). This model was far too complex to be tested in its entirety in an already complex study, but two factors in particular might have been important to what I was studying here. These are the roles played by comparison domains and motivations.

People can compare themselves to others in terms of appearance, academic/intellectual ability, social skills/popularity and wealth/success, among many other domains. Some research suggests that different domains, in and of themselves, affect the outcomes of social comparison (e.g., McKee et al., 2013; Monin, 2007). More than this, though, there is ample research to suggest that the relevance of the domain to the individual plays an important role in how comparisons will affect them (DeSteno & Salovey, 1996; Tesser, 1988; Tsai et al., 2014). Individuals are thought to stake their self-worth on certain domains, which vary between people, and successes/failures in these domains tend to have stronger impacts on their self-esteem (Crocker & Wolfe, 2001). These are known to differ along attachment dimensions (Park et al., 2004), but effect sizes are modest and there is likely to be plenty of individual variation. In particular, the effect of target closeness is thought to be entirely reversed when considering self-relevant vs. non-self-relevant comparisons (Tesser et al., 1988). Future studies into attachment and social comparison would benefit from measuring the self-relevance of certain domains or contingencies of self-worth at baseline and the domains in which comparisons were made, insofar as this is possible within a reasonable workload for participants.

Social comparisons also seem to follow different dynamics depending on the motivations for which they were performed. They may cause pride (Webster et al., 2003) or threat (Tesser et al., 1988) when performed for self-evaluative purposes, maintain and entrench already present self-views when performed for reasons of self-verification (Santor & Yazbek, 2006), or inspire or dishearten when performed for reasons of self-improvement (Diel & Hoffman, 2019; Lockwood & Kunda, 1997). Attachment dimensions may also influence what motivations people tend to have for performing social comparisons, and the effects of these motives, so future studies in this area could

include people's motivations for performing each comparison. One notable feature of my results is that they suggest the majority of social comparisons performed by young adults are not deliberate attempts at self-enhancement. The majority of comparisons were with upward targets, and it seems that these comparisons tend to make people feel worse about themselves on average. Ultimately, I hope that my blunt conclusions regarding the effect of attachment upon social comparisons can be integrated into a more nuanced model which reflects the many complexities of social comparison in real life.

Conclusion

In this study, I found that upward comparisons tend to lower self-esteem and higher jealousy among young adults, while other comparisons had no consistent effect on self-esteem but were also associated with heightened jealousy. Upward comparisons appear to increase jealousy, in part, by reducing self-esteem, while I argued that jealousy tends to lead people to compare with others, in downward and lateral directions. The effect of social comparisons on self-esteem does not differ substantially across individuals, evidence against zero-sum self-worth as an individual difference. There was also very little evidence from this study that attachment anxiety makes self-worth more zero-sum, in spite of self-report evidence linking attachment anxiety with the need to compete with others. Attachment anxiety was not associated with social comparison frequency or the effect that social comparisons have upon self-esteem. People did substantially differ in the effect of upward comparisons on jealousy, and this does appear to be associated with increased attachment anxiety. It does appear that attachment anxiety increases the likelihood of competitive rivalry, hostility and resentment of others, though it is unclear how related this is to the manner in which people seek self-worth.

Chapter 5: General Discussion

Abstract

In this PhD, I set out to investigate the tendency to approach self-worth as a zero-sum game: the extent to which people vary in this tendency, its association with attachment anxiety, and its capacity to explain levels of jealousy. In pursuit of this, I conducted three studies: a self-report questionnaire study (Study 1), an experimental study (Study 2) and an experience sampling study (Study 3). While participants differed in the frequency with which they performed social comparisons, there was no clear evidence of an individual difference in zero-sum self-worth, due to person-specific effects of social comparisons (Study 3 – Chapter 4) being either too inconsistent or too inconsequential to self-esteem in general. Generally, I found that attachment anxiety was not associated with the outcomes that I operationalised as measures of zero-sum self-worth, as it did not moderate the effects of social comparisons on self-esteem (Study 2 - Chapter 2 and Study 3 – Chapter 4), and was only inconsistently associated with the frequency with which people performed social comparisons (supported in Study 1 - Chapter 2, but not Study 3). I initially found no association between zero-sum self-worth and jealousy (Study 1 - Chapter 3). However, using experience sampling methods (Study 3 – Chapter 4), I found that not only was jealousy predicted by upward social comparisons, as expected, but it was also associated with all directions of social comparison, and those who performed more social comparisons tended to experience the most jealousy. The effect of upward comparisons on jealousy was mediated by state self-esteem (Study 3 – Chapter 4), so overall, zero-sum self-worth did appear to lead to greater jealousy. There were substantial differences between people in the association between upward comparisons and jealousy, so there appears to be something resembling an individual difference in tendency to be jealous of high-performing others. This difference is partly explained by people's levels of attachment anxiety. Finally, the ability for zero-sum considerations to provoke jealousy (self-esteem threat from comparisons), potentially due to the tendency to feel more ego threatened by close others. In sum, I conclude that the differences between people in sensitivity to social comparisons

are not what I initially expected them to be. Social comparisons do not appear to affect the self-esteem of young adults a great deal, but some forms of ego threat, for some people, do lead them to feel threatened by others. In this chapter, I review these findings in greater detail, and suggest that, in order to find ways to lower interpersonal hostility, researchers should investigate the potential of reducing attachment anxiety by encouraging autonomous goal pursuit, and making the high performance of others less threatening by encouraging self-compassion.

Aims of the Project

In this PhD, I investigated the tendency to approach self-worth as a zero-sum game, because when others threaten one's sense of self-worth, this can generate rivalry and hostility between people (Baumeister et al., 1996), especially through envy and jealousy (Alicke & Zell, 2008; DeSteno et al., 2006; Salovey & Rodin, 1986). These factors can in turn harm personal relationships (Barelids & Barelids-Dijkstra, 2007; Parker et al., 2005; Pichon et al., 2020; Salovey & Rodin, 1984).

The first goal I addressed in this project was describing and delineating zero-sum self-worth as a concept. I laid out similarities between zero-sum self-worth and contingent self-esteem, unstable or fragile self-esteem, egosystem motivations and narcissism, while also pointing out how these differ from the idea of zero-sum self-worth. I also placed the concept in the context of debates around self-esteem. Self-esteem theories differ in the centrality of role they assign to social comparisons (e.g., Barkow, 1975; Brummelman et al., 2016; Leary et al., 2014), with social rank theorists maintaining that self-esteem is inherently zero-sum (e.g., Barkow, 1975; Gregg et al., 2018), while others argue that self-esteem is inherently non-zero-sum (e.g., Brummelman et al., 2016). In contrast to this, and similar to the case outlined by Kerins (2003) about fragility of self-esteem, I proposed that people vary in the extent to which their self-worth follows zero-sum dynamics.

Evaluations, whether of oneself or of anything else, are very likely to involve comparisons somewhere in the process (Morina, 2021; Vlaev et al., 2011). Comparative judgements involve the use of comparison standards or targets, which anchor evaluations by acting as reference points that define the scale (Mussweiler & Strack, 1999). Zero-sum, self-worth specifically refers to the idea that one's worth as an individual relies on relative evaluations like this, with the performance and abilities of others acting as direct reference points for the evaluations. This implies that the performance of others is taken to be a relevant standard for assessing one's own worth.

Next, I outlined how comparison-based forms of self-worth could be operationalised and measured. I proposed two operational elements: the frequency with which a person performed social comparisons, and the effect that these comparisons had on their state self-esteem. Both appeared to indicate the perceived diagnosticity of social comparisons for self-worth. Previous research had found that these were related, such that upward social comparisons had a larger impact on self-esteem among people who reported performing more social comparisons (Vogel et al., 2015). With regards to downward comparisons, work involving self-esteem is lacking, but those who perform more social comparisons also show more positive affect following downward comparisons at work (Buunk et al., 2005). This heightens the possibility that frequency and impact of social comparisons on self-esteem together form a somewhat stable individual difference. However, the current project aimed to test this more directly. While prior researchers had reported the extent of variance in social comparison frequency (e.g., Gibbons & Buunk, 1999), I aimed to also investigate variance in the effect of social comparisons on self-esteem.

The next question was whether attachment anxiety might tend to make self-worth more zero-sum. The important role that personal relationships play in self-esteem led me to expect that such an individual difference might arise from relationship-based individual differences. Not only did attachment anxiety seem to provide a theoretically plausible explanation for why people might be more disposed to judge themselves comparatively, but previous research had found attachment

anxiety to be related to adjacent phenomena. For example, attachment anxiety positively predicts less stable and more contingent self-esteem (Foster et al., 2007; Park et al., 2004), as well as beliefs in the competitive nature of the social world (Gilbert et al., 2009). I therefore set out to measure whether attachment anxiety was associated with more frequent assessment of one's own worth through social comparisons, and whether it would heighten the effect of social comparisons on state self-esteem.

Finally, I wanted to examine whether these processes led to increased interpersonal rivalry and hostility, in the form of jealousy. Attachment anxiety has been found to positively predict jealousy, and in spite of ongoing debates around the ultimate nature and roots of jealousy, there is substantial consensus that upward social comparisons and self-esteem threat produce jealousy in at least some circumstances (Besser & Priel, 2009; Broemer & Diehl, 2004; DeSteno & Salovey, 1996; DeSteno et al., 2006; Sharpsteen, 1995). I therefore proposed that social comparisons and self-esteem threat would partially account for the association between attachment anxiety and jealous dispositions. I proposed that this could help us to understand substantial differences, which I mentioned in the introduction chapter, observed in young adults' readiness to experience jealousy towards others. These differences are particularly obvious in the case of romantic jealousy, where young adults are the age group in which people are both most likely to engage in consensual non-monogamy (Hauptert et al., 2017), but also most likely to commit acts of intimate partner violence (Halpern et al., 2009), which are very often motivated by jealousy (Pichon et al., 2020). This difference could be due, in part, to how threatened people feel their relationships to be from upward social comparisons.

My hypotheses were that people vary in the extent to which they measure themselves through social comparisons, that this tendency results from attachment anxiety, and that it tends to lead to increased jealousy. If I was correct about all of these, this would give future psychologists,

and the wider public, deeper insight into how interpersonal rivalries arise and how they can be attenuated.

The phenomena I set out to study were quite general, relating to people's tendency to judge themselves in comparison to others, regardless of the domain or situation, and their tendency to form rivalries with others as a result. This most likely stems from my philosophical background; my first exposure to these questions was in reading the works of philosophers attempting to grapple with questions of human nature. What is unavoidable in human life, what is subject to change, and what factors effect that change? I was therefore not looking to explain the specifics of all comparison behaviour in personal relationships. Instead, aware that a wealth of detail lay underneath, I was merely looking to understand broad patterns in the way that people understand themselves in relation to others, and the consequences of this for the way they respond to others.

What conclusions did I reach in this project?

Summary and Reflections

How Can Zero-Sum Self-Worth be Measured?

Establishing strategies for measuring zero-sum self-worth was a goal of this project, and I can now reflect on how satisfactory the measures used were. I employed three different methodologies in assessing zero-sum self-worth. The frequency with which people performed social comparisons was examined through self-report measures, both retrospective, and in daily life. I measured self-esteem following social comparisons in an online experiment as well as in daily life. Where consistent results were found across these methods, this gives a reliable understanding of the nature, antecedents and consequences of zero-sum self-worth. However, it was also important to understand the ways that these measures could differ from one another, and whether these reflected substantive differences (e.g., in people's responses to social comparisons in different

settings) or artefacts of measurement (e.g., differences in frequencies estimated retrospectively or reported in near-term surveys).

There were very important elements of methodological divergence, but also some convergence. Experimental and experience sampling methods both revealed that young adults tend to evaluate themselves more poorly when exposed to an individual who they perceive to be performing better than themselves. At the same time, this tendency was not influenced by demographic or trait-level characteristics. This leads me to believe that experimentally-induced social comparisons, at least those on domains which reflect the preoccupations of the sample, share important features with naturalistic social comparisons, and both can be used to study the extent to which self-worth functions in a zero-sum manner. For future researchers, I would recommend that both can be employed to study this element of zero-sum self-worth, though both have differing emphases. The controlled nature of experimental methods allows for greater precision in studying the effects of specific forms of social comparisons, while the richer and more ecologically valid information provided through experience sampling methods may sacrifice some precision but allows an exploration of how comparisons actually occur in daily life.

However, when considering my measures of social comparison frequency, the results from my experience sampling study (Study 3) stood in direct conflict with those of my retrospective/prospective study (Study 1). The frequency with which people performed social comparisons was positively associated with attachment anxiety in Study 1, but there was no association in Study 3. Study 3 also found no role for the other personality variables tested, i.e., neuroticism and trait self-esteem in predicting social comparison frequency, in opposition to prior research (Gibbons & Buunk, 1999; Van der Zee et al., 1998; Vogel et al., 2014; Wayment & Taylor, 1995). Additionally, in Study 1, people's reports of their social comparison frequency was unrelated to their emotional jealousy while my real-time measure of social comparison in Study 3 not only

predicted concurrent (and lagged) jealousy, but its overall frequency was also positively associated with frequency of jealousy experiences.

These divergences are evidence that conclusions about social comparison frequency are substantially dependent on the methods used to study it. If social comparison frequency is to be measured as an element of zero-sum self-worth, it is therefore very important to consider the strengths and limitations of each approach, which I turn to now.

Strengths and Limitations of the Iowa-Netherlands Comparison Orientation Measure.

Given these two measures of social comparison frequency disagree to such an extent, I was forced to question which I should trust. The INCOM, used in Study 1, has been one of the foremost self-report measures of social comparison since it was created. It has been validated on Danish, American, Dutch and German participants (Gibbons & Buunk, 1999; Schneider & Schupp, 2011), and separate variants have been created for Russian, Spanish and Portuguese speaking participants (Buunk et al., 2020; Garanyan et al., 2016; Velede et al. 2023). It is therefore no small matter to conclude that this measure does not fulfil its function accurately, i.e., that individuals with high INCOM scores do not, in fact, perform more social comparisons.

Studies which use the measure seem to have identified a relatively consistent personality profile of a person who scores highly on the INCOM, i.e., reports performing a lot of social comparisons. They are self-focused, but concerned with the viewpoints of others, they experience a great deal of negative affect, they experience self-doubt and self-related uncertainty, higher levels of anxiety and depression, and are generally pessimistic (Butzer & Kuiper, 2006; Gibbons & Buunk, 1999; Lee, 2022; Powell et al., 2018; Wayment & Taylor, 1995). The correlates and factor structure of this measure also appears to hold across cultures (Gibbons & Buunk, 1999; Lee, 2022; Schneider & Schupp, 2011; Velede et al., 2023). There is also evidence to suggest that high scorers on the INCOM are more prone to react strongly to social comparison information, in terms of their mood,

satisfaction with social relationships, and self-esteem (e.g., Alfasi, 2019; Buunk & Brenninkmeijer, 2001; Buunk et al., 2007; Vogel et al., 2015),

Being more likely to *report* performing social comparisons relatively frequently, however, is not the same as actually performing them relatively frequently. In line with my arguments in Chapter 4, the INCOM, as a self-report measure, could also suffer from respondent recall biases. As discussed in that chapter, survey respondents may be more likely to remember social comparisons if comparisons have strong impacts upon them (Gorin & Stone, 2001), but also if the idea that they are predisposed to perform a lot of comparisons fits with their existing self-models (Cameron et al., 2004; Maheshwari et al., 2021) or cultural values and beliefs (Maier & Richter, 2013; Ross, 1989). Thus, the associations between the INCOM and the strength of comparison outcomes (Buunk et al., 2007; Vogel et al., 2015) may reflect a salience bias in memory, while personality traits which lead to negative affect and self-criticism could suppress the self-enhancing tendency to report low levels of social comparisons, thus inflating the association between these variables and SCO. Gibbons and Buunk (1999) found only a small correlation between SCO and social desirability, arguing that variance in the INCOM does not appear to be due to varying levels of willingness to admit social comparison. Yet self-enhancing recall biases are not a self-presentation strategy; they are found even when participants are aware that researchers know their original responses (Ross, 1989). This possibility of recall biases is a cause for concern among any retrospective self-report measure (Schwarz, 2012).

One problem specific to the INCOM is that it employs fairly subjective terminology on multiple items. For example, one item states: “I *often* compare how I am doing socially (e.g., social skills, popularity) with other people” [italics mine]. Even two participants who perform social comparisons with equal frequency, and have perfect memory of their social comparisons, may have different interpretations of whether they “often” compare how they are doing socially or in their life achievements with other people. This amplifies the issue of preexisting beliefs about comparison

frequency, because participants can rely on whether the amount they perform social comparisons *seems* often to them. It is worth noting that this drawback also applies, to some extent, to my measure of jealousy in Study 3.

One final point that supports the validity of the INCOM, and thus offers justification for its use, is the observable behaviour of those who score highly on this measure. For example, high scorers on the INCOM showed more interest in viewing test scores of other participants after receiving bogus feedback on a test (Gibbons & Buunk, 1999). This is similar to findings among cancer patients when the INCOM was administered in the same session; those high in SCO tended to spend longer reading interviews with others undergoing the same experiences as them (Van der Zee et al., 1998). High INCOM scorers also tend to assimilate their behaviour towards that of prototypical individuals who engage in risky behaviour (Buunk et al., 2012; Gibbons & Buunk, 1999). Most of these findings cannot be explained by the role of demand characteristics (Nichols & Maner, 2008), as in some cases, the relevant behaviours were measured at very separate times to administration of the INCOM. At the very least, it appears that people who report high levels of social comparison via the INCOM pay particular attention to social comparison information, and to make more use of it, consciously or otherwise, when deciding on their actions.

Strengths and Limitations of Experience Sampling Measurement

My experience sampling measure of social comparison frequency in Study 3 was less vulnerable to recall biases. This is because studies which ask participants to report events a short time after they occurred - “near-term” reports, as Silvia & Cotter (2021) refer to them - rely on specific episodic memory, which tends to be consistent with real-time reports (Kahneman et al., 2004). There is, however, a potential problem with experience sampling measures of social comparison frequency. For example, Schwarz (2012) raises the point that participants adjust the phenomena that they report on based on what they believe researchers want to know. In particular, they will ignore more commonplace events when presented with a relatively long timescale.

Schwarz et al. (1988) investigated what events participants had included when asked to report how often they felt “really annoyed”, and found that participants who were given shorter timescales tended to include more mundane experiences of annoyance than those who are given longer timescales. In my case, participants might have assumed that the question which asked whether they compared themselves to others since the last survey only included very significant comparisons. After all, participants in Wolsko’s (2012) study of young adults maintain that they performed social comparisons nigh-on constantly. This is consistent with the viewpoint of some theorists, that because comparisons are fundamental to human judgements (Vlaev et al., 2011), such social comparisons must occur perpetually in a social world (Corcoran et al., 2011). If participants are constantly performing social comparisons, the literal answer to the question “have you performed a social comparison since the last survey?” would always be “yes”. Reporting this redundant information would violate the conversational maxim to add non-redundant information to the interaction (Grice, 1975), so participants might assume they should be reporting on rarer and more significant occurrences. If this were the case, my measure would have biased the reporting of social comparisons towards those comparisons which had a substantial impact on my participants.

There are a number of reasons to doubt this. Firstly, I gave participants detailed instructions on what events counted as social comparison, reducing the potential for reinterpretation of the question. Secondly, evidence for the ubiquity of social comparisons may not be as strong as it seems. In Wolsko’s (2012) study, for example, participants were engaged in a task of reporting every social comparison they made in detail, in a diary, along with numerous features of it, and were instructed to engage in mindfulness specifically related to the performance of social comparisons. This is a sensible procedure to facilitate detailed reporting of one’s reactions to social comparisons, but by orienting so much of participants’ thoughts and tasks around social comparisons, it arguably primes participants to perform them. Measurement reactivity has been found in experience sampling measures of social comparison (MacIntyre et al., 2021), such that participants report more social comparisons over the first couple of days of a study. I replicated this finding in Study 3, suggesting

that even the fairly minimal instruction I gave to my participants probably primed them to perform more comparisons.

My measure of social comparison frequency in Study 3 was somewhat hindered by having to rely on the social comparison occurrence measure alone; this dichotomous comparison occurrence measure counted all timepoints at which a person performed any comparisons equally. This means that timepoints at which a person reported performing one comparison were treated as identical to those in which a person reported performing five or six. This is an appropriate approximate measure of comparison frequency for people who perform comparisons with a fairly even distribution across the course of a day. For those who perform many comparisons in a single burst and then do not perform any more across the day, the comparison occurrence measure would tend to suppress their scores. If the distribution of comparisons across the course of a day is associated with trait variables like attachment anxiety or neuroticism, this measure could mask a genuine association between these traits and comparison frequency.

There are, therefore, advantages and disadvantages to both retrospective and daily-life measures of social comparisons. I believe that my experience sampling measure in Study 3 was more valid for specifically measuring social comparison *frequency* than the INCOM in Study 1. However, the fact that comparison frequency was unrelated to any trait level variable in Study 3 may suggest that frequencies on a given week do not reflect any trait-level preoccupation with relative standing as I proposed. Additionally, people who performed more social comparisons were not found to react more strongly to these comparisons in their self-esteem or jealousy levels. It is also possible that, despite all efforts that researchers employ to minimise measurement interference, the comparisons performed across any given study week are not, in fact, representative of how often individuals perform social comparisons on a normal week.

By contrast, while the INCOM's measurement of comparison frequency is hindered by possible recall biases, it does seem to reflect, in some way, the importance or focus that participants

assign to social comparisons. Insofar as zero-sum self-worth is concerned, this captures some of what the frequency of social comparisons was intended to capture. However, researchers should be cautious about using it as a genuine measure of comparison frequency. It may also be that SCO captures social comparison frequency or focus with a degree of unreliability. For instance, while retrospective reports of comparison frequency like the INCOM may largely reflect the genuine readiness with which people compare themselves with others, this could be inflated by factors like recall biases (mentioned above) or self-criticism, which is higher among people with high attachment anxiety, neuroticism and low self-esteem (Clara et al., 2003; Iancu et al., 2015; Rogier et al., 2023).

Future research could explore this issue further by exploring the behavioural and cognitive correlates of INCOM scores in greater detail. High scores could correlate with: high frequency of certain kinds of comparison (e.g., comparisons in certain contexts, or performed for certain motivations), greater attention paid to comparison information, stronger emotional reactions to comparison, or with self-criticality. In the case of experience sampling studies, researchers could provide participants with a multiple-choice measure of how many comparisons they had performed since the last survey, e.g., with options such as: "1", "2-4", "5-9", "10+" or similar. Additionally, researchers could ask the same set of participants to complete both the INCOM and diary measures of comparison frequency, investigating whether these scores are well-correlated, and whether they are differently correlated with other measures. However, in this, care must be paid to reduce the influence of demand characteristics.

I also believe that my measures of self-esteem reactivity took too little account of comparison dimensions and reactivity. However, to see why this is, we need to turn to substantive questions about the nature of zero-sum self-worth.

Is Zero-Sum Self-Worth an Individual Difference?

The next question was whether my results supported the idea of a genuine individual difference in zero-sum self-worth. This would manifest in variation in the frequency with which people perform social comparisons and the effect that these comparisons have on their state self-esteem. There was a substantial degree of difference in the frequency with which individuals reported performing social comparisons, according to both measures of SCO and near-term reports. However, the disagreement between Study 1 (where attachment anxiety was positively associated with social comparison on abilities) and Study 3 (where all measured trait variables were unrelated to social comparison on abilities) casts some doubt over whether this element of zero-sum self-worth is a trait-based process. Future research might benefit from studying participants across multiple weeks, to determine whether comparison frequency differs substantially from one week to another.

When I examined random slopes for the effect of upward comparisons on self-esteem in Study 3, I found a reasonable level of variation. Some individuals showed fairly negligible effects, while others saw their self-esteem decrease by an average of 1.6 points following an upward comparison. However, this effect only reduced residual model variance to a very small extent. This could suggest that these individual-level slopes are somewhat unstable due to more within, than between-person variation in the effect of upward comparisons on state self-esteem. However, another explanation is that the effects of social comparisons on self-esteem were fairly small, accounting for a mere 5% of overall self-esteem variance. This could mean that regardless of how different people were from one another, the slope variances might still be too small to make a meaningful difference to model error. Finally, as with comparison frequency, the strength of these effects was not associated with neuroticism, trait self-esteem or attachment dimensions. This is, again, evidence against interpreting zero-sum self-worth as an individual difference. The fact that a particular person performs more comparisons, or is more strongly affected by social comparisons, on a given week, might say more about that week than their personality or self-evaluative style.

Overall, I did not find conclusive evidence that zero-sum self-worth is an individual difference between people, that particular individuals treat their self-worth as a more zero-sum game than others. One possibility that I did not explore sufficiently in this project was that rather than being a general individual difference, in which the extent to which a person sees their self-worth as being a zero-sum is somewhat consistent across domains and contexts, between-person zero-sum dynamics in self-worth might be context-specific. In Chapter 1, I stated that “I expect that people exhibit zero-sum self-worth in ways that vary in all the ways in which self-worth judgements in general are known to vary. In this way, zero-sum self-worth is not a personality trait, like neuroticism or narcissism, but merely a description of one form of variation in self-worth judgments”. In treating zero-sum self-worth as an individual difference and looking for evidence of it across contexts, I have treated it more like a personality trait than a straightforward description of self-evaluations.

It might be more appropriate to consider zero-sum *dynamics* in self-esteem, which could occur in particular contexts for particular reasons. My arguments that attachment anxiety would lead people to treat their self-worth in more zero-sum terms were mainly couched in terms of potential relationship consequences of social comparisons; threat from high performing others and potential security given by poorly performing others. Considering this more closely, this does not directly support the idea that people would feel their worth to be under threat from others in all contexts. Rather, it supports the idea that attachment anxiety would encourage zero-sum dynamics in personal relationships, that they might feel in competition for their worth with others in their direct social world. Future research could use the same methods to investigate zero-sum dynamics (the frequency of social comparisons along with the self-esteem effects of these comparisons) but on a context-by-context basis, without assuming that zero-sum dynamics in one context imply zero-sum dynamics in all others.

Social Rank Theories of Self-Esteem Revisited

Do my results instead support a social rank conception of self-esteem, in which it is fundamentally based on one's place in a status hierarchy? Should we, in line with Crocker and Park's (2004) warning, see the search for self-esteem as an inevitable slide into treating others into rivals and enemies rather than allies and supports? So far as self-image goals are concerned, this relationship appears to hold (Crocker & Canevello, 2008). Yet the evidence from this project allows us to ask the more general question, as to whether being concerned about one's sense of self-worth in general entails viewing the positive performance and qualities of other people as threats, and their failings as positives for our own position. Some evidence certainly did support this conception. Firstly, as noted above, both my experimental and experience sampling studies found that upward comparisons lead to lower levels of state self-esteem. If social status is based around possessing valued skills at a higher level to others (e.g., Anderson et al., 2015; Henrich & Gil-White, 2001), perceiving oneself to be less able, possess less positive attributes or perform tasks less well than others, should lower one's capacity to hold high status, and therefore threaten self-esteem.

A second source of support for social rank theories is that downward comparisons were found to be associated with jealousy. In Chapter 4, I argued that this was likely because jealousy provokes people to denigrate their rivals (Parrott & Smith, 1993; Guerrero, 2014). If this is true, it is evidence of a general tendency for people to feel threatened by high-performing others and desiring to restore one's own status by pulling the other down to their level (Buss & Ledden, 1990; Gregg et al., 2018). This supports the idea that one's own sense of worth relies on the relative position of the other person.

However, I also found evidence against social rank theories of self-esteem. Firstly, in Study 3, I examined whether other people being present when a comparison was made influenced its effects. Social status is, importantly, a social process, based on the esteem of others and their tendency to give one deference (Henrich & Gil-White, 2001). If upward comparisons harmed self-esteem because

they worsened a person's status among their peers, we would expect that the presence of these others would make social comparisons more damaging. However, in that study, the presence of other people did not interact with the occurrence of upward comparisons, suggesting that losing face socially was not the mechanism by which upward comparisons worsened self-esteem.

Secondly, self-esteem was not usually higher in that study following downward social comparisons. More specifically, this refers to times at which participants identified a downward comparison as the 'most significant' comparison that they had performed. This is not because participants generally had low opinions of themselves which could not be shifted by isolated positive influences. The mean level of state self-esteem across the study week in Study 3 was 6.96, well above the scale midpoint of 5, similar to the mean score in state self-esteem in Study 2 (3.22 on a scale of 1-5, equivalent to 6.44 on a scale of 1-10). Feelings of worth did not appear to be based on perceiving oneself to be better than others. This offered some support to the argument that self-esteem is separated from narcissism because it does not rely on superiority to others, notably advanced by Brummelman et al. (2016). While this may be true, my findings seem to indicate self-esteem is affected by seeing oneself as inferior to others.

One potential counter-argument from a social rank perspective is that a lack of response to individual comparisons does not imply that self-esteem is not comparison-based, as this ignores the role of self-esteem stability. If a person securely thinks of themselves as better than other people and therefore has a stably high level of self-esteem, they may not shift their self-evaluations much due to isolated occurrences. Only when self-esteem is unstable is it likely to change after a single comparison. This could represent one advantage to the methods employed by Lennarz et al. (2017) and Mahadevan et al. (2020), in which participants rated their status relative to their peers on each occasion, as this represents the extent to which any given event has affected their perceptions of their own relative rank. However, participants' self-esteem did fluctuate through the study week (though within-person variance was lower than between-person variance), but this variance was

only due in a small part to the effects of social comparisons, and only upward comparisons at that. If participants base their self-esteem on inferiority/superiority to a large extent, we would anticipate this to account for substantially more of the fluctuations that they experience in self-esteem.

It seems, from my results, that experiencing self-worth in a zero-sum fashion is something that is fairly consistent across young adults, though apparently, not to a very large extent.. People were more likely to feel threatened by perceiving friends, family members or romantic partners ('close' targets' as I refer to them) to be performing better than they were, as compared with perceiving the same thing about distant targets. This suggests that, among this group, the closeness of another person to oneself generally increases contrast effects, rather than offering more opportunities to bask in their reflected glow (Tesser, 1988). Thus, Crocker and Park's (2004) concern about the damage that can be done to personal relationships was well-placed. Close others - friends, family members and romantic partners - are the people that young adults are most likely to experience this kind of rivalry with, to suffer from their successes, interfering with the desire to be happy for those they are closest to. Nonetheless, there appear to be some safeguards against all the negative consequences of this rivalry. People still seem to be motivated not to denigrate close others through downward comparisons. Previous research has found this to be moderated by narcissism, such that more highly narcissistic people are more prone to downwardly compare with close others (Krizan & Bushman, 2011).

Others are not merely obstacles to one's self-esteem. In Study 3, consistent with previous research (Denissen et al., 2008), the presence of others tended to increase people's self-esteem. This is some support for theories of self-esteem based on interpersonal belonging (e.g., Macdonald & Leary, 2012), in that the presence of others could indicate that the individual is, to some small extent, accepted by others. The size of this effect was fairly small, but this may simply reflect the fact that the presence of others is only a slight indication of acceptance. What is potentially surprising about this effect is that the presence of close others (friends, romantic partners or family members)

did not improve self-esteem any more than the presence of others in general. If it is the feeling of belonging that is improving self-esteem, we might expect an individual's self-esteem to improve most when they spend time with people who seem to value relationships with them most highly. However, this is somewhat consistent with the findings of Denissen et al. (2008), who found that the quantity of time spent with friends besides one's closest friend had a stronger positive effect on state self-esteem than the quantity of time spent with one's closest friend, while time spent with romantic partners had no effect and time spent with family members may even have made self-esteem marginally worse. Denissen et al. (2008) found that it is interaction quality, not quantity, that tends to improve self-esteem. High-quality time spent with any of these others tends to improve self-esteem, as it conveys belonging with these others, while poor-quality time is likely to make relationships seem less secure. I found mixed support for a social rank account of self-esteem, indicating that young adults in the UK experience inferiority-based self-doubt, but appear to be unmoved by a sense of superiority. Ultimately, I interpret these findings as indicating that individuals were largely unconcerned with social rank *per se*, but instead were concerned with being good enough, i.e., measuring up to acceptable standards. Other people can act as anchor points on the scale of acceptability, such that how talented or appealing one needs to be is established by how talented or appealing other people are. If a person is threatened by the performance of others, they may react by attempting to bring others down to their level. Nonetheless, when people feel they have reached standards of acceptability, social comparison no longer seems to make a difference to their self-esteem. They are not concerned with being better than others, but merely avoiding the sense that they are worse. This is only one possible interpretation, but one that is consistent with the data I have.

Attachment Anxiety and Zero-Sum Self-Worth (RQ1)

In this PhD, I proposed that because attachment anxiety fosters a preoccupation with more direct involvement from attachment figures, in the form of direct proximity, attention, reassurance and support (Mikulincer & Shaver, 2016; Shaver & Mikulincer, 2002; Shaver et al., 2005), individuals high in attachment anxiety will have more relationship experiences where their goals put them into competition with others. As a result, I proposed, they would develop more competitively-oriented internal working models of self and others because past experiences of felt rejection would give rise to relationship scripts in which the positive qualities or performance of others lead to the individual being ignored and rejected, while the drive to attain relationship security will recruit the goal of being more appealing than others.

Past research has investigated the content of working models through cognitive associations, finding that attachment anxiety is related to expectations of partners rejecting, hurting or abandoning oneself (Baldwin et al., 1993). However these working models can also shed light on the contingencies which people believe will lead to interpersonal rejection. For example, people with low self-esteem tend to associate failure with rejection (Baldwin & Sinclair, 1996). Given attachment anxiety is associated with negative self-views (Bartholomew & Horowitz, 1991; Mikulincer & Shaver, 2016), this means that they are more likely to expect rejection when their failures are made salient. VanDellen et al. (2009) found that individuals assume that characteristics related to their domain of self-worth are particularly influential to others' judgements of them, and tend to associate negative words in those domains with social exclusion. Given preoccupied attachment is positively associated with reports of basing self-worth on competition with others (Park et al., 2004), this makes it plausible that individuals high in attachment anxiety would anticipate rejection when they are outcompeted by others. Explicit measures have tended to support this idea, finding that attachment anxiety is associated with believing that one must earn one's place in the social world through competition (Gilbert et al., 2009). What's more, attachment

anxiety has been linked to explicit reports of social comparison frequency in appearance (Bamford & Halliwell, 2009) as well as generally (Powell et al., 2018).

My first aim was simply to see if I could replicate this latter finding. In Study 1, I found, similar to Powell et al. (2018), that attachment anxiety was associated with higher SCO and specifically to comparisons on ability, as well as confirming that these associations were not due to level of self-knowledge. However, in Study 3, I did not find attachment anxiety to predict any greater frequency of social comparisons. Whether this thesis found evidence to support or discredit this hypothesis therefore depends on whether we believe that the INCOM or my experience sampling method acts as a more valid and accurate measure of social comparison frequency (see above). However, I suggest that even if more anxiously attached individuals do not perform more social comparisons than others do, their higher scores on the INCOM suggest that they are likely to pay more attention to social comparisons in some fashion. This indicates that attachment anxiety is associated with zero-sum self-worth in at least one way. This brings us to the next question; does attachment anxiety increase the effects that social comparisons have on state self-esteem?

In both Studies 2 and 3, attachment anxiety did not alter the effect that upward comparisons with strangers or acquaintances ('distant targets') had on state self-esteem. Study 3 also brought evidence that attachment anxiety did not moderate the effect of upward comparisons considered as a single category (including both close and distant targets) or the effect of downward comparisons. This latter finding makes it unlikely that more anxiously attached individuals see their own worth as being dependent on being superior to others. There was no evidence that individuals who were high in attachment anxiety treated social comparison information as more diagnostic of their own sense of self-worth than others did.

If attachment anxiety does increase focus on relative investment from others (Murphy et al., 2020), why did it not lead people to see themselves more poorly following an upward comparison, or more positively following a downward comparison? With regards to upward comparisons, this

could relate to floor effects in self-esteem. If a person has a positive self-image, and this is then threatened by another individual, their self-esteem may decline sharply as a result. If a person already has a low opinion of themselves, and is then encouraged to see themselves negatively due to an upward comparison, this may not affect their self-esteem particularly strongly, simply confirming, as it does, their existing opinion. Indeed, their comparison could have been motivated by self-verification, i.e., maintaining the opinion might be the reason that they performed the comparison in the first place. My results in Study 3 offered some support for this conclusion, as people with lower self-esteem intercepts had less negative slopes for social comparisons on self-esteem.

Another interpretation is that even if attachment anxiety leads people to feel they are in a competition for the approval and investment of others, this only involves comparisons in one domain, one self-esteem contingency among many. People may also feel the need to compete to satisfy other contingencies, for example, in an academic performance – people may perceive academic success to consist in performing better than others around them, and/or perceive failure to consist in performing worse than others. In fact, given all individuals are rated on the same scale in academic assessments, this is a prime domain for social comparisons (e.g., Marsh, 1987; Wolsko, 2012). One of the dimensions of comparison I manipulated in Study 2 was academic performance, and among undergraduate students during term-time, comparisons on academic ability and performance may be made very salient. Many of the comparisons made by our participants in Studies 2 and 3 may therefore have regarded academic success.

As I did not explore in which domains participants had performed their comparisons on, I am unable to know whether attachment anxiety had domain-specific effects. Attachment anxiety has been found to be specifically positively associated with contingencies of self-worth which involve the views of others and which might be particularly relevant to forming and maintaining personal relationships, i.e., the approval of others, and physical appearance, which can also be cast as being attractive to others (Park et al., 2004). It may be that attachment anxiety makes self-esteem more

vulnerable to upward comparisons on appearance, i.e., when confronted with a person who seems to be more attractive than oneself, because this person might be a rival for a partner's attentions or commitment. This is supported by the moderated mediation results, discussed further below. By contrast, attachment anxiety is unrelated to basing self-worth on academic competence (Park et al., 2004), and so would not make self-esteem more vulnerable to upward comparisons on academic performance, because a high performing colleague is probably more likely to be a rival in the workplace than in personal relationships. If the majority of comparisons were made on this dimension, attachment anxiety might have no overall moderation effect, despite exercising an effect in one specific domain. This is part of what I mean when I suggest it is better to ask what might introduce zero-sum dynamics in a given context than to ask what increases zero-sum self-worth in general.

In response to research question 1, then,, while the association between attachment anxiety and SCO suggested that more anxiously attached individuals might be more concerned with social comparisons than others are, there was no strong evidence that they had more zero-sum models of self-worth (overall). They did not perform more social comparisons according to daily-life measures, and their self-esteem did not tend to be any lower following social comparisons.

Zero-Sum Self-Worth and Jealousy (RQ2)

In Study 1, I did not find that frequency of performing ability comparisons led to a stronger disposition to experience jealousy in romantic relationships. This was surprising, given jealousy has been both assumed (Dijkstra & Buunk, 2002) and found (Broemer & Diehl, 2004; DeSteno & Salovey, 1996) to be a process based in social comparisons. By contrast, Study 3 found a strong link between social comparison frequency and jealousy. The finding in Study 1 could be attributed to recall biases in responses to the INCOM, as discussed above. This is especially plausible given both forms of jealousy were associated with attachment anxiety, consistent with past theory and research (Knobloch et al., 2001; Rodriguez et al., 2015; Sharpsteen & Kirkpatrick, 1997). However, there are

also possible issues with my self-report measure of emotional jealousy in Study 1. This measure was prospective, requiring people to predict the emotion they would feel in specified situations involving their partner and a third party. As past researchers have found, people can be substantially inaccurate in forecasting their emotional reactions to events (Wilson & Gilbert, 2005), including with regards to jealousy (Harris, 2003). Additionally, the emotional jealousy subscale does not give much of any description of this third party. The qualities of the potential rival are an important situational antecedent of jealousy (Broemer & Diehl, 2004; DeSteno & Salovey, 1996; Dijkstra & Buunk, 2002).. This points to a general disadvantage of measuring jealousy through questionnaire measures. I believe that, if we want to understand what makes third parties into rivals and enemies, we should turn instead to measures which are based in daily life, in which participants are able to experience genuine relationship threat without this being induced through the research.

Consistent with the self-evaluation maintenance theory of jealousy (DeSteno & Salovey, 1996), upward social comparisons did tend to lead to higher levels of state jealousy in Study 3, and in particular, this effect was partially mediated by lower levels of state self-esteem. When exposed to others who appeared to be more able or performing better than themselves, people tended to experience self-esteem threat, which contributed to them feeling jealous of these other individuals. This effect was not more pronounced among people in romantic relationships than among single people, so it appears that this process is, as argued by Chung and Harris (2018) and Salovey and Rodin (1986), common across all forms of jealousy. It does not, for example, seem to be restricted to absolute rivalries [see Chapter 3] - where a partner's relationship alternatives could threaten to bring the relationship to an end - but also appears to apply to partial rivalries, in which the rival poses a threat to important relationship outcomes, such as the level of investment the relationship partner gives, in the form of attention or responsiveness to the individual's needs.

All three comparison directions were associated with higher levels of jealousy, though it seems likely that downward and lateral comparisons result from, rather than lead to, this jealousy.

Zero-sum self-worth, then, in the form of the tendency to perform many social comparisons, and for these comparisons to have strong effects on one's self-worth, were therefore shown to be associated with increased jealousy. There is mixed evidence as to whether individuals differ in this form of self-evaluation in a stable, trait-like manner, but the substantial between-person variation in the effect of upward social comparisons on jealousy indicates that people do, somewhat consistently, differ from one another in the extent to which they feel upward comparisons pose threats to their relationships.

In response to research question 2, my findings in this project were somewhat inconsistent with each other. However, considering the strengths and limitations of the different methods, on balance it seems that zero-sum dynamics in self-worth do lead to increased jealousy.

Attachment Anxiety, Zero-Sum Self-Worth and Jealousy (RQ3)

I hypothesised that attachment anxiety, due to the dynamics of relative investment, might dispose people to experience their own worth as under threat when others seem to outperform them. This was not borne out in my studies, but participants in Study 3 did tend to perceive their relationships to be under threat when this happened as it tended to heighten jealousy. Though it did not change the overall effect of comparisons on state self-esteem, attachment anxiety did make upward social comparisons more likely to lead to jealousy. Not only this, but the indirect effect of upward comparisons on jealousy through self-esteem threat was larger among people higher in attachment anxiety. Attachment anxiety appears to be a risk factor for the jealous rivalry and hostility that results from zero-sum self-worth, making zero-sum self-worth more dangerous, even if it does not specifically increase this tendency. As discussed in Chapter 4, this could be because more anxiously attached individuals are more likely to compare themselves to relationship rivals, or it could be because their sense of relationship security is already lower than individuals low in attachment anxiety, and therefore even fairly minor self-esteem threat could raise a substantial chance of relationship threat. Here we can address research question 3. Zero-sum dynamics do seem

to account for some of the reason why attachment anxiety is associated with increased jealousy among young people, though their contribution is not particularly large, and it does not seem to be because more anxiously attached people have generally more competitive models of self-worth. Instead, it seems that attachment anxiety may heighten zero-sum dynamics in the kinds of situation that tend to produce jealousy.

The fact that attachment anxiety seemed to lead to lower state self-esteem following comparisons with close others is worth considering in this light. If this effect is supported in future research, it means that attachment anxiety does exacerbate the possibility for close others to become rivals, and this may be another reason why attachment anxiety leads to heightened levels of jealousy. Seeing close others to be outperforming oneself, as noted above, leads to greater levels of self-esteem threat and jealousy than perceiving the same with distant others. These comparisons are therefore particularly dangerous, and attachment anxiety may well worsen them. More research is therefore needed which specifically examines comparisons made with close others, and the influence that attachment anxiety may have on their effects.

One important thing to note is that feeling jealous following upward social comparisons was to some extent the norm among my participants. Most young adults do sometimes feel twinges of jealousy when seeing another person who seems more appealing or more capable than them in some way; many will feel that this person is a threat to their relationships. As attachment anxiety is a dimensional construct, we may note that most people have some level of attachment anxiety (Brennan et al., 1998), and this might make them doubt the commitment of their friends to the relationship; they may wonder if their lack of some valued qualities make them an unappealing friend or romantic partner.

Thinking back now to the variation seen in young adults' dispositions to experience jealousy, it is important to remember that engagement in consensual non-monogamy is still fairly uncommon in the UK (Yougov, 2023). And we may now have more resources to understand this. While the acute

fears, suspicions and catastrophising which go on to lead to intimate partner violence (Finkel & Slotter, 2007) may not characterise most young adults, there are clear reasons why levels of attachment anxiety would make it more difficult, and less appealing, for people to engage in consensual non-monogamy (Moors et al., 2015). Firstly, this may lead them to feel unstable in the relationship, such that they would fear rejection and abandonment (Collins, 1996; Feldman & Downey, 1994) that might come because their partner is interested in another person. This would be all the more worrying if the other person appeared to outperform them in some noticeable ways. Even if they did not fear abandonment, they might feel worried that they would be overlooked, as attachment anxiety makes people sensitive to the investment given to others, out of fear of what it might mean for them. If this other person is a more appealing person for the partner to spend time with, this might lead to being overlooked permanently. After all, even though more anxiously attached infants are more sensitive to the dynamics of relative investment (Murphy et al., 2020), this concern is seen across the population generally (Hart & Carrington, 2002). Coming to accept an extradyadic romantic relationship may imply a strong sense of security in one's relationship.

Extradyadic romantic relationships are an extreme example of the sort of thing that could lead a person to experience jealousy of another person. There is evidence to suggest that romantic partners are most often jealous of their partner spending time with non-romantic others (Kennedy-Lightsey & Booth-Butterfield, 2011). People, it seems, do often feel some level of threat, and potentially some resentment for others, especially close others, who might get in the way of their relationships. In part, this seems to be because these others seem to threaten people's sense of self-worth.

Additional Note: Non-Binary Participants and Psychological Health

In all three of the studies in this PhD, I recruited a small number of individuals who identified their gender as being outside the gender binary. In Studies 1 and 3, there were insufficient numbers of these participants to statistically contrast their scores on the variables of interest with the other

gender categories, so such contrasts largely excluded these participants. However, it would be a glaring omission to fail to acknowledge patterns that seem to emerge from the data that these individuals provided across my studies.

The best starting point to examine these trends is Study 2, in which I recruited fourteen participants identifying their gender as non-binary/other, and was able to contrast these participants with men and women. In that study, participants outside the gender binary had lower self-esteem and optimism than both men and women. Their levels of neuroticism and attachment anxiety were not significantly different to those among female participants, but it is important to note that they were higher in both cases, and significantly higher than levels among men. This pattern matches the pattern of mean scores seen in the other two studies (though individuals identifying as non-binary/other were lower in neuroticism than women in Study 3). In both studies, participants outside the gender binary had the highest levels of attachment anxiety of any participants as well as the lowest self-esteem. In Study 1, their levels of self-certainty were much lower than those of either men or women. Broadly speaking, all these patterns are indicators of psychological ill health, as pessimism, low self-esteem, uncertainty in oneself and attachment anxiety are all related to depression and anxiety (Butzer & Kuiper, 2006; Lee & Hankin 2009; Sowislo & Orth, 2013; Uribe et al., 2022; Ye et al., 2012) and low levels of life satisfaction (Diener & Diener, 1995; Macdonald & Park, 2022; Myers & Diener, 1995; Wu & Yao, 2007). Indeed, previous research has found non-binary individuals to show more symptoms of anxiety and depression, and lower self-esteem, than transgender individuals who identified within the gender binary (Thorne et al., 2019). This is especially worrying given that transgender individuals in general are substantially more at risk of mental health problems than cisgender individuals (Claes et al., 2015; Millet et al., 2017).

I did not collect data on whether participants identified with the gender they were assigned at birth, so I do not know what proportion of my participants who identified as male or female were transgender. This further means that I cannot tell from my own data how these trends relate to

transgender individuals within the gender binary. However, I am able to observe these trends among participants outside the gender binary, and so I must note that this is a serious issue. As my research does not fall within this area, and was not able to collect enough data on these individuals, I cannot draw firm conclusions as to how these issues can be addressed. However, I hope that psychologists will begin to collect more data on non-binary and genderqueer participants in particular, to better understand the risk factors for their health.

Looking Forward

Strategies for Reducing Rivalry

If attachment anxiety, and a zero-sum approach to self-worth can lead to increased levels of jealousy felt towards others, how can people reduce this risk? Many people do seem to want to find ways to reduce their levels of jealousy, as it is a major reason why people visit therapists (White, 2008).

Enhancing Attachment Security

This issue has an intrapersonal and an interpersonal dimension. Jealousy is related, not just to attachment anxiety and self-esteem threat, but also to low levels of trust in a partner (e.g., Rodriguez et al., 2015). Trust is an appraisal of a person as predictable, reliable and committed to one's own needs (Rempel et al., 1985), and so while it might be desirable to have high levels of trust in a relationship partner, this cannot happen if they have given the individual reason to distrust them. Similarly, attachment anxiety arises out of relationship experiences with others who are unreliable (Ainsworth et al., 1978), meaning that vigilance for people's potential abandonment is not an unreasonable response, at least so far as one maintains relationships with the same or similar people.

The drive for very direct signs of an attachment figure's availability may well put one in rivalry with others. Being able to rely on less direct forms of commitment and responsiveness would

both reduce the load on attachment figures and reduce the hostility one might feel towards others. However, again, a person cannot merely decide to feel secure from less direct indications of care if past experiences have given them reason to doubt the commitment of others. Some people are likely to need more reassurance in order to feel secure in their relationships. If relationship partners are capricious and majorly reduce their investment in their existing friends, romantic partners or even their children, when third parties exhibit appealing qualities, vigilance for this possibility is also not unreasonable.

From an interpersonal perspective, relationship partners need to be trustworthy and reliable, in order to strengthen cognitive expectations of their dependability (and that of other relationship partners) in future (Kumashiro & Arriaga, 2020). Being able to balance rewarding relationships with other people with attending to the needs or attachment drives of existing relationship partners may be able to lessen the association between the positive qualities of a third party and threats to one's own relationship, thus reducing the hostility and rivalry felt between these individuals. Kumashiro and Arriaga (2020) emphasise, however, that conveying closeness and commitment to a partner may not resolve their feelings of anxiety, especially in the long-term. Attachment security is built through a dynamic process in which the individual feels that their attachment figure is available in times of need, and so they can explore and pursue their own goals, building up a sense of competence and autonomy. Unfortunately, attachment anxiety in adulthood tends to reflect the fact that an individual has already developed a model of self as incapable and dependent. Providing reassurance may give the anxious individual security in the short term, but without steps to improve their models of self, this could reinforce a cycle of dependence and wear out the partner. As such, the anxious individual's sense of competence and autonomy needs to be bolstered, to give them the sense that while the attachment figure is available should they be needed, the individual is capable enough to deal with their life stresses to not need the partner constantly. This must be done sensitively, as anxious models of others might lead individuals to see a partner's attempts to encourage their independence as a form of rejection (Jakubiak & Feeney,

2016). Kumashiro and Arriaga (2020) recommend affirming the individual's strengths as one way to increase their sense of self-competence. Park et al. (2023) review evidence around receiving validation from romantic partners, and conclude that more anxiously attached individuals may particularly benefit from affirmations of their strengths.

However, it is important to note how this relates to other research discussed in this thesis. After all, validating a person for their achievements does not prevent them from measuring themselves against others (Schimel et al., 2001). Praising an individual for particular qualities can "objectify" them (not in terms of assessing them purely by their appearance, but in casting them as a fixed entity whose worth is based only on their specific and immediate qualities). This could lead them to believe that they need to excel in these ways to be accepted. It also arguably places them on the same scale as all others who possess these qualities, such that the qualities of those others anchor the scale on which one is measured and therefore to feel threatened when others outperform them. This is supported by findings in jealousy research. It is rivals who excel in domains relevant to a person's self-concept which tend to provoke the greatest jealousy (DeSteno & Salovey, 1996). Broemer and Diehl (2004) found that priming one's similarity with others increases the jealousy they can provoke.

This problem does not seem to be specific to attachment anxiety, after all, we saw that attachment anxiety did not interact with the effect of upward comparisons to worsen self-esteem. However, young adults in general appear to be somewhat prone to judging themselves in comparison to others, and so there are risks associated with bolstering attachment security through validation of a partner's qualities. Another possibility, more in line with the importance of validation of the "core self" (Schimel et al., 2001), is to recognise and validate an individual's own goals, and helping them to see that their steps towards these goals are valuable in themselves. Supporting a partner in reaching their own goals is referred to as the "Michelangelo phenomenon" in which relationship partners help an individual to move towards their ideal selves (Rusbult et al., 2009).

Validating and encouraging a person's values and goals does not have the same implication as validating their achievements and immediate qualities – a person need not consistently succeed in their goals to be striving towards important things, so long as they continue to strive for them in the face of setbacks and shortcomings. This may help to explain why valuing a person's core self can reduce their defensiveness. Arriaga et al. (2014) found that perceived affirmation of goal pursuits tended to reduce attachment anxiety over time. Bolstering attachment security, by increasing confidence in the relationship and in oneself, is therefore one path to reducing the conditions which give rise to hostility between people.

Practicing Self-Compassion

Another path to reducing this self-worth rivalry is intrapersonal. Neff (2011) recommends self-compassion as a way of circumventing the damaging fixation on one's own standing. Self-compassion refers to the practice of adopting a compassionate attitude towards oneself, especially in response to suffering or personal failings (Neff, 2011). It has three major elements: self-kindness, common humanity and mindfulness. Instead of engaging in self-judgement and criticism, people are encouraged to attempt to acknowledge the fact that they are suffering (mindfulness), to attempt to soothe themselves by adopting a kind and understanding manner when addressing themselves (self-kindness), as they might if they were practising compassion towards a close other. Finally, people are encouraged to keep in mind that all people face problems, suffer and make mistakes (common humanity), such that they do not feel alone or isolated in their pain or their shortcomings.

Neff tends to emphasise the social-rank contingencies of self-esteem, saying, for example, that self-esteem is "thought to represent an evaluation of superiority / inferiority that helps to establish social rank stability" (Neff, 2011, p. 7). As discussed earlier, my results do not support the idea that social rank is the predominant contingency of self-esteem among young adults.

Furthermore, Neff (2011) attributes this focus on superiority to a threat-based mentality, drawing on the biopsychosocial model of Gilbert et al. (2007), in which individuals in unsupportive environments

tend to adopt mentalities which centre on social rank. Following my argument in Chapter 2, results from this PhD do not support that idea. Attachment avoidance, which should be strongly related to unsupportive and threatening social environments (more so than attachment anxiety), was unrelated to both social comparison frequency (Study 1) and to the effect that social comparisons have on self-esteem (Studies 2 and 3). Notwithstanding this disagreement about the roots of the comparison-based contingencies of self-esteem, there is compelling evidence that self-compassion can help to lessen their influence.

In general terms, self-compassion is positively associated with self-esteem stability and negatively associated with contingent self-esteem (Neff & Vonk, 2009). Once the effect of self-compassion was adjusted for, these authors found that level of self-esteem was not associated with self-esteem stability or contingency. In more concrete terms, Leary et al. (2007) found that people who tend to practise self-compassion experience lower levels of negative emotion following negative self-relevant events, such as failing an important test or forgetting one's lines in a stage performance. Controlling for self-esteem and narcissism, self-compassion was related to less catastrophising about the event, and also less personalising (thinking, for example, "I'm such a loser"), while self-esteem did not have a unique predicting effect on these outcomes. As such, self-compassion appears to lessen the self-relevant threat that arises from failures. This strategy is particularly relevant for the form of zero-sum self-worth displayed by young adults in the studies I conducted. Instead of feeling superior to others when they excel, the comparisons these individuals performed with others appeared to function as a form of self-criticism; encouraging them to view themselves negatively because they do not measure up.

There is some evidence that self-compassion can reduce the specific problems that I identified in this thesis. For example, Neff and Vonk (2009) found that self-compassion is related to less frequent social comparisons (as measured via the INCOM). Thogersen-Ntoumani et al. (2017) found that appearance-based self-compassion reduced body dissatisfaction, though they did not find

this to interact with upward appearance comparisons, such that while self-compassion did aid people's self-image, this was not specifically through its effects on social comparisons. More importantly, though, there is evidence that self-compassion is negatively related to both emotional and cognitive forms of romantic jealousy (Tandler & Petersen, 2020). All subscales of the Self-Compassion Scale were related to these jealousy outcomes, except common humanity. Of particular relevance here is the fact that self-judgement and isolation (these subscales are reverse-coded for overall self-compassion scores) both showed positive associations with jealousy. When people judge, and criticise themselves for performing poorly, casting such shortcomings as evidence of personal flaws, they appear to feel more threatened by others in their relationships. If the relevant way to assess oneself is in the possession of positive or negative qualities, and other people seem to possess more positive qualities than oneself, these others may seem like the kind of people that one ought to be, and, as a result, the kind of people that one's loved ones will prefer to oneself. If instead, people can replace such self-criticism with kindness and understanding towards themselves and, through this, feel more connected to others, they might not see their failings as reasons for themselves to be disliked, and might expect others to understand their shortcomings.

Similar to my arguments around bolstering attachment security, there are of course barriers to people developing a more self-compassionate mindset. Attachment insecurity is related to lower levels of self-compassion (Neff & McGehee, 2010), because part of the way that people develop the ability to self-soothe and to treat themselves with compassion and understanding is by internalising the compassion of others (Mikulincer & Shaver, 2004). Attachment insecurity tends to arise from less supportive caregiving, and so goes hand-in-hand with possessing fewer internal resources which one can draw on to develop self-compassion. However, the major benefit of self-compassion is that it is a practice, which can, despite difficulties, be learned. Interventions have been designed to assist people in developing this practice, including mindful self-compassion training (Neff & Germer, 2013) and Compassion-Focused Therapy (Gilbert, 2010), intended for clinical populations. Meta-analytic work suggests that compassion-based therapies increase people's levels of self-compassion (Wilson

et al., 2019), though, as a note of caution, to no greater extent than other appropriate therapeutic interventions. In summary, self-compassion appears to mitigate problems associated with zero-sum self-worth and can be trained or developed through interventions and therapy.

Neff (2011) notes the similarity between self-compassion and so-called optimal or true self-esteem (Deci & Ryan, 1995; Kernis, 2003) but points out that self-compassion is not a form of self-regard. Instead, it is something practised in place of self-judgement. Instead of needing to be good enough, people can avoid the need to evaluate themselves altogether, by mindfully accepting their shortcomings and adopting a growth-focused mindset. “Self-esteem is a measuring stick that we use to sum up our worthiness as ‘good’ or ‘bad.’ Instead of accepting the richness and complexity of our experience, the pursuit of self-esteem tries to capture and sum up our lived experience with simplistic evaluations of self-worth” (Neff, 2011, p. 9). This is a position that has been advanced before, by Ryan and Brown (2003), who argue that self-esteem as such is unnecessary, being an unwarranted leap from diverse assessments of personal qualities and performance to an overall categorisation of self. They attribute this leap to the need to measure up to other people’s standards for oneself, which is to say that self-esteem itself may be a form of introjection.

However, there is some doubt as to whether self-compassion can truly overcome self-esteem striving altogether. Self-compassion and self-esteem are fairly highly correlated (Neff & Vonk, 2009), and one longitudinal study has found self-esteem to lead to increased self-compassion, but not the other way around (Donald et al., 2017). Self-compassion is an important practice for drawing people’s focus away from their performance based on successes and failure, and seeing others as rivals, to adopting a more growth-focused mindset. Yet in order to develop it, it appears to be extremely helpful to view oneself as worthy in the first place. As numerous theorists have argued, there are important evolutionary as well as developmental reasons why individuals do evaluate themselves in this way, such as the need to belong in social groups (Leary & Baumeister, 2000), to

gain social position (Leary et al., 2014; Gregg et al., 2018), or to maintain supportive relationships (Bowlby, 1973; Macdonald & Leary, 2012).

In Chapter 3, I mentioned that people want their relationship partners to be responsive to them. Part of this is the desire for others to be responsive to the self, to accept and validate who they are. Reis and Shaver (1988; Reis, 2006) posit this as one of the processes central to intimacy. Philosophers have noted a tension between the desire for unconditional love, and the desire for the love that others have for you to reflect something worthwhile in you. Delaney (1996, p. 347) notes: “while you seem to want it to be true that, were you to become a schmuck, your lover would continue to love you, ... you also want it to be the case that your lover would never love a schmuck.” It is important that others, and indeed we ourselves, are able to look past our shortcomings, it is important to feel that relationships are secure such that isolated instances of fault or the immediately appealing qualities of another person do not put a relationship in jeopardy. This is something that more insecurely attached individuals struggle to attain, and my results suggest it may help to lead them to a sense of rivalry with others. For this, self-compassion may be a vital tool to help people to avoid viewing themselves in stark, self-critical terms. However, it is also important to believe that there is a reason that other people love you in particular.

Strengths, Limitations and Future Directions

There have been a few studies that investigated the associations between attachment anxiety and self-report measures of zero sum self-worth, measured in the following ways: self-assessments of the degree to which one’s self-worth is based upon competition with others (Park et al., 2004), self-reported beliefs about a variety of pressures to perform, achieve and compete in society (Gilbert et al., 2009) and retrospective estimates of how frequently one compares oneself to others (Bamford & Halliwell, 2009; Powell et al., 2018). Instead of relying purely on self-assessments, this project investigated whether attachment anxiety influenced the direct effects of social comparisons on people’s self-esteem. The fact that attachment anxiety did not exacerbate the self-

esteem effects of social comparisons runs counter to those prior self-report findings, emphasising the need for methodological corroboration.

Prior experimental research that has examined the role that attachment anxiety plays in responses to social comparisons has either relied on imagined scenarios (Scinta & Gable, 2005) or on dubious manipulations of social comparisons (Alfasi, 2019). By contrast, in Study 2, I used a social comparison manipulation, based on a previously validated manipulation (Aspinwall & Taylor, 1993) and piloted for use among the population of study. I also investigated the effects of social comparisons through a controlled, experimental procedure, and in a more ecologically valid, experience sampling procedure. The convergence of findings across Studies 2 and 3 add reliability and generalisability to my conclusions. My diverse range of methods allowed me to be more critical of my findings, especially in further interrogating my initial self-report findings. This enabled me to explore what could have led to certain results being found in self-report studies but not in experience sampling contexts, and vice versa. Furthermore, my rich experience sampling findings offered a possible qualification to my experimental findings, suggesting as they did that attachment anxiety did not exacerbate the effects of upward comparisons with strangers (or in general), but may well do so when one has a close relationship with the target.

Additionally, instead of relying on retrospective estimates of comparison frequency, in this PhD, I tested actual frequencies more directly. However, this also represented a key limitation of the project. There was substantial divergence in findings depending on which measure of social comparison frequency was used, and I was not able to find a definitive justification to trust either over the other. As a result, there is still an open debate as to whether attachment anxiety, in particular, and personality traits in general, lead people to compare themselves to others more frequently. Future research would benefit from addressing this problem directly. On the one hand, a more detailed exploration is needed as to whether retrospective measures of social comparison frequency reflect genuine frequency, and if not, what they reflect instead. On the other hand, future

experience sampling studies should confirm that participants are reporting all the social comparisons they remember when asked, as well more precisely capturing social comparison frequency, without inadvertently priming participants to perform more comparisons. Finally, future researchers could investigate the convergence and divergence in the correlates of these two measures by using them jointly on the same set of participants. Addressing these issues directly could help the field to reach a valid consensus on how best to study social comparison frequency.

Despite noting the fact that attachment orientations are relationship-specific as well as general (Baldwin et al., 1996), I only used general measures of attachment in this research. This is a problem because the way that individuals will behave and see themselves differs from one relationship to another. The different effects that each of these relationships have can be seen through experimental evidence, such as when individuals are primed with secure, anxious or avoidant relationships, leading to differences in mood, mental health and self-views (Carnelley et al., 2016; Gillath et al., 2022). Indeed, in this thesis, I have discussed the work of Schimel et al. (2001), who showed that participants will exhibit different behaviour, reflecting different self-related preoccupations, depending on whether they are primed with an accepting or a judgemental other. This means that people may respond differently to social comparisons depending on which relationship script is activated for them at a particular time. As such, future research could look into whether zero-sum self-worth is observed more in the context of relationships characterised by attachment anxiety.

My very broad approach to studying psychological processes may have obscured important nuances. While studying the effects of social comparisons in general, rather than on any particular domain, fit best with my chosen research questions, there is evidence that this approach hampered the drawing of definitive conclusions. Substantial heterogeneity was observed in the effects of social comparisons in Study 3, and this could indicate differences between comparisons performed on different domains or for different motivations. A similar point can be made for the study of jealousy.

While I found support for the idea that different forms of jealousy share the common thread of comparison-based self-esteem threat, finer grained distinctions might exist. It is important to remember that psychological processes can be very contextual, including processes relating to the self or one's attachment orientations (e.g., Ditzfeld & Showers, 2013; Mikulincer & Shaver, 2003; Mitchell et al., 2003). Future research could investigate whether all forms of jealousy are equally likely to result from upward comparisons, or to lead to downward comparisons. Similarly, is zero-sum self-worth something restricted to social comparisons performed for specific motives, or does any form of comparison carry the same potential to harm a person's self-regard?

In studying processes among young adults, mostly in the UK, this project investigated a population that is already overrepresented in psychological research (Rad et al., 2018). This is especially true of people currently in university education, due to the convenience of recruitment (Hanel & Vione, 2016), and studies two and three both exclusively studied 18-25 year-old undergraduates at British universities. There were good reasons to be interested in jealousy in this population, and recruiting homogenous samples was a deliberate strategy, but it does restrict the generalisability of our findings to this very specific population of young, educated participants from WEIRD (western, educated, industrialised, rich and democratic) countries (Henrich et al., 2010). My results are informative about social comparison processes among this population, but we are very much in need of further research to understand how they might differ by culture, age, education level and social class. I found no effect of country of origin across these studies, but only a small proportion of participants came from outside the UK (14% - 37%, depending on the study), and the most frequent alternative was the USA, which has a shared history, in terms of cultural values, with the UK and other Western European nations (Vignoles et al., 2016). If I removed all Study 3 participants who came from the USA, Canada or Western Europe, I would be left with less than 8% of the original sample. Recruiting participants from outside this population would have been more difficult but is very necessary to understand social comparison in a more general fashion. One simple

way to correct for the WEIRD bias of this research is to publish social comparison research from researchers across a diverse range of countries and cultures.

In this project, I argued that self-worth, as a category, included both one's own evaluation of self (self-esteem) and the evaluations held by others (perceived regard), but I only studied the effects of social comparisons upon self-esteem. Many of my theoretical arguments implicated self-esteem effects only indirectly, through the role of perceived regard. Therefore, further research could examine whether there are meaningful differences in the extent to which people view the approval of others to be based in social comparisons, and further, to what extent these perceptions are accurate: to what extent is the regard of others altered by relative standing? In particular, research could examine whether these relationships are affected by attachment anxiety, as my arguments regarding differential investment suggest that it would make perceived regard a more competitive affair.

I hypothesised that social comparisons could lead to jealousy because people perceive high performing others as threatening the extent to which a partner will invest time and energy in them, but also their importance to relationship partners. These could be two separate pathways to jealousy, and future research could examine this possibility. Also, I attributed the association between downward comparisons and jealousy to an inverse causal relationship in which individuals engage in downward comparisons in order to denigrate the people they are jealous of, but my lagged results did not provide evidence for or against this interpretation. Future research could examine the links between jealousy and downward comparisons with shorter survey windows, to examine whether this interpretation was correct. Another possibility worth investigating is whether upward comparisons lead to downward comparisons with jealousy acting as a mediator. This hypothesis would fit with the quote from one of Wolsko's (2012) participants, mentioned in Chapter 4, who stated that they derogated the achievements of others specifically because their superior performance was threatening.

Conclusion

In this PhD, I found evidence to support the self-evaluation maintenance theory of jealousy among young adults in the UK; that performing upward social comparisons with others, and having one's self-esteem threatened in this way, is a risk factor for becoming jealous of others. In particular, it appears that this risk is highest when these others are close to oneself. This brings with it the dangerous consequences that jealousy can bear for interpersonal relationships (e.g., Parker et al., 2005; Pichon et al., 2020; Puente & Cohen, 2003), though close others do seem to be protected from one aspect of this rivalry, in that young adults appear less willing to downwardly compare as a form of rival derogation. I found mixed support for social rank theories of self-esteem, as upward comparisons consistently had a negative effect on state self-esteem, but contributed very little to the self-esteem fluctuations observed among young adults, and downward comparisons had no effect.

I hypothesised that there would be an individual difference in the extent to which self-worth was zero-sum, or based on social comparisons, but I did not find solid evidence for this in my data. Instead, it may be helpful to think of this rivalrous approach as a problem that affects different people in different contexts, or alternatively, as a situational issue that can affect anyone so long as situations prompt them to consider their worth as a relative affair.

I also hypothesised that, due to the felt need to compete for the attention and affections of their loved ones, attachment anxiety would increase zero-sum self-worth. Further research is needed to identify whether attachment anxiety is genuinely related to the *frequency* with which people perform social comparisons, but I did find that attachment anxiety was unrelated to their overall *effects* on state self-esteem, whether these comparisons were upward or downward. However, I did find that attachment anxiety worsened the effect of social comparisons on jealousy, and this relationship did seem to be, in part, due to the threat that jealousy posed to the self-esteem of these individuals.

Some people, in particular those high in attachment anxiety, do appear to be more vulnerable than others to feeling relationship threat from the positive qualities of other people. I propose that this can help us to understand a puzzle in the modern era, in the difference between being able to celebrate a loved one's relationships with others, and treating these others as deadly rivals. This appears to relate, in part, to the way that young adults relate to their own self-worth, but as mentioned previously, this does not seem to be a stable individual difference.

In this chapter I proposed strategies that could help people to move away from this form of rivalry, both interpersonal and intrapersonal. Self-compassion may help reduce the tendency to judge oneself as flawed or lacking due to one's shortcomings, and thus reduce the sense of inadequacy, as a partner and/or compared to others. Supportive partners, who not only demonstrate their consistent support and care for the individual, but encourage that individual's sense of self-competence and support them to pursue their own personal goals, may help the individual to recontextualise their sense of worth, driving them away from the fear of being outcompeted by others. I was not able to investigate the ability of these strategies to lower zero-sum self-worth, but given the stakes of jealousy can be so high (Pichon et al., 2020), this may well be an important avenue for future research.

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Appendices

Appendix 1: Study 1 Measures

Experiences in Close Relationships Questionnaire

- Brenna, Clark & Shaver (1998)

The following statements concern how you feel in romantic relationships. We are interested in how you generally experience relationships, not just in what is happening in a current relationship. Respond to each statement by indicating how much you agree or disagree with it on the following scale:

1 2 3 4 5 6 7

Strongly Disagree

Strongly Agree

- I prefer not to show a partner how I feel deep down
- I worry about being abandoned
- I am very comfortable being close to romantic partners
- I worry a lot about my relationships
- Just when my partner starts to get close to me I find myself pulling away
- I worry that romantic partners won't care about me as much as I care about them
- I get uncomfortable when a romantic partner wants to be very close
- I worry a fair amount about losing my partner
- I don't feel comfortable opening up to romantic partners
- I often wish my partner's feelings for me were as strong as my feelings for them
- I want to get close to my partner, but I keep pulling back
- I often want to merge completely with romantic partners, and this sometimes scares them away
- I am nervous when partners get too close to me
- I worry about being alone
- I feel comfortable sharing my private thoughts and feelings with my partner
- My desire to be very close sometimes scares people away
- I try to avoid getting too close to my partner
- I need a lot of reassurance that I am loved by my partner
- I find it relatively easy to get close to my partner
- Sometimes I feel that I force my partners to show more feeling, more commitment
- I find it difficult to allow myself to depend on romantic partners
- I do not often worry about being abandoned
- I prefer not to be too close to romantic partners
- If I can't get my partner to show interest in me, I get upset or angry
- I tell my partner just about everything
- I find that my partner(s) don't want to get as close as I would like
- I usually discuss my problems and concerns with my partner
- When I'm not involved in a relationship, I feel somewhat anxious and insecure
- I feel comfortable depending on romantic partners
- I get frustrated when my partner is not around as much as I would like
- I don't mind asking romantic partners for comfort, advice or help
- I get frustrated if romantic partners are not available when I need them
- It helps to turn to my romantic partner in times of need
- When romantic partners disapprove of me, I feel really bad about myself

I turn to my partner for many things, including comfort and reassurance
 I resent it when my partner spends time away from me

Iowa-Netherlands Comparison Orientation Measure

- Gibbons, F. X., & Buunk, B. P. (1999). Individual differences in social comparison: development of a scale of social comparison orientation. *Journal of personality and social psychology*, 76(1), 129.

Most people compare themselves with others from time to time. For example, they may compare the way they feel, their opinions, their abilities, and/or their situations with those of other people. There is nothing particularly “good” or “bad” about this type of comparison, and some people do it more than others. We would like to find out how often you compare yourself with other people. To do that we would like to ask you to indicate how much you agree with each statement below, by using the following scale:

1 2 3 4 5

Disagree Strongly Agree Strongly

I often compare how my loved ones (boy/girlfriend, family members etc.) are doing compared with how others are doing

I always pay a lot of attention to how I do things compared with how others do things

If I want to find out how well I have done something, I compare what I have done with how others have done

I often compare how I am doing socially (e.g., social skills, popularity) with other people

I am not the type of person who compares often with others

I often compare myself with others with respect to what I have accomplished in life

I often like to talk with others about mutual opinions and experiences

I often try to find out what others think who face similar problems as I face

I always like to know what others in a similar situation would do

If I want to learn more about something, I try to find out what others think about it

I never consider my situation in life relative to that of other people

Note. Bold items are included in the Ability factor that I ultimately used in Study 1

The Self-Attributes Questionnaire Short-Form

- Pelham & Swann (1989)

This questionnaire has to do with your attitudes about some of your activities and abilities. For the first five items below, you should rate yourself relative to other people your own age by using the following scale:

A B C D E F G H I J

| | | | | | | | | | |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-----------|
| Bottom 5% | Lower 10% | Lower 20% | Lower 30% | Lower 50% | Upper 50% | Upper 30% | Upper 20% | Upper 10% | Top 5% |
|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|-----------|

An example of the way the scale works is as follows: if one of the traits that follows were "height", a woman who is just below average in height would choose "E" for this question, whereas a woman who is taller than 80% (but not taller than 90%) of her female counterparts would mark "H", indicating that she is in the top 20% on this dimension.

Intellectual/academic ability
Social skills
Artistic/musical ability
Sporting Ability
Physical attractiveness

Now rate how certain you are of your standing on each of the above traits (you may choose any letter):

| | | | | | | | | |
|-----------------------|---|---|---|-----------------------|---|---|---|----------------------|
| A | B | C | D | E | F | G | H | I |
| not at all certain | | | | moderately certain | | | | extremely certain |

6. intellectual/academic ability
7. social skills/social competence
8. artistic and/or musical ability
9. competency or skill at sports
10. physical attractiveness

Multidimensional Jealousy Scale

- Pfeiffer & Wong (1989).
-

Please think of a person with whom you are having or have had a strong romantic/love relationship. This person is referred to as X in this questionnaire. Please rate your response to the following questions by circling the appropriate number beside each item.

Cognitive Jealousy

How often do you have the following thoughts about X?

1 2 3 4 5 6 7

Never

All the time

1. 1. I suspect that X is secretly seeing someone of the opposite sex.
2. 2. I suspect that X may be attracted to someone else.
3. 3. I suspect that X may be physically intimate with another member of the opposite sex behind my back.

4. 4. I think that X is secretly developing an intimate relationship with someone of the opposite sex.
5. 5. I suspect that X is crazy about members of the opposite sex

Emotional Jealousy

How would you emotionally react to the following situations?

1 2 3 4 5 6 7

Very Pleased

Very Upset

6. X comments to you on how great looking a particular member of the opposite sex is.
7. X shows a great deal of interest or excitement in talking to someone of the opposite sex.
8. A member of the opposite sex is trying to get close to X all the time.
9. X is flirting with someone of the opposite sex.
10. Someone of the opposite sex is dating X.
11. X hugs and kisses someone of the opposite sex.

Rosenberg Self-Esteem Scale

- Rosenberg (1965)

Please rate each item below on the following scale:

1 2 3 4

Strongly Disagree Disagree Agree Strongly Agree

On the whole, I am satisfied with myself.
 At times I think I am no good at all.
 I feel that I have a number of good qualities.
 I am able to do things as well as most other people.
 I feel I do not have much to be proud of.
 I certainly feel useless at times.
 I feel that I'm a person of worth.
 I wish I could have more respect for myself.
 All in all, I am inclined to think that I am a failure.
 I take a positive attitude toward myself.

Appendix 2: Trait Measures Used in Study 2

Big Five Inventory - Neuroticism Subscale

- John et al. (1991)

I am someone who...

1. Is depressed, blue
2. Is relaxed, handles stress well.
3. Can be tense
4. Worries a lot
5. Is emotionally stable, not easily upset
6. Can be moody
7. Remains calm in tense situations
8. Gets nervous easily

Experiences in Close Relationships - Short Form (ECR-12)

- Lafontaine et al. (2015)

I feel comfortable depending on others

I worry that others won't care about me as much as I care about them

I usually discuss my problems and concerns with close others

I worry a fair amount about losing people close to me

I tell people close to me just about everything

I worry a lot about my relationships

I don't mind asking close others for comfort, advice or help

I worry about being alone

I don't feel comfortable opening up to others

I need a lot of reassurance that close relationship partners care about me

I feel comfortable sharing my private thoughts and feelings with others

If I can't get a relationship partner to show interest in me, I get upset or angry

Life-Orientation Test-Revised

- Scheier et al. (1994)

In uncertain times, I usually expect the best.

It's easy for me to relax.

If something can go wrong for me, it will.

I'm always optimistic about my future.

I enjoy my friends a lot.

It's important for me to keep busy.

I hardly ever expect things to go my way.

I don't get upset too easily.

I rarely count on good things happening to me.

Overall, I expect more good things to happen to me than bad.

Appendix 3: Comparison Condition Narratives (Study 2)

Control Passage

When students first attend university, there is usually a large amount that is different from what they are used to. Students tend to live in shared accommodation, with several other students at the same stage in their education, sharing kitchen facilities and sometimes bathroom facilities.

Higher education relies much more upon independent work than most school subjects, even at A level. Additionally, the style of teaching and assessment is very varied in a university. While most subjects have lectures, which resemble classroom learning, other types of sessions are also used, depending on the subject. Humanities subjects, for example, will frequently involve seminars, while science degrees tend to use workshops and tutorials in a lab environment. Practical work in the lab is often used as a method of assessment, and in some cases students are assessed on research they conduct independently.

University Students Unions offer a variety of extracurricular activities, such as sports teams, special interest societies, volunteering placements and opportunities to gain work experience. Universities differ in how much variety is offered, but all provide some range of activities for students to try outside of their studies.

Upward Comparison Manipulation

I really liked my first term. My flat had a great atmosphere – all of us actually got on really well. On the first night after everyone had moved in, we all went out to the pub together to get to know one another and that led to a really supportive and close-knit group of friends.

I loved the independence of being able to go out whenever I want to and feeling completely free. It was a brilliant opportunity to 'find my feet' and bridge the gap to becoming an adult if that makes sense? I was also obsessed with making every day count, which helped me live that time to the fullest - I took part in several different societies, entered an art competition, and took on a

leading role in organizing a university event. These activities were a lot of fun and I think they'll really help when I apply for jobs.

I really enjoyed the challenge of my course - I learned so many things and gained skills I didn't expect. I managed to score relatively high in all my assignments, averaging over 70% for the term.

Appendix 4: State Self-Esteem (Self-Liking) Measure (Studies 2 + 3)

(Adapted from Tatarodi & Swann, 2001)

- I am very comfortable with myself right now.
- I lack respect for myself right now.
- It is currently unpleasant for me to think about myself.
- I have no doubt about my personal worth right now.
- I currently feel great about who I am.

Appendix 5: Briefing Script (Study 3)

Hello! Can everybody hear me?

One piece of housekeeping before we get started: you don't need to have your camera on if you don't want to, and you can change your name to a pseudonym if you're concerned about privacy. Hopefully you will have all seen the reminder about this on the zoom link email.

So, welcome to this study on social comparisons! Thank you very much for agreeing to take part. In this session, I'm going to explain the procedure you'll follow in this study, as well as how to install and use the app that you will be completing the surveys on. You'll get a chance at the end of every section to ask any questions about what you've heard, or anything that I haven't covered. If you have questions as we go, you can also put them in the chat, and I will go through them when I reach the question section. The session should last about twenty-five minutes in total.

You should all have received an email from the SEMA3 app before this session. Can you open that email while I'm going through the next section? That'll speed up the process when we get to the section on the app.

Right, now onto it!

This is a really exciting study, because instead of doing research in the lab or online, which can be pretty artificial or detached, we're actually studying your experiences as they happen in your lives. You folks are really driving science forward by taking part in research in the actual, real human world! It's only been possible to use methods like this for quite a short period of time, since smartphones became widely available.

On that point, does everyone here own a smartphone? If you don't have one, could you raise your hand or put this in the chat? This research will only work on these devices, so now is the time to say if you don't have one.

[Really sorry, but you won't be able to participate in this study, just because of the way the method works. Thank you for agreeing to take part anyway.]

So let's talk about how this study's going to work.

Study Procedure

The week of momentary surveys will last for seven days, starting on [Sunday, date] with the last day on [Saturday, date]. You will answer three surveys per day on every one of these seven days.

You'll complete all surveys on an app called SEMA3. This app will also send you the notifications that let you know it's time to complete a survey. If you click the notification, it will open the survey. Each survey should only take a minute to complete. You will have fifteen minutes from the moment that you receive a notification to access the app and complete the survey, after this the survey will expire.

First though, you'll need to complete the baseline measures. These will be sent through to you tomorrow, which is [date], at exactly 12 noon. There are three personality questionnaires and a few demographic questions to answer and they should take about ten minutes to complete. Unlike the momentary surveys, you'll have an hour to complete these measures from the moment you receive the notification because all that matters is that you complete them before taking the momentary surveys.

So let's get back to those momentary surveys through the week. You'll be asked questions about social comparisons, jealousy, self-esteem and conflict with others. These may be things that you're not used to paying attention to in your daily life. You might want to have a quick think after this session about the kinds of social comparisons that you might perform regularly, whether that's small things like whether you're taller than other people, or big things, like whether someone is a better person than you. There's a balance to be struck; we're not asking you to think about it all the

time, such that you start making comparisons you wouldn't usually make, but equally we hope that you will remember if you do make a comparison.

Some questions will concern things that you're experiencing at the moment. This means how you were doing just before you accessed the app. Some of the questions will instead be about anything you've experienced since the previous survey, so you need to think about that entire time span. One important thing is that the surveys will ask you about things that have happened "since the last survey or since the start of the day". For the first survey of the day, you only need to think about things that have happened that morning, not since the last survey of the previous day. In the second and third survey, you need to think about anything since the previous survey. Finally, if you happen to miss a survey, the time since last survey is the time since the one you missed, not the last one you completed, so you are still only being asked about the last few hours.

These notifications won't come at exactly the same times each day. Instead, we have set out three time windows, each one hour long. You can see the start and end times of these on your briefing sheet. You will receive one notification per window, and it can come at any time during the window, so please make sure you're ready to complete a survey at any point through this time. Some people have found that setting a phone alert helps them to avoid missing notifications.

The great thing about this kind of research is that it measures your experiences in your everyday life. This means that you should go about your days as you normally would - we don't want you to cancel your plans or anything like that! Just make sure you stop and access the app to complete a survey whenever you receive a notification.

It's important that you don't miss surveys. However, we do understand that there are some situations in which you won't be able to complete a survey, for example if you are driving. If you cannot complete a survey safely, please do not attempt to complete it. You will not be penalised for missing up to 5 surveys. This is designed to give you a buffer in case of moments where you cannot

complete surveys, so please complete the survey if you can! However, if you miss more than 5 you will not be credited for your participation, as we will not be able to make use of your data.

Are there any questions on this before we move on?

SEMA3

Now let's look at the app that allows us to do this real-world research!

Hopefully, you will all have been sent an email from SEMA3, which has a link to download the app. Has everyone had that email? Raise your hands if you haven't.

[Optional, If anyone hasn't had the email] Have you given a Hotmail address? The app can't send emails to Hotmail addresses. If so, could you message me with an alternative address. I can try to get you set up while we're still in the session.

Right, so now we'll go through the process of installing and using the app. I promise you, it's really simple. I'm just going to share my screen so you can see how it should look.

SEMA3 [Share Screen]

You'll need to open the SEMA3 email on your phone, so that you can click the link and install the app there. The link will take you to a download page where you choose whether to download it for Android or iOS. Anyone who's given an AOL or Yahoo email, I'm afraid you may have trouble with your links. If anyone does have an issue with a link, just use the link on the briefing sheet. This will only work if you already have an email though, as this is where you get your participant ID.

Once you've installed the app, you'll get this screen, asking for your participant ID. This will be on the email, and you will use that to log in. You don't need to set up a password or create an account.

When you log in, you should see Social Comparison Study on the screen as an active study. You don't need to do anything with it, it should tell you that you have no surveys to complete at the moment. Surveys will only appear here following a notification.

If you click on the study, you'll see information on it, including my contact details. Contact me on this email address if you have any issues with the app, or any confusion over the study procedures. Please do this as soon as you notice a problem, because if it prevents you from completing more than five surveys, you will not be paid, no matter what the cause.

Please make sure that notifications are enabled for the SEMA3 app. On almost all phones this can be done by going to Settings, followed by Notifications or Apps and Notifications. You can click on the app symbol to put notifications on, change the volume or make it vibrate. Make sure it's loud enough for you to hear! If you do miss a notification, you don't need to contact us about it, just please make sure you change your settings so that you don't miss the next one.

If you do not receive a notification to complete the baseline surveys at 12pm exactly on the day before the study starts or cannot access the app at this time, please email me and I will check if there's a setting we need to change for you.

When a notification comes through, just click on it, and it will take you to SEMA3 with the survey open. As we said before, you will have fifteen minutes to complete this from the moment you receive a notification. Once you have completed all the items, it should bring you back onto the home screen.

One really important thing to know here is that you can't go back once you have submitted an answer, so make sure you're happy with the answers you give!

You don't need to be logged onto the internet to get a notification or complete surveys, but you must connect regularly in order to upload your responses from your device. We recommend

accessing the app when connected to the internet every 48 hours. You must log on while connected to the internet before the baseline survey notification tomorrow, so please do that now.

Some people have had issues with expiry times – the survey just expires if they leave the app. If this happens, it's probably due to your phone stopping the app running in the background due to battery optimisation settings. We have fixes for it, so let me know and I can send you instructions on how to fix it. Just need to protect this app from your battery optimisation procedures.

Are there any questions about the use of the SEMA3 app?

Contacts and right to withdraw

If an emergency occurs in your life that means you won't be able to complete the remainder of the surveys, email me to let me know. If you have completed more than half of the surveys, you will be paid (or credited) the full survey reward. If you have completed between a quarter and a half of the surveys, you will receive half the survey reward. If you have completed less than this, you won't receive any credit. Please note that this is only if you email me to let me know about an emergency or a concern with the study that means you need to withdraw. If you simply stop responding to surveys, you will not receive any credits.

In order to withdraw from the study for any reason, email me with your participant ID and I will remove your response set from the study. We may run more than one wave of this study, so it is still possible that you could take part in future.

For everyone else, once you have completed your final survey, you should receive an email within 24 hours, confirming your completion of the study and thanking you for your time. This email will have a completion code, which you will need to enter into Prolific to receive payment for this study.

If you'd like, you can request a graphical display of your own responses, so you can observe your patterns over time, by emailing us with your participant ID. We will happily send this to you at the end of the study! Details about this will also be on the debrief form you get in that final email.

And that's it. Any final questions before you go out to become scientific pioneers?

Thank you all for attending and thank you all for taking part!

Appendix 6: Measures Clarifications (Study 3)

Some of the questions you will answer in the course of this study could cause confusion, and sometimes we're using words in a slightly more technical way than you might use them day to day. We've therefore put together some guidelines to help explain what we're actually asking you about. Please try to read through this document before you take the first survey.

Jealousy

You will be asked how much jealousy you have experienced since the last notification. For this question, you will need to consider everything you have felt in the last few hours, meaning since the last notification or since the start of the day, in the case of the first notification of the day.

Firstly, jealousy must be *interpersonal*, and *triadic*. This means that there are (at least) three people involved in any experience of jealousy:

- Yourself
- The target (the person you are jealous of)
 - N.B. You don't need to know who the target is to feel jealous of them
- Another person that you have, or want to have, a relationship with.
 - While this relationship could be romantic, it doesn't need to be. it could be a friendship or family relationship, or even a work relationship. You need to feel (rightly or wrongly!) that the person you're jealous of is a problem for this relationship, or your place within that relationship.

Importantly, wanting to have what someone else has is counted as *envy*, not jealousy. You can feel jealous of someone who has nicer clothes than you, but only if they make you feel socially threatened. Finally, jealousy can be mild or severe, ranging from a light twinge of jealousy to an all-encompassing sadness or rage.

Examples of Jealousy

- You think that everyone is going to admire a fellow student because he has a new car, and you feel threatened by this.
- You worry that your partner is cheating on you with someone you don't know, and this makes you feel awful.
- You feel insecure when you see your partner has liked a photo of another attractive person on social media.
- Your parents bought your sister a really nice present for her birthday and you feel overlooked.
- You're upset that your best friend has started spending lots of time with a new friend that you don't know. You fear that this will make the two of you less close.
- You dislike Sian's boyfriend, as you have a crush on Sian as well.

Not Examples of Jealousy

Not interpersonal. You've noticed that James has a very nice car, that you would like to have yourself.

You feel annoyed about this, as you don't feel that James has worked hard enough to earn it. In this case you're *envious* of James, but not *jealous*.

No Target. You and your partner have been arguing a lot and you worry that they're going to break up with you. This, by itself, is not jealousy, as there is no one for you to be jealous of.

Social Comparison

Again, here you are asked to think about any social comparisons you have performed in the last few hours (since the last notification, or since the start of the day). Please only answer yes to this if you can remember making a comparison. You'll be asked specific questions about it, and these won't

make much sense if you don't remember anything about it. If you've made more than one comparison, please select the most significant one for you personally.

A social comparison can be anything where you have compared yourself to another person, in terms of your ability, your characteristics or how well you think you have done something. Considering how successful you are compared to someone else is a comparison based on your characteristics, but considering how much cake you got at a party compared to them is not, and so does not count as a social comparison.

You might have performed better than the person you compared yourself to, or you might have performed worse. Equally, you might be doing just as well as the other person.

Examples of Social Comparisons

- You think that you're better at statistics than the other students in your class.
- You're glad you're not as forgetful as your housemate.
- You consider yourself less successful than your sister.
- You think that you and your friend are equally good at football, but in different ways.
- You're very impressed by a musician who can play much better than you can.
- You think your friend is better looking than you are.

Not Examples of Social Comparisons

Temporal comparison. You're pleased that you're more organised than you used to be.

No target person. You think that you're less motivated than you should be

No specific target. You think that you're kinder than most people

Not based on characteristics, ability or performance. You see that your friend has a smaller bedroom than you do.

Not based on characteristics, ability or performance. You feel that you're asked to do more than your fair share of work at home

We appreciate that in any given situation, these distinctions may not be completely clear. If you think that you were making a social comparison, it is best to assume that it does count and you should record it.

Appendix 7: Evaluation Survey Responses (Study 3)

I received one hundred and forty-four responses to the post-study evaluation survey, though thirty-one were entirely blank, leaving one hundred and thirteen responses. Some of these will have been from participants who were excluded from the analyses, but whose perspectives on the study are still important.

Quantitative Measures

On a scale from 0 (Very Easy) to 10 (Very Difficult), the mean difficulty rating for answering the questions was 1.91 with an *SD* of 2.15. Participants seemed to vary substantially in how difficult they found to answer the questions – the highest difficulty score was the maximum score, 10, but this was only reported by one participant. Twenty-two participants (19%) reported frustration in answering the surveys. These participants were asked to indicate the level of frustration they experienced from 0 (Only Mild) to 10 (Extreme). The mean score was 4.59, roughly the middle of the scale, with an *SD* of 1.97. The highest level of frustration was 7, reported by three participants.

Additional Comments

I received thirty-five comments in the free text box I provided for additional comments. One participant misinterpreted this question, so their response is not included in the frequencies below.

All other responses fit into one of the following categories:

| Category | Frequency |
|------------------|-----------|
| Positives | |
| Design | 9 |
| Other | 5 |
| Negatives | |
| Tedious | 3 |
| Technical | 3 |
| Other | 1 |
| Survey Window | 8 |
| Design | 4 |

Positives

Design. Many participants reported finding the app easy to use and the instructions and surveys clear to follow, or simply reported that “everything went well”. Occasionally this came with a negative as well, such as being tedious but straightforward. One participant complimented the choice of methodology in general.

Other. Some participants gave other compliments or reported different benefits. Most of these responses reported finding the study interesting. Two participants reported a benefit in terms of insight into their own behaviour, emotions and cognitions. This is positive to see, as it suggests that taking part in research which encourages people to pay attention to their own psychology can make people more mindful of the ways that they think, feel and act.

Negatives

Survey Window. Many participants reported problems with this aspect of the study, reporting that they missed surveys due to the short window before the study expired. This may well have been a contributed to the difficulty that some participants experienced in answering the questions, as most participants who scored the difficulty over the midpoint of the scale also commented on the short survey window. This difficulty must be balanced against the need to gain data reflecting the participant’s self-esteem at the moment the notification is sent. If participants had the opportunity to answer surveys at their full convenience, the circumstances that were convenient to them might bias self-esteem scores or give them time to perform additional social comparisons.

Tedious. Three participants reported finding the questions dull or repetitive. To some extent, this is a feature of intensive longitudinal research, as participants must receive the same surveys repeatedly. However, if a large number of participants find a study dull, this might present problems for participant-retention/attrition. I am encouraged in this case by the fact that only 3% of

the respondents reported finding the study boring. I omitted some measures I considered including (e.g., comparison domain) so it would not have been easy to make the surveys quicker and easier.

Technical. Some participants reported not receiving surveys during the appropriate intervals, or experiencing glitches in the app. These problems arose fairly regularly during the research (participants forfeited credit/payment if they missed more than five surveys, so they tended to raise these issues as they occurred) and I worked hard to fix issues as they arose. One take-home lesson for me is that it is easy to cause problems in the app by making changes to the schedules, so researchers should work hard to resolve all issues prior to the start of a study week.

Design. One participant raised the issue that mistakes could not be corrected because there was no back button. This is an issue built into the app, and I encouraged participants to be certain of their answers before submitting them. One participant reported that they had not been able to give the questions the reflection they needed while trying to do other things. One participant reported scheduling their day around completing the surveys, possibly as a way to deal with the above problem, but this is against the stated aims of daily life research. One participant reported finding it difficult to recall social comparisons. This was a problem that I foresaw in the design of the study, and while regrettable, I am encouraged by the fact that less than 1% of respondents reported this issue.

Other. As a counterpoint to the positive insights reported by some participants, one participant reported struggling more in their life due to being more aware of their emotions. This reminds me that research in social psychology, especially studies as involved as this one, can have tangible impacts on participants, and these impacts are not always beneficial. There are a number of ways this problem could be ameliorated. Firstly, as Gibbons and Buunk (1999) do at the beginning of the INCOM, researchers could make sure to tell participants that social comparisons and jealousy (in some form) are normal parts of life, and that participants are not doing anything wrong by performing/experiencing them. Secondly, researchers need to clearly signpost participants to

mental health and wellbeing services if they are negatively impacted by the research. Finally, researchers should consider the filler items they include in their studies. In this study, I included measures of mood and conflict with others, as these seemed to be thematically similar to my other questions, without being directly relevant. However, conflict especially can be a painful thing to pay close attention to in one's life, and this could have caused unnecessary harm to participants.

Every one of these issues were reported by at least one participant who said they found it frustrating to answer the survey questions, suggesting these negative aspects are all sources of frustration.

In summary, there were problems with the study, which made answering surveys both difficult and frustrating to participants. Some of these could be avoided by more careful planning prior to the start of a study, while others are – arguably and to some extent – necessary evils, such as tedium or short completion windows. In general, participants did not find it very difficult or frustrating to take part in this study, but some faced quite meaningful problems, especially to psychological wellbeing. This experience has raised my awareness of issues in ESM research, and I believe I will be more proficient if/when I next run such a study.