Women and the Wireless: British Women's Developing Roles and Representations in the Interwar Electronics Industry

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Submitted in accordance with the requirements for the degree of
Doctor of Philosophy

The University of Leeds
School of Philosophy, Religion and History of Science

July, 2021

UNIVERSITY OF LEEDS   UKRI   Arts and Humanities Research Council

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Acknowledgements

The writing of this thesis would not have been possible without the direct help and assistance of many different people and institutions. Firstly, I would like to thank both my supervisors at the University of Leeds: Alison Fell and Graeme Gooday. Without their help throughout the writing of this thesis its completion would not have been possible, and their constant insight and expertise has proven crucial in shaping my approach to the thesis. I must also thank both the National Science and Media Museum and my CDP partner institution the Science and Media Museum for the assistance I received from their staff, specifically: Annie Jamieson, Claire Mayoh and Jan Shearsmith whose vast knowledge of their respective archives proved invaluable. I would also like to extend my gratitude to the White Rose College of the Arts & Humanities and the Arts and Humanities Research Council as without their resources and funding this thesis would not have been written. Finally, I would like to thank my family for their eternal support and give specific mention to my father Paul, my brother Jordan and also my mother Jayne who sadly passed away before the completion of this thesis.

Abstract

Born out of wartime developments, Britain's new electronics industry emerged in the interwar period as a successful and growing part of a then fragile national economy. The electronics industry was indeed one of few big growth areas in the British interwar economy, one which facilitated the sector taking on thousands of new female employees at a time when other sectors, such as telephone exchanges, had begun to mechanise and thus eliminate women's employment. This growth facilitated the mass production of wireless sets, and their essential internal components such as electronic amplifying valves, that contributed to a developing consumer culture in Britain. In turn, the development of the electronics industry brought about a variety of complicated evolutions in the roles of women and the gendered representations of them in relation to both waged work and their consumption of, and relationship to, new technologies. I argue that within the newly-developed electronics industry it was in the years of peace between the two world wars that longer-lasting changes truly took hold regarding not only the cultural perceptions of women but also in the material conditions in which they lived and worked. In this thesis I analyse three major roles women had in the interwar electronics industry: as workers manufacturing wireless technology, as the public face of the electronics companies demonstrating the technology and finally as consumers of wireless radio sets. However, I argue that alongside these changes to women's lives in relation to the electronics industry, more traditional representations of gender were still upheld even when these notions contradicted and challenged the economic, gender and social realities of the interwar years. The originality of this thesis stems from its focus on the lived realities and representations of women as manufacturers, demonstrators, and consumers of

electronics. This phenomenon has hitherto received little direct scholarly attention, merely being mentioned in relation to women and interwar work as a whole. In this study I adopt a cultural history framework with a focus on visual culture to facilitate an analysis on representations using relevant visual sources as evidence in conjunction with statistics and textual sources, for my analysis. Such an approach has not previously been undertaken in relation to this specific area of study to any significant degree.

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List of Abbreviations

- AEI - Associated Electrical Industries

- AEU - Amalgamated Engineering Union

- BBC - British Broadcasting Corporation

- EAW - Electrical Association for Women

- GEC - General Electrical Company

- GPO - General Post Office

- ILP - Independent Labour Party

- IWM - Imperial War Museums

- MCL- Manchester Central Library

- MRCW - Modern Records Centre Warwick

- MSI - Museum of Science and Industry

- NFWW - National Federation of Women Workers

- NSMM - National Science and Media Museum

- MVG - Metropolitan-Vickers Gazette

- ORA - Oscillator, Rectifier, and Amplifier

- PHM – People's History Museum

- RAF - Royal Air Force

- RFC - Royal Flying Corps

- TUC - Trade Union Congress

- UK - United Kingdom

- VMA - Valve Manufacturers Association

- WCML - Working Class Movement Library

- WES - Women's Engineering Society

- WRNS - Women's Royal Navy Service

- WSTC - Women Signallers Territorial Corps

Introduction

'It is generally realised that, temperamentally, women are more highly sensitive than men and temperament is likely to play a considerable part not only in the degree of efficiency with which a worker may perform her regular duties, but also to the extent to which she can carry on contentedly in her working environment'[1]

'As a whole engineering probably offers less scope than many industries for women's labour. On the other hand, in electrical manufacturing there is probably a greater scope for women's work than any other branch of engineering owing to the fact that much of the work requires deftness and speed, and being comparatively light, involves little strain'[2]

One of the biggest changes in Britain's industrial landscape during the interwar years compared to its pre-war years was the emergence of the consumer electronics industry. This industry remained a stable employer of a large number of women workers in manufacturing throughout its growth years as companies shifted to electronics manufacturing and new companies were established. Industry leaders made claims about the suitability of women for this kind of industrial work based on their gender, and these were repeated by supervisors of factory workers such as Miss E.E. Wilson from Metropolitan-Vickers, who in the above quotations notes women workers' 'deftness and speed' alongside their supposedly heightened 'sensitivity'. This thesis will reveal both the limitations and the consequences of these traditional gendered understandings of women's roles in the electronics industry. Throughout

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[1] E.E. Wilson, 'The Employment of Women in Industry' *The Metropolitan-Vickers Gazette,* July 1922, YA1998.16, MSI p.15.

[2] E.E. Wilson, 'The Employment of Women in Industry' *The Metropolitan-Vickers Gazette,* July 1922, YA1998.16, MSI p. 14.

this thesis I use the term the 'electronics industry' to refer to the various companies

that manufactured wireless technology such as thermionic valves during the interwar

period. I have done this to specify the growth of the industry and technology as a

mainstream consumer product on a completely different scale to the small pre First

World War hobbyist culture that developed around wireless. It must also be noted

that 'electronics' as a term synonymous with wider electrical engineering work did

not come into popular usage until after the Second World war; therefore I also use

the term electrical engineering in the context of quotes and statistics. It is necessary

to retrospectively use the term 'consumer electronics' as to differentiate wireless

sets from electrical goods, such as vacuum cleaners, that were also mass produced

during this period. I focus on the growth of telecommunications in the context of the

1920s and the emergence of these new consumer goods but the technology had its

origins well before that during the nineteenth century.

The origins of the use of telegraphy can be found in a variety of proposals for

electric telegraphs being proposed in the latter half of the eighteenth century.[3] The

first widespread usage of them can be seen in the safety signalling devices on the

railways in the1840s. Before the First World War telegraph technology had

facilitated the widespread use of morse code as the primary method of military

communication. By the late nineteenth century the government organisations such as

the Postal Telegraph Department utilised Morse's recording apparatus for telegraphs

messages that could record around 40 words per minute.[4] Even prior the First

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[3] R.W Burns, *Communications: an International History of the Formative Years* (London: The Institute of Engineering and Technology, 2004), pp.57-60.

[4] Burns, *Communications*, p.96.

World War and the advent of audio broadcasts this limited adoption of new technology facilitated new opportunities of employment for women. R.W Burns points out that 'in 1859 the directors of the District Telegraph Company advertised for female telegraph operators. They were surprised at the number of highly respectable and well-educated young women applicants' but that 'some customers felt that female labour tended to lower the tone of the service although they agreed that the telegraph service was a most elegant employment for young women and they were very attractive to observe! Usually a female supervisor or matron was recruited to manage the operators'.[5] Here is an early example of the 'lighter' work brought about by new communication technologies and being perceived by those who interact ed directly with it, as a role suitable for women, if not an ideal one.

Following these developments 'the method of distributing time signals by electric telegraphy began to be superseded by wireless telegraphy from 1905'.[6] Writing in the *Radio Times* George Day recalls that regarding early wireless broadcasts 'in those pre-war days, there was nothing to be heard but Morse, which usually went too fast for me to transcribe'[7]. In these early days of the wireless industry and its reliance on morse code, women were already employed on the manufacturing side of the industry, albeit in much smaller numbers than they would be following the expansion of the industry following the First World War. Brian Hennessy describes how in 1898 on the first floor of Marconi's initial warehouse in Chelsmford a small

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[5] Burns, *Communications*, p.99.

[6] Burns, *Communications,* p.121.

[7] Brian Hennessy, *The Emergence of Broadcasting in Britain* (Lympstone: Southerleigh, 2005), p.11

number of women were employed in 'winding, insulating lacquering the induction coils for sparks transmitters'.[8] However, as Elizabeth Bruton and Mar Hicks argue 'even though it was significantly cheaper to employ women, sexist cultural mores ensured that economic arguments did not precipitate a sudden influx of women into telegraphy or any other sphere of work in telecommunications'.[9] In the following chapters I demonstrate how the growth of the industry in the interwar years altered this balance between social expectations and economic expectations and how this change began to be accepted by employers through the forced necessities experienced during the First World War.

Like many new technologies, electronics and specifically wireless technology initially found prominence as a wartime tool. In the history of Britain very few phenomena have been given the importance and label of 'transformative' by historians as regularly as the First World War.[10] The world's first 'total war' saw massive changes in how wars were fought, with repeating machine guns and tanks appearing for the first time on the battlefield. Other technologies emerged to a previously unseen prominence and were adapted for use in wartime, such as wireless. In Britain prior to the war, wireless had emerged as a hobby for a small group of dedicated enthusiasts following the initial invention of the thermionic valve

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[8] Hennessy, *The Emergence of Broadcasting in Britain*, p.49.

[9] Elizabeth Bruton and Mar Hicks, 'A History of Women in British Telecommunications: Introducing a Special Issue' *Information and Culture* 55 (2020), pp.1-9 (p.4).

[10] Suzie Grogan, *Shell Shocked Britain: The First World War's Legacy for Britain's Mental Health* (Barnsley: Pen and Sword History, 2014). Martin Pugh, *We Danced All Night: A Social History of Britain Between the Wars* (London: Vintage Books, 2009).

by the Marconi company's John Ambrose Fleming in 1904, just a decade before the outbreak of the First World War.[11]

Both the technology and the enthusiasts themselves were drafted into the war effort. On the home front, one of the biggest changes brought about by the demanding conditions of the early war years was its impact on the industrial workplace and particularly the rapid increase of women working within those spaces.[12] The most obvious symbol of the feminization of wartime industry was the mass of women and young girls who entered munitions and other war factories to manufacture the weaponry, ammunition, tools and industrial goods needed to fight the war. This was not the only example of women taking on the work of absent men, or moving from one sector to another, during the war years; teaching, agriculture, the civil service and hospitals all saw a willinginflux of women workers from across all classes.

Since the 1980s, the extent to which women entering the wartime workforce brought about progress in terms of women's employment opportunities, pay or conditions has been questioned by some historians and the lasting impact of this 'transformative' impact questioned. Several historians have concluded that, while the war years saw a temporary rise in wages and greater number of opportunities for women, the interwar years saw a backlash in terms of progress in women's rights

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[11] Keith Thrower, *History of the British Radio Valve to 1940* (Beaulieu: MMA International Ltd, 1993).

[12] Deborah Thom, 'A Revolution in the Workplace? Women's Work in Munitions Factories and Technological Change 1914-18' in *Women Workers and Technological Change in Europe in the Nineteenth and Twentieth Centuries,* ed. by Gertjan Degroot and Marlous Schrover (London: Taylor and Francis, 1995), pp.97-118.

and roles.[13] It is telling that a similar historical narrative initially developed around the entry of women into industry during the Second World War despite this 'transformation' supposedly having already taken place.[14] Furthermore, historians such as Deborah Thom and Gail Braybon argued that the fact that women were already heavily employed in industries such as textiles before the war had often been overlooked. It is now commonly accepted that most of the changes brought about during the years of the First World War did not have a lasting impact on female employees, and that many women were forced to revert back to their pre-war working conditions including the removal of services such as crèches and a scaling back of opportunities and wages.[15] This was exemplified by the dismissal of women from certain wartime industries upon the return of men from the war which was brought about by the Restoration of Pre-War Practices Act of 1919.

However, as this thesis argues, this was not the case in all sectors. A permanent change regarding women's work within the new interwar electronics industry, brought about by the government and companies' development and deployment of the technology, is discernible in the years following the Armistice. Neither the historical narrative that claims that any progress in women's working rights or conditions during the First World War was reversed, nor the one that views the war

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[13] Susan Kent, 'The Politics of Sexual Difference: World War I and the Demise of British Feminism', *Journal of British Studies,* 27 (July 1988), pp.232-253. Linda Clarke and Christine Wall, 'Skilled Versus Qualified Labour: The Exclusion of Women from the Construction Industry', in *Class and Gender in British Labour History,* ed. by Mary Davis (Pontypool: Merlin Press, 2011), pp.96-109. Deborah Thom, *Nice Girls and Rude Girls,* (London: I.B. Tauris and Co Ltd, 1998), p.45.

[14] Penny Summerfield, *Women Workers in the Second World War: Production and Patriarchy in Conflict* (Abingdon: Routledge, 1984).

[15] Gail Braybon, *Women Workers in the First World War* (London: Routledge, 1981), pp.183-184.

as transformative for working women can be applied completely to Britain's new interwar electronics industry. This industry emerged *after* the war but was born out of wartime advancements in wireless technology, and quickly became dependent on working-class women on the factory floor at one end of the production cycle and middle-class women consuming its products at the other end. R.E Catterall highlights the fact that 'employment in the electrical engineering industry increased by over 90 percent between 1920 and 1938' and that 'male employment in the industry in England and Wales had risen by 47 percent between 1921 and 1931, but female employment had risen by 123 percent'.[16] While the industry employed more men overall, the number of women employed in companies such as Metropolitan-Vickers, Ferranti and Cossor (whose sources I draw on in this thesis) grew faster. In 1931 50,049 women were employed in electrical manufacture, which included cables, accumulators, batteries and telegraph and wireless apparatus (except valves), more than double the numbers from a decade earlier.[17] These developments in the interwar years had a more permanent effect on shaping the experience, perceptions and representations of women and work in the electronics industry than the social upheavals brought about by the war. This also applies to the evolving relationship between engineering trades unions and all women workers in industry following the war, both in the ways it compares to other trade union responses and approaches to female industrial workers and in understanding why eventually all union opposition to women members was dropped during the Second World War. I argue that while

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[16] R.E Catterall, 'Electrical Engineering' in *British Industry Between the Wars: Instability and Industrial Development 1919-1939*, ed by Neil K. Buxton and Derek H. Aldcroft (London: Scolar Press, 1979), p.253.

[17] Miriam Glucksmann, *Women Assemble: Women Workers and the New Industries in Interwar Britain* (London: Routledge, 1990) pp.59-61.

the conditions of wartime industry did play a big role in this change it was the unique circumstances of the Second World War compared to the First alongside the consistency of female employment patterns in the electronics industry throughout the interwar years that ultimately brought about this change.

In this thesis I consider three groups of women in relation to the electronics industry: women as workers in manufacturing, women workers at electronics exhibitions and women as consumers of wireless. In doing so I explore how the emergence of the interwar electronics industry, centred on the growing consumer adoption of wireless technology, reshaped women's representation in relation to the technology and placed them in multiple gendered roles. I examine how the social, economic and gendered realities of these years, coinciding with the mass production and consumption of electronics, determined how and why working-class women increasingly worked in the electronics industry on a permanent basis, and why middle-class women became the primary marketing targets and consumers of the technology, despite its male-dominated origins. I also examine the limits of this transformation, asking to what degree this was a continuation rather than a complete change of existing gender norms and class relations. The first of three major groups of research questions answered within this thesis is concerned with the opposition to the feminisation (meaning the widespread adoption of female labour for specific jobs) of the electronics industry, and with trade union attempts to organise women in the industry. First, how and why did changes regarding the relationship between women and new interwar technologies meet resistance and opposition from interested groups such as trades unions? Secondly, how and to what extent were women working in the electronics industry organised as a workforce? My second group of research questions deals with the representation of women workers within the industry. First, how were the working-class women who manufactured wireless

technology represented within and outside of the industry? And secondly, why and to what extent did these representations attach working-class women to the mass production of wireless, thermionic valves and other electronic technology? The final group of research question relate to women as consumers of the technology. First, how were women of different social classes represented as consumers of wireless technology? Secondly, how did female consumers shape the representation of the technology as a consumer product? In the following section I detail the methodological approaches and the sources I have utilised to answer these research questions.

0.1 Methodology and Sources

This thesis primarily examines the British interwar electronics industry through the lenses of gender history, history of science and technology, social history and cultural history frameworks. I examine both representations of women and their lived social realities. I adopt a social history framework as I am analysing the experiences of women working in the interwar electronics industry as well as the ways they were depicted, viewed and commented upon by others. I have chosen to focus on the interwar period because this period has received less attention in relation to the representation of women and work in comparison to the two World Wars. Also, the rapid increase in the adoption of wireless into British homes over this period makes it an important one regarding the history of technology and consumer culture. Wireless was prohibited by the government from being used by civilians during the First World War but was the centrepiece of many family homes by the commencement of the

Second World War. The interwar period is thus a fertile area of study to analyse how the women making and consuming the technology were represented and viewed by groups such as employers, advertisers and trades unions, during the technology's initial transition to a mass-produced consumer product. By focusing on the experiences of and changing attitudes towards women workers and consumers in this period I highlight the unique roles they had in relation to the widespread consumer adoption of wireless technology, on both ends of the production cycle.

In order to understand representations of women workers and consumers it is essential to use gender and cultural history methodologies in an analysis of, for example, the press, visual sources and material culture. I adopt a cultural analysis as this approach 'is mainly concerned with the sense men and women from the past gave to the world they lived in'[18]. One major way this 'sense' can be analysed is through visual culture. Applying this cultural analysis of visual sources 'most effectively enlightens: gender; the family and sexuality; the body'[19]. I use visual culture to 'introduce social history, context, and criticality'[20] to my analysis of culturally significant visual sources. This has proved to be the most fitting approach when considering visual representations of women. When discussing how perceptions of gender and women were changed or upheld it has proven vital to interrogate visual images such as photographs to elucidate these developments. I adopt the same methodology in analysing these images as Julie Wosk, that is to say, an analysis

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[18] Alessandro Arcangeli, *Cultural History A Concise Introduction* (Oxon: Routledge, 2012), p.1.

[19] Arcangeli, Cultural History, p.1.

[20] Marquand Smith, *Visual Culture Studies: Interviews with Key Thinkers* (London: SAGE, 2008), p.5.

focusing on the relationship represented between women and technology to provide a framework to discuss evolving social attitudes. Wosk argues that such a framework provides insight into 'the role of representations in perpetuating stereotypes about women and machines and in helping to refute those stereotypes' and can reveal 'deeply divided cultural attitudes'.[21] Visual sources from different origins play a crucial role in my analysis across all chapters of this thesis. When analysing these visual sources, it important to consider the context in which they were produced and their function and intended audience. For example, the different intentions between an advertisement trying to sell a product, company publications trying to influence employee and public perceptions and biased press reporting on strikes and labour relations.[22] This thesis utilises sources that fall under all these descriptions. One of the most extensively analysed of these are the official magazines and club news produced by the electronics companies. Photographs in the company magazines alongside articles about the companies' female employees provide evidence of the ways in which working-class women were viewed internally, how they were discussed within the industry and how they were presented to the magazines' readers. These magazines and newsletters provide a variety of images that show women at work, under supervision and taking part in leisure activities provided by the employers. These sources have allowed me to answer my second set of research questions. For this thesis, a major strength of these company magazines as a source is that they demonstrate clearly how the electronics companies wanted to represent their women

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[21] Julie Wosk, *Women and the Machine* (Baltimore: The Johns Hopkins University Press, 2001), p.1.

[22] Pamela Cox, 'The Uses of Film and Visual Sources in Labour History' *Revista Mundos de Trabalho,* 1 (2019), 1-12. Jessica Horsley, ''Eyewitnessing'? History and Visual Sources', *History Compass* 5 (2009), pp.1317-1337.

workers internally, allowing a comparison to other groups and institutions such as advertising companies and trades unions. They also reveal the contradictions present in how these companies visually represented femininity and class. Company magazines have been recognised by other scholars as valuable source for historical insight. Roland Marchand frames company magazines as an important tool for employers in creating a 'corporate soul'.[23] Simon Phillips has built upon this work by showing how the Boots the Chemist company magazine *The Bee* 'could be used to demonstrate corporate soul to employees as much as to the consumer'.[24] Michael Heller and Michael Rawlinson argue that a significant drawback of company magazines is it is difficult to fully understand 'what specific roles these play within such a multiplicity of organisational communication' and '[…]how organisational magazines contribute to internal communication'.[25] However, these issues are not at the heart of my research questions; rather, I build on these previous uses of company magazines by placing them within my gender and technology framework of analysis rather than one of business history.

Other visual sources I use include press photography such as the archive of the *Daily Herald* held at the Science and Media Museum in Bradford. This archive contains a photographic section dedicated to the Radio Exhibitions held in Olympia throughout

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[23] Roland Marchand, *Creating the Corporate Soul: The Rise of Public Relations and Corporate Imagery in American Big Business* (Berkeley: California University Press, 1998).

[24] Simon Phillips, 'Chemists to the Nation': House Magazines, Locality and Health at Boots the Chemists 1919–1939', *Management & Organizational History* 3, (2013), 239-255, (p.239).

[25] Michael Heller and Michael Rawlinson, 'Organizational Magazines: Addressing Captive or Cautious Audiences' in *The Routledge Handbook of Magazine Research: The Future of the Magazine Form,* ed. by David Abrahamson and Marcia R. Prior-Miller (New York: Routledge, 2015), pp. 119- 134 (p.121).

the interwar years. These provide a unique insight as they contain images intended for publication alongside many 'behind the scenes' photographs that were not officially used or attached to a particular published story. Alongside this, I analyse other examples of similar imagery found in newspapers and books from the period that place the Radio Exhibitions and the women involved with them in a broader context. Another reason I make extensive use of the *Daily Herald* archive is because of its focus on labour relations and the newspaper's sympathies with the trade union movement, which is relevant to the topic of this thesis.[26] Advertisements aimed at women during the interwar period, and specifically advertisements for electronic goods, are also examined. I have found a variety of advertisements in a multitude of publications, such as magazines aimed at women, advertising archives and company magazines (in which I have found multiple examples aimed at or using images of women). These sources have allowed me to tackle the set of third research questions about women as consumers that I have posed. A prominent collection I draw on is the UK edition of *Good Housekeeping*, which was primarily aimed at a middle-class female readership, alongside magazines directed at male hobbyists such as *Popular Wireless Weekly*. Furthermore, companies encouraged their female employees to partake in activities such as wireless clubs which are recorded in official company magazines, which can be viewed as another form of product advertising aimed at their own employees. A weakness of such visual sources, particularly press photographs, is that they rarely provide the full context behind the events they show and are often not archived with the associated article to provide further details on what is being

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[26] *The Daily Herald* was published from London between 1912-1964 and began publication during the London Compositors strike of 1910-1911 after they were locked out for demanding a 48-hour work week. It was Britain's first working-class focused daily newspaper. Stanley Harrison, *Poor Men's Guardians: A Record of the Struggles for a Democratic Newspaper Press, 1763-1973* (London: Lawrence and Wishart, 1974).

depicted. Also, in comparison to statistics, for example, they provide a much narrower and more controlled amount of information.

To answer my research questions which focus on representations and why and how these were constructed, it has been crucial to take into consideration where these visual sources were published, the context they were placed in (such as surrounding articles) and to consider the possible reasons that they were taken and published in the first place. However, for this thesis visual sources possess the key advantage in that they demonstrate how different groups and organisations represented women at various points in time and in specific circumstances. Furthermore, representations of women in press photographs and advertising were widely disseminated and therefore provide insight into how women would have been perceived by the different audiences and publishers of these images. For instance, Tawnya J. Adkins Covert has shown how the American advertising industry utilised images of women to mobilise women during the Second World War. By examining visual representations in American women's magazines Covert shows how wartime representations altered the peacetime trend of advertisements gendering women in 'limited, predicable roles' such as 'domestic, caregiver and sexual object'[27], due to the countrywide mobilisation effort. Pearl James also argues for the importance of considering the intended audience when analysing visual depictions of women and how they are gendered. James highlights how wartime posters featuring women appealed to 'a collective national audience' through 'visually cross-gendered terms'.[28] Visual sources such as

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[27] Tawnya J. Adkins Covert, *Manipulating Images: World War II Mobilization of Women through Magazine Advertising* (Lanham: Lexington Books, 2011), p.30.

[28] Pearl James, 'Images of Femininity in American World War 1 Posters' in *Picture This: World War I Posters and Visual Culture*, ed. by Pearl James, (Lincoln: University of Nebraska Press, 2009), p.301.

the electronics companies' magazines highlight how the companies promoted the idea that women could and should work within the industry, albeit in strictly gendered roles. Advertisements reflect gendered notions of women's relationship with technology in their attempts to sell wireless technology to them. These visual sources thereby provide insight into how electronics companies and the press attempted to represent women and how the women working in electronics would have been perceived by the audiences of these images. I aim in my analysis of these visual sources to understand to what extent they created, reinforced, reflected or challenged social constructs of gender and why those who made them were doing so.

In order to contextualise the cultural analysis of representations of women in the electronics industry in the interwar period, however, I also utilise statistics, such as employment figures across industries, trade union membership, wages and wireless ownership. For instance, I have used statistics found in the interwar editions of the *BBC Handbook* to inform my analysis of radio advertisements found in magazines such as *Good Housekeeping* and my conclusions regarding their effectiveness and intended audience. Internal documents of companies such as Metropolitan-Vickers, found at the Manchester Museum of Science and Industry (MSI), provide international wage comparisons. For example, an internal report produced by Metropolitan-Vickers entitled 'International Rates of Wages in the Engineering Industry'[29] provides insight into how the company viewed their own wages in the context of the global industry. Other statistics such as employment and trade union membership figures were gathered from interwar surveys by organisations such as the Trade Union Congress and the National Women's Advisory Council. These kinds of

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[29] 'International Rates of Wages in the Engineering Industry' *Metropolitan-Vickers Research Department Report,* August 1923, MSI 2003.50/7/2/71, MSI.

data provide clear evidence of historical trends across multiple years and allow for direct comparisons to be made between industries, such as between the textile and electronics industries. It has proved crucial to consult statistics to spot things such as regional differences and similarities. Of course, a major weakness when relying on statistics is that while they may demonstrate developments, they do little in the way of explaining how and why such developments have taken place. However, I bolstered my analysis of statistics with an extensive examination of textual sources that reveal the cultural and social milieu and developments in norms and attitudes, particularly towards gender roles.

Key examples of these textual sources include the writing of prominent female leaders with connections to engineering such as Katharine Parsons,[30] as well as interviews and newspaper articles related to political and industrial action taken by women electronics workers in factories. These sources highlight the promises that were made regarding post-war female employment as well as revealing some anxieties surrounding the potential continuation of the employment of women following the end of the war and first-hand assessments of the employment situation in the interwar years. Archival records of the companies and industry meetings held at MSI including those of the engineering trade demonstrate that despite the large number of women employed, female employees were still a contentious issue within the industry. For instance, the *Ferranti Journal* provides numerous insights into the development of the company during the interwar years, such as working hours, the initial hiring of women and how this was viewed as a temporary novelty by some within the company. In addition, the MSI also houses electronics company records, meeting notes and

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[30] The Hon. Lady Parsons, *Women's Work in Engineering and Shipbuilding during the War* (North East Coast Institution of Engineers and Ship Builders, 1919).

brochures that show the key issues these companies faced such as production output, patents, pricing, employment, and the health of the industry. For instance, a report from the Ferranti Valve Department details a step-by-step overview of the production and inspection process.[31] Reports like this provide exact details of the work being done by women, the variety and volume of valves being manufactured and how this was assessed by the company. These documents provide the background and context for the visual representations of the women workers in valve manufacturing published by the company. Brochures from companies such as Ferranti, Osram and Tungsram which list valve types and prices are also important evidence of the emerging consumer culture surrounding wireless technology. In this thesis I use documents regarding pricing, in conjunction with hobbyist magazines such as the *Popular Wireless Weekly*, to understand who wireless technology was being aimed at, who could afford it and when they were buying it.

A range of other archives and records have also illuminated my study of women as the producers and consumers of electronic goods. When it comes to analysing the period's wireless programming in relation to women listeners and female wireless ownership, the University of Leeds collections of the BBC's *The Listener* have proven to be a valuable source of information. Union records, such as those held at the Working-Class Movement Library in Manchester, reveal the evolving debates over female membership, unskilled labour, pay and strike activity during the interwar period. My analysis of these archival sources show why unions and workers with links to the electronics industry took industrial action during this period. They also tell us to what extent women employees were involved and, why despite the number of

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[31] Valve Assembly Inspection, *Ferranti Valve Department,* March 1935, YA1996. 10/4/5/1, MSI, p.79.

women employed in the interwar industries, trades unions often argued against the need to defend or accept women workers as members. Barbara Drake's 1920 report *Women in Trade Unions*[32] provides the historical background and further important context for the trade union sources. Another crucial source that provides a historical overview of the development of women in the wider engineering industry is the journal of the Women's Engineering Society (WES), *The Woman Engineer*, which unlike the trade union material provides articles and reports aimed at a more 'skilled' and middle-class female audience. *The Woman Engineer* also provides a wealth of images produced by a women's organisation which contrast with those produced by the electronics companies or trades unions. Taken together, the writing of prominent female campaigners and union material, transcripts of trade union congresses, and journal articles from *The Woman Engineer* alongside others from left-wing magazines such as *Labour*, which were attempting to attract a working-class readership, are used to show the continuing and developing debate around women in trade union activity. These sources have provided a wealth of resources for my first set of research questions and ample opportunities for a comparison between 'unskilled' and 'skilled' women workers' experiences of how involved trades unions were with the organisation of electronics workers and to what extent trade union opposition to women workers evolved over the interwar years.

Analysing such a wide variety of published and unpublished documents dating from the war and interwar years enables a nuanced understanding of the social, political and cultural attitudes that lay beneath the visual sources representing women. They also provide vital context to the reactions to and even the causes of the statistical data

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[32] Barbara Drake, *Women in Trade Unions* (Westminster: Labour Research Department, 1920).

that I use within this thesis. However, an important weakness of political sources such as *Labour* and trades unions congress reports that has been crucial for me to realise and address is that they provide the perspective of organisations and groups with very specific aims and ambitions in relation to working-class women, rather than the voices of the women themselves. They offer a lopsided perspective in that regard and therefore I have strived wherever possible to include the perspective and input directly from working-class women employed in the electronics industry. A key source regarding analysing individual working women's views on the gendered nature of the workplace, wages, union activity, working conditions and the technology itself comes in the form of correspondence and oral history interviews. For example, I use recordings from women working at the Courtaulds and GEC factories in Coventry in the interwar years, held at the University of Warwick's Modern Records Centre. Oral history interviews have been used effectively by historians such as Elizabeth Roberts in her 1986 book *A Woman's Place: An Oral History of Working-Class Women 1890-1940*.[33] Donald A. Ritchie argues that the use of oral histories such as this are an effective method of presenting a 'bottom up' form of history that demonstrated that 'no one group had an exclusive understanding of the past'.[34] A major weakness of recollections such as these is simply the passage of time and the reliance on the fallible and/or selective memory of older individuals. Ritchie highlights how 'some social historians have accused oral historians of swallowing whole the stories that informants

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[33] Elizabeth Roberts, *A Woman's Place: An Oral History of Working-Class Women 1890-1940* (Oxford: Blackwell, 1986).

[34] Donald A. Ritchie, *Doing Oral History: A Practical Guide* (Oxford: Oxford University Press, 2003), p.24.

tell them.'[35] Furthermore, oral historians such as James Macgregor Burns have found that interviews can generate spurious information and therefore to have true value to the historian 'must be used in conjunction with more conventional sources, like documents'.[36] In conjunction with what might be viewed as the more 'accurate' and 'objective' documentation and statistics, however, recollections offer a unique and valuable insight into how women working within the electronics industry felt about, recalled and experienced it. These sources help round out my answers to all three sets of research questions as they provide a viewpoint that is absent from the majority of the other sources I use, that is, individual women's views of their employers and of any industrial action that was undertaken. While recollections of work collected in the later decades must be treated with caution, they provide a unique perspective for the thesis and one that must be acknowledged when considering the impact the interwar electronics industry had upon working-class women's lives.

0.2 Literature Review

This thesis has been greatly influenced and informed by the large swathe of existing literature that is both directly related to my subject of study and has informed my methodology and overall approach to the sources I have collected and analysed. In this literature review I detail published scholarship that my thesis builds upon, and, in other cases, that my conclusions challenge or nuance. This literature review's first section begins with an overview of the historiography regarding the development of wireless technology in the war and interwar years. In section 0.2.2 I

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[35] Donald A. Ritchie, *Doing Oral History: A Practical Guide*, p.26.

[36] James Macgregor Burns, 'The Truth of the Battlefield' *The New York Times,* March 6, 1994, p.31.

examine the literature regarding the relationship between women and technology that has been important to take into consideration when establishing my methodology and tackling my research questions. Section 0.2.3 summarises the historiography of exhibitions and public demonstrations in the interwar years and their importance in relation to empire and the country. Following this I go through the significant studies that have been completed on women and the trade union movement. These studies help place women working in the electronics industry in the wider context of the developing relationship, positive and negative, women had with trades unions. In section 0.2.5 I summarise the historiography of women workers in the First World War, which provides a crucial context for the thesis. And finally, in Section 0.2.6, I examine broader historical studies of working women in the context of employment and gender in the interwar years.

0.2.1 The British Electronics Industry and Wireless Technology

In order to fully understand why and how electronics emerged as a new and one of the most important industries in interwar Britain, it has been vital to have a good understanding of the existing secondary literature that covers both the early use and selling of valves and radio technology alongside the economic, geographical and social reasons why certain companies succeeded and others failed. An important study in relation to valve technology is Keith R Thrower's 2009 book *British Radio Valves the Classic Years: 1926-1946*.[37] Thrower examines each major producer of British radio valves while looking at the innovations, strengths and weaknesses of the designs created by each of the British companies. He shows how 'from 1925

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[37] Keith R. Thrower, *British Radio Valves the Classic Years: 1926-1946* (Reading: Speedwell, 2009).

onwards there was rapid progress in valve design. Amongst the most significant developments was the change from the thoriated filament to oxide-coating, which, in turn led to the indirectly-heated cathode' and that 'further improvements in construction led to valves of smaller size and reduced electrode spacing, enabling them to operate at increasingly higher frequencies'.[38] Thrower's approach consists of a narrow focus by highlighting in detail the production of the technology and its variations. Thrower does not consider the context surrounding this production of radio valves, such as who was physically manufacturing the technology on a micro level on the factory floor, gender divisions at the workplace or why it was primarily women making the majority of interwar radio valves. This thesis, while ostensibly dealing with the same subject matter of the production of wireless technology as Thrower, focuses on the areas that he positions in the background.. This thesis therefore provides a broader context of class, gender and consumption to the work done by historians of technology such as Thrower. Whilst Thrower is focusing solely on the details of the technology and is approaching the subject from an engineer's perspective, his approach does provide important context for my thesis regarding the companies that produced these valves. For example, Thrower writes of the Metropolitan-Vickers Company that 'for the first few years, production was concentrated at their Trafford Park plant in Manchester. It was here that Short Path series of Valves was developed, which was introduced in 1925'.[39] In particular this thesis draws on Thrower and others to provide an overview of the development of the British electronics industry in the opening section of the first chapter. Whilst I do

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[38] Thrower, *British Radio Valves*, p.1.

[39] Thrower, *British Radio Valves,* p.11.

not emulate Thrower's sole focus on the specifics of the technology, studies such as this have been invaluable in providing the overview and details regarding interwar electronics companies; where, when and what kinds of British valves were being mass produced in the interwar years and how this fitted into the overall development of the technology.

Graeme Gooday's and Stathis Arapostathis's 2013 book *Patently Contestable: Electrical Technologies and Inventor Identities on Trial in Britain*[40] highlights not just the existence of patents, but the proliferation of them and the fact that disputes over them were a prominent feature in how British businesses operated from the nineteenth century onwards. The book states 'we see that that disputing invention was a recurrent characteristic for electrical investors, arguably for some even a deliberate strategy, albeit partially constrained by the normative credit-granting cultures of public life'.[41] The book also explores the 'role of the legal system in promoting debate about the identification of an inventor'.[42] It dedicates a chapter to the patents surrounding the development of early wireless telegraphy and it highlights how many of the initial disputes against patent holders such as Marconi 'were almost entirely fought without litigation'[43], with the press and public opinion used as a deciding factor for maintaining titles such as 'inventor'. Overall, in relation to this thesis, this chapter of the book effectively explains how and why

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[40] Stathis Arapostathis and Graeme Gooday, *Patently Contestable: Electrical Technologies and Inventor Identities on Trial in Britain* (Massachusetts: Massachusetts Institutes of Technology, 2013).

[41] Arapostathis and Gooday, *Patently Contestable,* p.9.

[42] Arapostathis and Gooday, *Patently Contestable,* p.4.

[43] Arapostathis and Gooday, *Patently Contestable,* p.4.

much of the early development of wireless revolved around Marconi and his company's patents and how a patent-centred culture engenders technological diversity — new inventions have to be different to existing forms to avoid infringement of patents. This also informs my overview of the British electronics industry in the opening of my first chapter.

Alongside the growth and successes of certain companies within the interwar electronics industry, other studies have examined the development of wireless and broadcasting as a cultural object and analyse how the technology shaped and was shaped by society. One such study is Mark Pegg's 1983 book *Broadcasting and Society 1918-1939*.[44] Pegg focuses on the listenership and the changing demographic of the audience in order to examine the cultural position of broadcasting within British society. Pegg argues 'the social consequences of these technical changes and the economic circumstances in which they were applied must be considered, otherwise many reasons for the pattern of listening would remain obscure'.[45] To achieve this, Pegg's methodology revolves around statistical data relevant to listener numbers, licence owners and the readers of the various British amateur wireless magazines that emerged following the First World War. Pegg emphasises how these sources allow insight into local and small communities based around their relationship to the new consumer wireless products and broadcasting, particularly the BBC, as its reach rapidly grew across the country in the 1920s. Pegg states that 'the local community is the ideal place to judge how broadcasting

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[44] Mark Pegg, *Broadcasting and Society 1918-1939* (Kent: Croom Helm Ltd,1983).

[45] Pegg, *Broadcasting and Society 1918-1939,* p.3.

informed and educated the public'[46]. He highlights one example of this by posing
the question 'did broadcasting introduce a tendency towards a standardised form of
English?'.[47] He also notes how broadcasting changed the nature of politics in the
country as election campaigns had to factor in the growing number of those getting
their news from the wireless set. Pegg's study demonstrates to what extent the early
enthusiasm for wireless was facilitated by the genuine enthusiast communities based
around it. Naturally, the book relies upon and focuses heavily on statistics and
sources from the BBC. This thesis draws on Pegg's work, but equally fills in some
of the gaps present in studies such as this by shifting the focus to gender and class at
a fundamental level, rather than the nebulous 'British public', when looking at the
production and consumption of wireless technology. I elaborate on Pegg's study by
examining how the workspace and workers were organised around the technology as
well as expanding on the consumption of the technology by focusing on women as
the main consumers of the technology.

0.2.2 Gender and Technology

When considering how women workers were represented by the state, the media and
the electronic manufacturing companies, it is important to have a grasp of the
historical trends relating to the depiction of women and new technologies. Perhaps
the most comprehensive and well-regarded example of a text providing such context
is Julie Wosk's 2001 book *Women and the Machine*.[48] Wosk analyses images,

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[46] Pegg, *Broadcasting and Society 1918-1939,* p.3.

[47] Pegg, *Broadcasting and Society 1918-1939,* p.4.

[48] Wosk, *Women and the Machine*.

photographs and advertisements of women alongside technology in the nineteenth and twentieth centuries to show how these depictions highlight 'the role of machines in helping women reconfigure and transform their lives' and 'the story of images that capture this sense of transformation and change, often brilliantly bringing to the surface deep-seated attitudes about women themselves'.[49] Wosk also uses her image centred source analysis to show how women could use machines to 'help them redefine their own identities- women challenging cultural stereotypes that pictured them as timid and fearful, childlike and frail'.[50] One example of this that Wosk highlights are photographs from the 1909 handbook 'Women and the Car' written by Dorothy Levitt, which Wosk summarises as an attempt by a woman to 'help other women become proficient drivers' but also as a 'revealing portrait of women's ongoing efforts to become mechanically proficient yet also remain appropriately feminine'.[51] While Wosk's work provides context necessary for my own study, its primarily influence is in its methodological approach in how to undertake a visual analysis of images and what needs to be considered such as the gender of the creator, where an image was published and the intended audience for images and photographs. This has been an invaluable influence on how to approach visual sources that depict women and technology, and to investigate how they can project multiple and often contradictory meanings via the interplay of technology and gender. I contribute to this examination of historical visual depictions of women and technology by focusing on areas that Wosk does not fully develop, which includes women employed in the electronics industry, wireless advertisements, press

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[49] Wosk, *Women and the Machine,* p.1.

[50] Wosk, *Women and the Machine,* p.1.

[51] Wosk, *Women and the Machine,* p.136.

photographs of live events and exhibitions, as well as by focusing on the interwar years as a specific and defined period.

Other historians that analysed visual sources through the framework of gender history have tended to focus on advertisements either featuring women or aimed at women consumers. Lori Anne Loeb's 1994 book *Consuming Angels: Advertising and Victorian Women*[52] for example, does this and argues that consumer culture and a form of hedonism centred on material culture emerged in the nineteenth century and was in large part aimed directly at women. Loeb states 'in the periodical press women, the clear audience for most nineteenth century advertisements, encountered all the puffery and paraphernalia that a Victorian consumer society supplied'.[53] Loeb's methodology utilises a wide variety of images and advertisements to highlight the social anxieties of the period, the domestic ideology, and the aspirational nature of nineteenth century consumer culture. I expand on studies such as this by showing how consumer culture and advertisements re-gendered the wireless as a consumer technology new to the interwar period. To achieve this, it has been crucial to understand what differentiates nineteenth-century British consumer culture from consumer culture during the interwar years. These two studies have greatly influenced my cultural history methodological approach and the centring of visual records and sources in examining the developing representations, debates and inter-play between new technologies and the changing representations and perceptions of women.

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[52] Lori Anne Loeb, *Consuming Angels: Advertising and Victorian Women* (Oxford: Oxford University Press, 1994), p.5.

[53] Loeb, *Consuming Angels,* p.5.

Due to my focus on the visual representations of women both in images and at public exhibitions it is important to acknowledge the work that has been done on consumer culture in relation to technology, beauty, and appearance. James F. Stark's 2020 book *The Cult of Youth Anti-Ageing in Modern Britain* analyses how emerging technologies and products for anti-aging fostered a cultural and social desire for rejuvenation and youthfulness due to their commercialisation. Stark posits that the interwar years 'concretised many of the features which have since persisted: an imperative for women to remain young and attractive, deep commercial drivers behind product generation and marketing, appeals to the importance of enhanced productivity and social utility in later life'.[54] In this book Stark also explores how trends such as electrotherapy were linked to notions of scientific rejuvenation during this period. A chapter of this book is devoted to the ways in which electricity became linked to the desire for rejuvenation of the body through devices such as 'face masks which employed the technique of diathermy, electrical massage and exercise devices, and violet ray apparatus'.[55] Devices such as the Overbeck rejuvenator are highlighted as symbolic of this trend. Stark ties the growth of a consumer culture around anti-aging directly to the increasing adoption and acceptance of electricity into the home. This study has been an important influence when undertaking my analysis of visual sources, such as of promotional models at Radiolympia, as it places them within the gendered and youth-based consumer culture of the period. I will expand on this study by demonstrating how youth was

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[54] James F. Stark, *The Cult of Youth Anti-Ageing in Modern Britain* (Cambridge: Cambridge University Press, 2020), p. 207.

[55] Stark, *The Cult of Youth Anti-Ageing in Modern Britain,* p.107.

also linked to concepts of modernity through the imagery of young women working on and promoting wireless technology.

A key piece of research that focuses on the changing depictions and visibility of women in the interwar years is Liz Conor's 2004 book *The Spectacular Modern Woman: Feminine Visibility in the 1920s*.[56] Conor approaches the subject by focusing on the visual culture of femininity in 1920s Australia. She argues that 'the visual extent of the modern significatory scene spectacularised the feminine and produced a new subjectivity in which the performance of the feminine became more concentrated on the visual'.[57] Conor concludes this by examining the ubiquity of the flapper or 'New Women' across all visual mediums during the 1920s. Conor describes the flapper as 'willing to exploit new technologies associated with mobility, leisure and amusement, and she handled them adeptly'.[58] Conor's work effectively highlights how the concept of 'modernity' influenced depictions of gender during the interwar years. This is an important aspect to consider for this thesis. However, I focus on an area Conor does not highlight or give much consideration to, that is, class differences in the visual depictions of women, and how female workers were represented by the companies they worked for, in advertisements and as trade union members. While the concept of modernity, in regard to both new technology and women's new roles in its production, is an important consideration, it is also important to discuss in what ways supposedly 'modern' depictions of women actually reinforced older notions, particularly in

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[56] Liz Conor, *The Spectacular Modern Woman: Feminine Visibility in the 1920s* (Bloomington: Indiana University Press, 2004), p.6.

[57] Conor, *The Spectacular Modern Woman,* p.6.

[58] Conor, *The Spectacular Modern Woman,* p.216.

relation to gender and work. In this thesis I contribute to this visual methodological approach of gender historians by focusing on an area that existing studies do not consider. I examine official company photographs and images that provide direct insight into the gendered nature of the workplace and not just broader social perceptions. In terms of consumer culture, I add to the existing scholarship by exploring the construction and consumption of wireless technology through the framework of gender and cultural history to demonstrate how the technology became gendered through its depiction in advertisements and magazines.

It has been crucial when considering women as consumers of new interwar electronics and when considering surviving wireless sets from the period as historical objects of study, to be aware of previous work done in this regard, specifically, on advertising, programming and material culture. As Deborah G. Johnson summarises 'technology is socially shaped; gender patterns in society can therefore be reproduced in constituting technology. At the same time, technology shapes society; if gender has been coded into technology, that technology may reinforce gender patterns'.[59] A chapter of the thesis is dedicated to the interwar development of women as consumers of electronics and the transition of the wireless from a male centric hobbyist item to an object defined by the domestic household scene. A key piece of research regarding this is Maggie Andrews's 2012 book *Domesticating the Airwaves: Broadcasting, Domesticity and Femininity* which examines how wireless became defined by the domestic space and informed by it through the kinds of broadcasts it brought into the home. In contrast to this thesis,

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[59] Deborah G. Johnson, 'Introduction' in *Women, Gender, and Technology,* ed by. Mary Frank Fox, Deborah G. Johnson, Sue V. Rosser, Sue Vilhauer Rosser, (Springfield: University of Illinois), pp.1-12, (p.3).

Andrews focuses solely on this topic and covers the period from the introduction of consumer wireless in the 1920s up until the present day. Andrews describes her approach as one counter to the common tendency to make histories of wireless one of the BBC and that 'a historical approach, which focuses upon the relationship between broadcasting and domesticity, will offer an alternative history of the medium'.[60] Andrew's uses a multi-disciplinary methodology that consists of a 'textual analysis of a range of radio and television texts' and the use of oral history interviews which have 'provided an alternative and more personal approach to the material'[61]. I take a similar methodological approach to sources through the entirety of this thesis and, in particular, for the chapter focusing on women as consumers. Whilst Andrews' work and methodology has been a great influence there is clear room for expansion and further research, particularly in relation to the class divisions that were experienced in the interwar years. I expand on Andrews's analysis of the domestication of the interwar wireless, the growth of the middle-class female listener and programmes dedicated to them by intertwining this with an analysis of the use of working-class female labour to produce the electronics. As a result, the thesis goes beyond a gendered analysis of the wireless to consider classand the ways in which new technologies altered (or did not alter) the class dynamics between women from differing economic backgrounds.

When providing any analysis of the domestic space, even if it not the main focus of this thesis, it is crucial to acknowledge the work and influence of social historians such as Ruth Schwartz Cowan and her study of the widespread adoption of

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[60] Maggie Andrews, *Domesticating the Airwaves: Broadcasting, Domesticity and Femininity* (London: Continuum International Publishing, 2012), p.1.

[61] Andrews, *Domesticating the Airwaves,* p.1.

electricity and the availability of new labour-saving devices aimed specifically at housewives. Ruth Schwartz Cowan's 1983 influential work *More Work for Mother*[62] explores the realities of women's traditional role in housework and household management with their growing presence as a market of consumer products. Cowan's work is an important landmark in labour historiography as it openly and forthrightly positions housework as work which, like other forms of work, is influenced and shaped by technology employed in the workplace.[63] Cowan argues that technology and tools 'will do the jobs we want done; but, once obtained, the tools organise our work for us in ways that we may not have anticipated'.[64] Cowan argues that many new households appliances often led to an increase in the amount women had to complete in the house, rather than it being alleviated by the technology. While this thesis takes into consideration how the production of wireless technology shaped the workplace and women's role within it, Cowan's work makes a convincing case that, if I am to consider working-class women's relationship with technology, it is important to include the consumption of the technology within this. The wireless set is not a tool or labour-saving device and therefore by highlighting it I add nuance to the work done by Cowan by showing how other forms of technology, even ones based around leisure, reshaped the domestic space, which was for many women also a workplace. This crucial point emphasised by Cowan is

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[62] Ruth Schwartz Cowan, *More Work for Mother: The Ironies of Household Technology from the Open Hearth to the Microwave,* (New York: Basic Books, 1985).

[63] Traditional Marxist studies published in the 1960s and 1970s on labour and work conditions neglected to consider the unpaid labour undertaken by women in the domestic space. Feminist and gender historians have devoted more attention to this factor following the publication of studies by those such as of Ruth Schwartz Cowan to highlight the discrepancy between male and female unpaid work.

[64] Cowan, *More Work for Mother*, p.9.

important for the chapter based on women's consumption of the wireless, placing the technology in middle-class domestic women's 'workplace'.

0.2.3 Interwar Exhibitions

Much of the existing literature regarding exhibitions of technology and industry highlight the significance of the British Empire Exhibition (1924-1925) as an event used by the British state to promote its imperial power, ingenuity, and progress. In his 1997 book *Exhibiting Electricity* K. G. Beauchamp demonstrates how one of the key features of these public exhibitions was electricity and its use by other technologies. Beauchamp provides a chronological overview of many exhibitions from early Victorian ones to more recent examples. Beauchamp stresses the cultural importance of public exhibitions and argues 'exhibitions themselves are important not only to provide a given generation with a summary of its current capability but also to present a forum for new inventions and techniques, often shown to the public for the first time'.[65] The book positions the British Empire Exhibition as a show of pride and self-promotion where 'in the large palaces of industry and engineering that the technical progress of the post-war years was seen most clearly. It offered more than a great collection of exhibits illustrating the advancements made by the leading inventions of the time; it also set out to bring to the public the inventions of engineers upon which this progress depended'.[66] I adopt a similar approach when looking at the Radiolympia exhibition as a celebration of a domestic industry. I

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[65] K. G. Beauchamp, *Exhibiting Electricity* (The Institute of Electrical Engineers, 1997), p.xii.

[66] Beauchamp, *Exhibiting Electricity,* p.249.

expand and add to his overview of radio exhibitions by analysing Radiolympia through the framework of gender.

In his chapter in the 2000 book *Exposing Electronics* Alan Q. Morton examines the ethos and approach of a single exhibit at the 1924-1925 British Empire Exhibition. Morton focuses on the Exhibition of Pure Science which displayed the cathode ray tube J.J Thomson used in his discovery of the electron. Morton argues that this interwar exhibit is an 'an example of how the technical discourse of scientists and the public's understanding of science are linked. In this case, not only was the public's understanding of science informed by scientific discourse, public attitudes to science influenced the technical discourse of scientists'.[67] Morton argues that the discovery of the electron and its associated cathode ray tube were presented at the British Empire Exhibition in manner that constructed a new public image of the research and that this led 'to the establishment of a permanent public space for science, what became the Science Museum in London'[68]. He concludes that 'what was new for the public was a vision of pure science'.[69] I have taken influence from Morton's work in how it shows the interplay between exhibitions shaping public opinion on technology and the audience shaping the aesthetics of an exhibition. However, I take a significantly different approach by focusing my analysis not just on the objects or the planning of the exhibition, but on those working alongside the technology on the show floor. The interwar Radiolympia Exhibition has received

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[67] Alan Q. Morton, 'The Electron Made Public: The Exhibition of Pure Science in the British Empire Exhibition, 1924-5' in *Exposing Electronics* ed by. Bernard Finn (London, Science Museum, 2003), pp. 25-44 (p.26).

[68] Morton, 'The Electron Made Public', p.40

[69] Morton, 'The Electron Made Public', p.40.

little attention in the existing literature. However, Michael John Law's 2018 book *1938: Modern Britain Social Change and Visions of the Future* argues that 1938 was the year when Britain was experiencing significant social changes and that representations and images of modernity were being constructed and displayed at projects such as Radiolympia. Law summarises his book's aims as 'six case study chapters that interrogate the relationship between modernity and the social and cultural elements'.[70] He argues that one of these important elements during the interwar years was Americanization, explaining that 'American music had been popular since arrival of ragtime in the late nineteenth century. The early interwar years saw the rising popularity of the gramophone and by the 1930s Hollywood movies were very popular in Britain in the 1930s and influenced language, fashion and behaviour. The widespread consumption of American novels and story papers reinforced their impact'.[71] While Law does devote a chapter to the 1938 Radiolympia exhibition in an attempt to reflect on Britain's imagery of modernity, this thesis greatly expands on this and fills areas that Law's chapter neglects. For example, Law does not give much attention to the image and aesthetics of the Exhibition itself and focuses instead on how it helped disseminate the technology. I will show how modernity and gender were represented through the people, mainly women, employed at the show and not just through the technology itself.

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[70] Michael John Law, *1938: Modern Britain Social Change and Visions of the Future* (London: Bloomsbury, 2018), p.8.

[71] Law, *1938: Modern Britain Social Change and Visions of the Future,* p.7.

0.2.4 Women and the Trade Union Movement

Many histories of the trade union movement in the interwar years (and overall) that were published in the 1960s and 1970s came from a Marxist perspective. They tended to neglect the growing importance of working-class women members amongst the trade unions' ranks. Groups of women such as those that worked in electronics who experienced a lack of trade union representation receive little or even no attention in such studies, with interwar women electronic workers being perhaps the least discussed due to the Amalgamated Engineering Union's consistent stance against women members being admitted. A clear example of this trend is seen in the studies on interwar trade unionism and trade unionism as a whole produced in the 1970s such as Albert Edward Musson's 1972 book *British Trade Unions, 1800–1875*[72] which acknowledges the deep 'divisions between artisans and others i.e. skilled craftsmen and semi-skilled or unskilled workers'[73] but makes no mention of how women industrial workers were deeply embedded in this division and how this informed how many trades unions perceived them. This is also the case in the 1970s literature that focuses on longer periods including the interwar years. For example, John Christopher Lovell's 1977 book *British Trade Unions 1875–1933*[74] makes no mention of women trade union members or even any attempt by the trade union movement to recruit the women workers who were entering the workforce of new industries such as electronics in increasing numbers during this period.

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[72] Albert Edward Musson, *British Trade Unions, 1800–1875* (London: Macmillan, 1972).

[73] Musson, *British Trade Unions,* p.16.

[74] Christopher Lovell, *British Trade Unions 1875–1933* (London: Macmillan, 1977).

This apparently widespread blind spot of how sex and gender were increasingly intertwined with the trade union movement, particularly following the First World War and the influx of female labour, did not go unchallenged. Unsurprisingly, within the context of the rise of second wave feminist approaches to history, women historians in the 1970s made a point of highlighting the often-overlooked story of women and the trade union movement. Once of these historians is Sheila Lewenhak in her 1977 book *Women and Trade Unions: An Outline History of Women in the British Trade Union Movement.*[75] It is clear Lewenhak was acutely aware of the research gap she was attempting to fill in the 1970s with this study, stating that there had been 'so little written about women's trade unionism, in fact only one major work all told, that the contents of this book may come as something of a shock to many readers' and that 'even economic and specialist Labour historians have tended to treat women as also-rans when dealing with labour struggles and organisation'.[76] Much has been done to mitigate this in the following decades particularly in the 1980s and 1990s as feminist schools of thought and gender studies challenged many orthodox tenets of Marxist labour history. This can be seen in the work of Sarah Boston, specifically in her 1987 book *Women Workers and the Trade Union Movement.*[77] Boston chronicles the historical challenges and confrontations women workers faced in order to attain acceptance and equal status from the trades unions. Her context was the overall reduction of trade union and collective bargaining power that was experienced in the 1980s. She emphasises that 'above all the past decade

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[75] Sheila Lewenhak, *Women and Trade Unions an Outline History of Women in the British Trade Union Movement* (New York: St. Martin's Press, 1977).

[76] Lewenhak, *Women and Trade Unions,* p.1.

[77] Lewenhak, *Women and Trade* Unions, p.1.

has been a harsh reminder that women can *never* take for granted any rights that they have won. Rights, as the last ten years have shown, have to be defended and support rallied for their defence'.[78] This thesis highlights the same plight but also emphasises how certain industries and jobs became increasingly feminized in the interwar period despite the fact that several specialist and skilled trades unions remained in complete opposition to the idea of admitting female members, or to fighting for equal pay for women.

In the 1990s and 2000s gender studies have also further helped to re-contextualise working women's place in British labour history. In *Class and Gender in British Labour History: Renewing the debate or starting it?*[79] the editor of the collection, Mary Davis, argues that 'a gender and colour-blind misapplication of Marxist theory has resulted in a partial understanding of class which has had a profound repercussion in labour historiography and labour movement practice' and that a more fruitful approach is one that has 'the ability in theory and practice to connect the hitherto separate spheres of class, race and gender in a manner that comprehends both their distinctiveness and inter-relationship'.[80] While, like this thesis, the essays in this collection describe themselves as analysing 'gender', they primarily deal with women's social, political and economic roles in working-class history. Davis justifies this by arguing that studies such as this are not simply women's history but that 'gender is increasingly used as an analytical tool, thus establishing a framework

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[78] Sarah Boston, *Women Workers and the Trade Union Movement* (London: Davis-Poynter, 1980), p.8.

[79] Mary Davis 'The Making of the English Working Class Revisited: Labour History and Marxist Theory' ed by Mary Davis in *Class and Gender in British Labour History: Renewing the Debate or Starting it?* (London: Merlin Press, 2011), pp. 12-29.

[80] Davis, 'The Making of the English Working Class Revisited', p.12.

within which women can at last be analysed as active historical actors, rather than as victims of historical events'.[81] This has been an important point for me to consider when tackling my subject as my thesis focuses on explaining the changing role of women within and around the electronics industry, and I utilise gender as an analytical tool to achieve this.

0.2.5 The First World War and the Employment of Women

The most prevalent school of thought regarding the First World War's impact on women emerged in the 1960s and 1970s. It argued that the war had been a catalyst in 'emancipating' women from their pre-war conditions and limitations. This line of thinking was influenced by wartime propaganda produced promoting women's contributions and is embodied in the work of historians such as David Mitchell in his book *Women on the War Path*.[82] Mitchell places women workers 'squarely in the thick of the battle'[83] but simply regurgitates official narratives of First World War propaganda. This emancipation narrative has survived in a limited manner in contemporary popular work, for example, Neil R. Storey's and Molly Housego's 2010 book *Women in the First World War*.[84] The book focuses on four specific aspects of women's war-time work: nursing, munitions, the land army and women in the military. The book makes liberal use of illustrations and photographic sources to

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[81] Mary Davis, 'Introduction' ed by Mary Davis in *Class and Gender in British Labour History: Renewing the Debate or Starting it?* (Hyde: Merlin Press, 2011), p.1.

[82] David Mitchell, *Women on the War Path: The Story of the Women of the First World War (*London: Cape, 1966).

[83] Mitchell, *Women on the War Path,* p.15.

[84] Neil Storey and Molly Housego, *Women in the First World War* (Oxford: Shire Publications Ltd, 2010).

illustrate its overall point that the war provided expanded and new opportunities for women. For example, the book uses a studio portrait of a land girl in her work uniform to demonstrate that 'she is proudly showing off her smart boots and buskins as well as a hint of her breeches-this would certainly have been considered risqué before the war'.[85] However, while the book does effectively demonstrate the impact the war had on changing the gendered perceptions of women, it does not focus much on the interwar situation beyond some allusions to the various attempts to create all female football teams. The book places the First World War as the starting point for the transformation of women's role within society - 'the emancipation of women had begun'.[86] However, thanks to the work of many feminist historians over the last two decades this narrative is no longer accepted by historians as the correct assessment regarding how transformative the First World War was for women in Britain.

The emancipation narrative was most strongly challenged in the 1980s and 1990s by historians such as Gail Braybon and Deborah Thom. In her 1981 book *Women Workers in the First World War*[87] Braybon concludes that many of the gains women had obtained during the war were negated in the following years and that 'therefore, women's work in the 1920s was of a similar nature to pre-war employment'.[88] Following on from Braybon, Thom emphasises the fact previous historians had focused heavily on 'skilled' middle-class wartime workers and argues for the

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[85] Storey and Housego, *Women in the First World War*, p.47.

[86] Storey and Housego, *Women in the First World War*, p.62.

[87] Braybon, *Women Workers in the First World War*.

[88] Braybon, *Women Workers in the First World War*, p.220.

importance of representing the voices and recollections of working-class women to avoid placing 'the author of a piece of women's history at the centre of her own story'.[89] Thom reaches similar conclusions to Braybon while also arguing women had made certain advances in terms of their rights and roles, in part via the suffrage movement, which was well-established by 1914: 'War did not find women serfs. They were already emancipating themselves by organising themselves by origination and agitation. Nor did it leave them free'.[90] This narrative was maintained and elaborated on throughout the 2000s by historians such as Susan Grayzel who acknowledges the limited nature of the war's impact in that it undeniably brought about changes for some women, but not changes that were as fundamental or as seismic as earlier historians had insisted.[91] In *Evidence History and the Great War: Historians and the Impact of 1914-18*[92] Braybon directly challenges the notion that the war was a moment of emancipation for the majority of women. She argues that historians such as Susan Kingsley Kent[93] and literary critics such as Sandra Gilbert[94] ineffectually construct their emancipation narrative because they 'eschew detail, satisfy themselves with a small range of sources, and choose to discuss women- as though all ages and classes went through a single, defining war

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[89] Thom, *Nice Girls and Rude Girls*, p.2.

[90] Thom, *Nice Girls and Rude Girls*, p.114.

[91] Susan R. Grayzel, *Women and the First World War* (London: Routledge, 2002).

[92] Gail Braybon 'Introduction' in *Evidence History and the Great War: Historians and the Impact of 1914-18,* ed.by Gail Braybon (Oxford: Berghahn Books, 2003).

[93] Susan Kingsley Kent, *Making Peace: The Reconstruction of Gender in Interwar Britain* (Princeton: Princeton University Press,1993).

[94] Sandra Gilbert and Susan Gubar, *No Man's Land: The Place of the Women Writer in the Twentieth Century* (New Haven: Yale university Press, 1989).

experience' while relying too heavily on 'literary texts'.[95] For historians such as Braybon and Grayzel, any changes deemed to have been brought about by the war need to be viewed alongside continuities in long-standing gendered attitudes towards female labour and the prioritisation of motherhood as women's primary role. Statements such as this are commonplace throughout much of the literature regarding women's employment during the war.

While this thesis does not dispute these conclusions, it does develop and nuance them further. By focusing on the interwar electronics companies, I show how wireless technology developed in the war was transformative in terms of centring women in the developing technology-based consumer culture and providing thousands of new employment opportunities for young working-class women. As I demonstrate, these developments did not end pre-war understandings of gender in relation to consumption, work and technology. However, they did complicate and often contradict them. I also expand upon existing studies by focusing on visual representations of women workers and consumers. The work of the historians above has led me to analyse the continuities between the work done by women in the electronics industry and earlier forms of gendered work, while still arguing for the significant changes that emerged in the interwar years regarding women and their relationship to wireless technology.

In her 2020 journal article "Uncertain at Present for Women but, May Increase": Opportunities for Women in Wireless Telegraphy during the First World War' Elizabeth Bruton provides a nuanced study of the opportunities made available for women to work within the General Post Office (GPO) during the First World War.

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[95] Braybon 'Introduction', p.15.

Bruton's study of women working in wireless telegraphy 'contradicts established histories of women in wireless communications in Britain in the mid-1920s' as 'these histories generally depict female radio amateurs and women working in broadcast radio as the first women to operate wireless sets'.[96] Bruton challenges this perception and shows that women were employed to work as professional wireless operators by the GPO, Royal Navy and Royal Air Force during the war. The article concludes that this work took place in the context of 'increased opportunities for women in telecommunications during the First World War, opportunities that can be located within pre-war and wartime women's movements—mostly suffragettes and suffragists—who sought to serve their country and to free up men for frontline military service'.[97] This is an important article as it gives agency to the women who were able to take of advantage of the new (if temporary) opportunities for working with wireless telegraphy at a professional level. Furthermore, in this article Bruton highlights an area of women's work that has been overlooked by much of the historiography concerning wireless and wartime work. My thesis takes a different approach by focusing on representations of women, however this study's challenging of the historiography remains an influence over my own work.

Another important work that has been a major influence on this thesis is Margaret Higonnet's and Patrice Higonnet's 1987 essay 'The Double Helix'. This essay poses the question of the First World War's impact on women as: 'when is change not

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[96] Elizabeth Bruton, 'Uncertain at Present for Women, but May Increase: Opportunities for Women in Wireless Telegraphy during the First World War' *Information & Culture* 55 (2020), pp.51-74 (p.67).

[97] Bruton, 'Uncertain at Present for Women', p.67.

change?'.[98] It argues that while women did experience real changes in the years

following the First World War, they did not alter the fixed power structures that

positioned women's work as subordinate to men. The Higonnets use the imagery of

a double helix to frame their argument. They argue that imagery of the double helix

demonstrates 'a persistent system of gender' where 'the female strand on the helix is

opposed to the male strand, and position on the female strand is subordinate to the

position on the male strand'.[99] Using this framework of structural continuities to

examine the supposed changes brought about by the First World War, the essay

concludes 'war does not change but rather exacerbates the social and political order'

but 'at the same time however, a study of war is truly productive for the study of

women and social change, because war crystallises contradictions between ideology

and actual experience'.[100] It argues, in sum, that wartime shortages forced

employment changes for women but underlying gender assumptions were merely

supressed or disguised rather than forgotten and that any changes experienced by

women happened within the gendered framework of the 'double helix'. This thesis

builds on these conclusions and applies them to the interwar electronics industry.

0.2.6 Women and Gender in the Interwar Workplace

Following on from literature related to the impact of the First World War on

women's working lives it has proven vital to look at works that offer varying

perspectives and methodologies directly tackling the subject of the employment of

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[98] Margaret Higonnet and Patrice Higonnet 'The Double Helix' in *Behind the Lines: Gender and the Two World Wars* ed by Margaret Higonnet and Jane Jenson (New Haven: Yale University Press, 1987), pp. 31-50 (p.31).

[99] Higonnet and Higonnet, *Behind the Lines: Gender and the Two World* War, p.34.

[100] Higonnet and Higonnet, *Behind the Lines: Gender and the Two World Wars*, p.41.

women within the new growing interwar industries. Historians of gender and

women's work take a different perspective to interwar employment, including

feminist, social history and Marxist approaches.[101] Economic historians such as T.J.

Hatton and R.E. Bailey have examined the interwar trends regarding female

employment and have concluded that 'despite a gradual change in attitudes towards

women's work from the turn of the century, the statistics on female participation

display little change: female employment was still largely concentrated among

single women, and in a narrow range of occupations'.[102] This broad approach does

not take into account the difference and importance of the rise of new industries

such as the electronics industries. As I note above, feminist historians have critiqued

the narrative that the interwar years continued the transformation brought about by

the First World War in relation to gender and their work has greatly informed this

thesis. Miriam Glucksmann in her 1990 book *Women Assemble*[103] argues the

interwar industries that were opened to women factory workers imposed newly

gendered restrictions by organising the workplace around the mass production of

products. In order to fully evaluate the truth of such statements it has been important

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[101] Adrian Bingham, *Gender Modernity, and the Popular Press* (Oxford: Clarendon Press, 2004). Alison Fell, *Women as Veterans in Britain and France after the First World War* (Cambridge: Cambridge University Press, 2018). Henrietta Heald, *Magnificent Women and their Revolutionary Machines* (London: Unbound,2019). Julie V. Gottlieb and Richard Toye, *The Aftermath of Suffrage* (Basingstoke: Palgrave Macmillan, 2013). Karen Hunt, 'Labour Women and the Housewife' in *Women's Periodicals and Print Culture in Britain, 1918-1939: The Interwar Period,* ed.by Catherine Clay (Edinburgh: Edinburgh University Press, 2018). Lisa Adkins, *Sexuality. Family and the Labour Market* (Philadelphia: Open University Press,1995). Sian Reynolds, *France Between the Wars: Gender and Politics* (London: Routledge, 1996). Susan Kingsley Kent, *Making Peace: The Reconstruction of Gender in Interwar Britain* (Princeton: Princeton University Press, 1993).

[102] T. J. Hatton and R. E. Bailey, 'Female Labour Force Participation in Interwar Britain' *Oxford Economic Papers,* 40 (December 1998), p.696.

[103] Glucksmann, *Women Assemble.*

to look at the overall role women played in the interwar years, both in terms of employment in general and the state's reaction to it, and of the gendered aspects of the newly emerging consumer electronics industries that gained prominence during the interwar years. Glucksmann concludes that 'women were the pilots and pioneers of the new relation between capital and labour which was integral to mass production'.[104] She utilises 'a feminist and historical materialist'[105] framework to place women at the centre of consumerism, industrial development and working-class labour relations during Britain's interwar years. In utilising company records, national statistics and interviews Glucksmann constructs a nuanced perspective in comparison to that of the traditional Marxist view and emphasises how gendered expectations contributed to the sexual division in the workplace, arguing 'that women have class relations in their own right'.[106] Glucksmann's perspective has been important in influencing how I analyse representations of women in the workplace, by focusing on the sexual divisions that are unintentionally or intentionally revealed in images of women working in the electronics industry. That said, my thesis differs from Glucksmann's approach as I place more emphasis on the differences between classes of women. I do this this by focusing on both the manufacturing and consumption ends of the production cycle of mass-produced wireless technology. Furthermore, I devote more time to the trade union and non-trade union industrial action taken by the women electronics workers which had its own gendered divisions that Glucksmann does not highlight.

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[104] Glucksmann, *Women Assemble,* p.4.

[105] Glucksmann, *Women Assemble*, p.35.

[106] Glucksmann, *Women Assemble*, p.267.

More recently, scholars such as Clare Wightman have argued against an approach that places gender ideology as singularly important. For Wightman, 'market circumstances, the need for flexibility' and a 'continuing reliance on skilled male workforces'[107] all played a key role in the organisation of the interwar female workforce. Wightman contrasts her study with the work of Glucksmann by attempting to focus on aspects of female employment other than gender in the workplace. For example, she states 'those who stress the agency of ideology neglect what is a more complicated picture' and argues that these writers focus too heavily on the concept that 'employers, driven by gender ideology, defined women's work as consisting of unskilled, fragmented, repetitive tasks'.[108] This is a fair point in relation to skilled work in the engineering and electronics sectors as can be seen from the writings of Katharine Parsons during the interwar period and the establishment of the WES, which reveals that there were indeed women employed in skilled engineering and electrical engineering positions. However, Wightman perhaps overstates the number of such examples. Carroll Pursell highlights that as early as 1922 Parsons considering shutting down the WES due to 'small membership, and even smaller treasury, and a generally hostile environment to women engineers'[109] and as late as 1932 the King's College London Engineering Society resisted accepting female members. Furthermore, between 1916 and 1938

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[107] Clare Wightman, *More than Munitions: Women, Work and the Engineering Industries 1900-1950* (Essex: Addison Longman Limited, 1999), p.13.

[108] Wightman, *More than Munitions,* p.186.

[109] Carroll Pursell, ''Am I a Lady or an Engineer?' The Origins of the Women's Engineering Society in Britain, 1918-1940', *Technology and Culture*, 34 (January 1993), pp.78-97 (p.91).

only 'about 35 ladies were admitted to various classes of membership'[110] into the Institution of Electrical Engineers. Wightman also does not differentiate her perspective on gendered expectations in comparison to Glucksmann in any clear way and it is not evident to what degree she disagrees with Glucksmann's approach, as Wightman also acknowledges the prevalence of gendered expectations regarding the type of jobs women were commonly assumed to be most suitable for. My thesis builds on both Glucksmann and Wightman by demonstrating that economic incentives and gender perceptions were not separate developments. Rather, in the interwar electronics industry they were intertwined and changed the gendered representations of the work done in places mass producing electronic goods. I contribute to these studies by focusing solely on one new interwar industry, electronics. Furthermore, I adopt a broader methodological approach which incorporates more sources directly from the electronics companies themselves, more analyses of images and photographs and, where possible, some use of existing interviews with the working-class women who worked at these companies at the time. This ensures that women's actual voices are not lost in an attempt to discuss them as a uniform 'female' workforce. Including women's voices and individual company records adds a vital 'bottom up' approach that offers a richer and more rounded analysis of the experience and representation of women's interwar industrial work than one that takes an exclusively macro view of multiple industries.

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[110] Rollo Appleyard, *The History of Institution of Electrical Engineers 1871-1931* (London: Institution of Electrical Engineers: 1939) pp.167-168.

Celia Briar's 1997 book entitled *Working for Women?*[111] builds upon this framework but looks at the employment of women from a long-term perspective, from the years 1905 to 1995. Rather than looking at specific industries, Briar focuses on the economic and social policies implemented by the British state throughout these years and examines how they shaped gender divisions at work. For example, Briar highlights how early unemployment acts such as the 1905 Unemployed Workmen Act which were supposedly implemented to deal with all unemployment initially included 'no work schemes for unemployed women'.[112] Briar utilises a feminist perspective with a focus on government policy to analyse the patriarchal structures and assumptions that underpinned legislation and government policy regarding women workers in the interwar period, as well as offering an economic analysis of women's response to war work. For instance, rather than attributing the influx of female workers to patriotic duty in the First World War, as Neil R. Storey and Molly Housego do, Briar states that the wartime mobilisation of a female workforce was due to economic necessity and finally being given the option of paid employment as 'many women were still unemployed and seeking work'.[113] Following the 'double helix' theory, Briar argues that government policies emphasised that women were merely substituting for men's roles and that, as a consequence, gender divisions at work 'were never significantly eroded'.[114] Briar contrasts this with what she views as the misleading rhetoric of government

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[111] Celia Briar, *Working for Women: Gendered Work and Welfare Policies in Twentieth Century Britain* (London: UCL Press Limited, 1997), p.14.

[112] Briar, *Working for Women,* p.14.

[113] Briar, *Working for Women*, p.32.

[114] Briar, *Working for Women,* p.33.

officials who promised that 'gratitude to women would ensure that their improved industrial conditions were permanent'.[115] Briar makes a convincing argument that the patriarchal power of both the state and employers conspired to make the interwar period one where 'the small gains achieved by hard work before and during the First World War were systematically removed'[116] such as in the government's attempt at re-training industrial workers as domestic servants. One area which Higonnet and Briar do not completely integrate into their overall thesis is the role that the trades unions played in opposing the employment of women and how they also facilitated the retraction of pre-war guarantees alongside the government and employers. By dedicating a full chapter to the trades unions and their opposition to women workers, I ensure I do not neglect this area, at least in regard to women employed in the interwar electronics industry. Briar also makes little mention of the new industries such as electrical engineering and electronics, and how they fitted into the regression of progress beyond stating 'some occupations were feminised' but that 'most of the new jobs were classed (and paid) as unskilled'.[117] Studies such as Briar's reinforce the commonplace narrative that women as a whole were dismissed from their wartime jobs and returned to more gender 'suitable' positions. In contrast, this thesis shows that that while nationally this narrative has merit, new industries such as electronics were entirely defined by their continued and expanded use of female labour and came to be seen as a new kind of 'women's work' albeit with a continuity with older forms of 'women's work' such as textiles.

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[115] Briar, *Working for Women*, p.44.

[116] Briar, *Working for Women,* p.64.

[117] Briar, *Working for Women,* p.62.

Given the focus of this thesis, it has also been important to explore studies that look at a single industry and encompass the interwar years. Laura Lee Downs' examination of the British and French interwar metal working industry proposes that 'it is not sufficient […] to assert that metals employers simply imported into their factories the gender divisions familiar outside of the halls of production' but that the male employers' convictions regarding gender 'emerged transformed from the process whereby work was restructured during and after World War 1'[118]. This comparative history demonstrates how during the war traditional notions of gender brought about a new reorganisation of the workplace and informed how the development of notions of 'skill' came to be mapped along gender lines. Downs concludes 'when the principle of sexual division was applied in the microcosm of the metals factory, those managers who applied it, and those workers who had to live by it, wrangled over the placement of the line between men's work from women's work. But the existence of the line itself stood largely unchallenged'.[119] I make similar assertions about the electronics industry but expand on this study by utilising visual sources that help to foreground the complex dynamics of gender in the interwar workplace and its various permutations.

Rex Pope has examined women weavers in the interwar years and highlights how in Lancashire, women faced higher risk of unemployment due to their traditional reliance on the textiles industry, particularly if they were married.[120] Jack

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[118] Laura Lee Downs, *Manufacturing Inequality: Gender Division in the French and British Metalworking Industries 1914-1939* (New York: Cornell University Press, 1997), p.4.

[119] Downs, *Manufacturing Inequality,* p.5.

[120] Rex Pope, 'Unemployed Women in Interwar Britain: The Case of the Lancashire Weaving District', *Women's History Review 9* (2000) 743-759.

Southern has analysed how the struggling Lancashire cotton industry promoted imagery of female employees through regional events such as through the Cotton Queen Competition.[121]. I develop a similar point in relation to the electronics industry and how it used its working-class female workers as a symbol of progress, modernity and better working conditions in comparison to the older industries. The reduction in capacity of traditional industries such as textiles underwent in the interwar years has been outlined by historians such as J.H Porter.[122] In contrast, the revival of the British steel industry during the 1930s has been demonstrated by K. Warren.[123] These studies take a purely economic and statistical approach in their analysis but help in providing a comparison to the development of the electronics industry. Davis' collection of essays *Class and Gender in British Labour History: Renewing the debate or starting it?*[124] uses gender as an analytical tool for individual industries. For example, Katrina Honeyman's essay entitled 'Sweat and Sweating: Women Workers and Trade Unionists in the Leeds Clothing Trade, 1880-1980' is a study of the Leeds tailoring trade that effectively makes the argument that sexual divisions in the workplace were directly responsible for 'sweated' conditions. Honeyman shows that once a job became gendered as feminine, pay and conditions rarely improved and that 'gender divisions at work perpetuated a system of low pay

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[121] Jack Southern, 'Lancashire Accents, Lancashire Goods and Lancashire Girls: Local Identity and the Image of the Cotton Industry in the Interwar Period' *International Journal of Regional and Local History,* 12 (2017), 77-91, (p.85).

[122] J.H Porter, 'Cotton and Wool Textiles' in *British Industry Between the Wars: Instability and Industrial development 1919-1939*, ed by Neil K. Buxton and Derek H. Aldcroft (London: Scolar Press, 1979), pp. 25-47.

[123] K. Warren, 'Iron and Steel', in *British Industry Between the Wars: Instability and Industrial development 1919-1939*, ed by Neil K. Buxton and Derek H. Aldcroft (London: Scolar Press, 1979), pp.103-128.

[124] Mary Davis 'The Making of the English Working Class Revisited', pp.12-29.

and poor conditions for the bulk of women workers'.[125] Honeyman's essay provides

a good example of what needs to be considered when using gender as an analytic

tool for an industry and workplace, including the health of the industry, how the

workplace was already divided according to sex and how technology impacted jobs.

Furthermore, the essay highlights how 'skilled' work in the tailoring industry was,

for the most part, entirely gendered. This has been important to consider in relation

to the type of work being done in the electronics industry. Honeyman also highlights

how trade union leaders often resented women taking strike action through their own

initiative despite the unions rarely arguing for better conditions for women. While

many of Honeyman's conclusions can be applied to the electrical engineering

industry, such as 'skilled' work being gendered, her study also serves as a point of

contrast. The analysis regarding the connection between conditions and gender

divisions highlights some of the appeal that the 'new' electronics industry held for

young women in comparison to the traditional ones. This thesis contrasts with

Honeyman's study by showing how the electronics industries presented their

workspaces as modern, safe and inclusive to women despite the reality of the

repetitious and demanding work not being entirely different from the traditional

industries that employed women.

A similar approach to Honeyman is taken by Sally M. Horrocks in her study of

the interwar chemical industry.[126] Horrocks argues that women were employed

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[125] Katrina Honeyman, 'Sweat and Sweating: Women Workers and Trade Unionists in the Leeds Clothing Trade, 1880-1980' in *Class and Gender in British Labour History: Renewing the debate or starting it?* ed by Mary Davis (London: Merlin Press, 2011), pp.55-75(p.68).

[126] Sally M. Horrocks, 'A Promising Pioneer Profession? Women in Industrial Chemistry in Interwar Britain' *The British Journal for the History of Science* 33 (2000), 351-367, (p.351).

because they could be 'offered conditions of service very different from those which were regarded as the norm for men, and because the nature of the work which they undertook could be readily associated with established notions of female skill and expertise'.[127] In her analysis of the Staffordshire pottery industry Jacqueline Sarsby argues the commonplace imagery of industrial work including heavy machinery had perpetuated the idea that 'men's work' was more difficult and therefore more important.[128] While this conclusion can be applied to the use of women employees in the interwar electronics industry, I demonstrate that it was not as clear cut as simply stating that the production of electronics was viewed as more suitable for women. Rather, using and working directly with new technology was still largely perceived as masculine but because of the post-war economic incentives alongside the example of women's work during the war, the electronics companies made a concerted effort through published imagery and newly built amenities to re-gender the production of new technology as 'women's work'.

The development and implementation of changes in the interwar workplace concerning both worker health and productivity has been analysed comprehensively by Vicky Long in her 2011 book titled *The Rise and Fall of The Healthy Factory*.[129] Long argues that in the early twentieth century as empires and economies grew nation states began to focus directly on understanding and managing the health of

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[127] Horrocks, 'A Promising Pioneer Profession?', p.351.

[128] Jacqueline Sarsby, 'The Staffordshire Pottery Industry', in *Women Workers and Technological Change in Europe in the Nineteenth and Twentieth Centuries,* ed. by Gertjan Degroot and Marlous Schriver (London: Taylor and Francis, 1995), pp.97-118 (p.120).

[129] Vicky Long, *The Rise and Fall of The Healthy Factory: The Politics of Industrial Health in Britain, 1914-60* (Hampshire: Palgrave Macmillan, 2011).

their children, mothers and working men in an effort to maintain their global power and position.[130] Long claims the health of the working man has been the most neglected area from this area of study and in her book 'explores the political history of industrial health'. Long claims that through contested negotiations between the State, trades unions, employers and the medical profession that the concept of industrial health emerged as proactive theory on how spaces such as factories and the people within them should be maintained and managed.[131] This an important consideration for this thesis as I examine the employers perspectives on their female workforce and their role in the industrial workplace. While Long provides a longer overview of factory conditions and management, including the decline over efforts regarding worker health she does highlight the importance women held in relation to the changes that took place in the interwar industrial work place.[132] Long analyses multiple subjects, such as the role trades unions played in regards to improved factory conditions, disease management and the health of workers , that I do not focus on in this thesis. However, I add and expand on her analysis of the industrial workplace by showing how employers in the electronics industry used women workers during the manufacturing process as visual symbols of these supposed 'healthier' and better managed factories.

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[130] Long, *The Rise and Fall of The Healthy Factory*,.p.10.

[131] Long, *The Rise and Fall of The Healthy Factory*,.p.11.

[132] Long, *The Rise and Fall of The Healthy Factory*,.p.11.

A more recent study that focuses on the interwar employment of women comes from Valerie G. Hall's 2013 book *Women at Work 1860-1939*[133] which takes a broad approach, looking at how different industries shaped women's experiences from 1860 to 1939. Hall focuses on 'three groups of women- those in coal mining, inshore fishing and farming communities-in Northumberland, the northernmost county in England, in the period 1860 to 1939'.[134] She argues that this period, which includes the interwar years, was one of massive change, expansion and retraction for this community and her three chosen industries. Hall focuses on a narrow geographic area, and by contrasting women workers' experience in three separate industries highlights the fact that 'middle-class women and working-class women had little in common except for bearing children. But working-class women were not a monolithic whole either'.[135] Hall's main methodology consists of a local study which facilitates a close comparison of different kinds of working-classwomen. Hall posits that 'these examinations inevitably contribute to many of the broader debates in gender history' and summarises her overall conclusion thus: 'the communities chosen show, for example, how cultural and economic factors can take precedence over gender ideology, conclusions which have broad significance for the study of women'.[136] This point is one I have kept in mind while focusing on the interwar electronics industry. Hall also highlights how work environments can differ, shaping the experience of working-class women, and while this thesis looks at the interwar

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[133] Valerie G. Hall, *Women at Work 1869-1939: How Different Industries Shaped Women's Experiences* (Suffolk: The Boydell Press, 2013).

[134] Hall, *Women at Work 1869-1939*, p.2.

[135] Hall, *Women at Work 1869-1939,* p.4.

[136] Hall, *Women at Work 1869-1939,* p.6.

electronics industry in conjunction with the adoption of mass production techniques which happened across many industries, Hall's book highlights how industries that were not at the centre of this change functioned in the interwar years, allowing for a direct contrast between such industries. While this thesis does not follow the methodological approach of focusing on one geographic location, it does largely focus, like Hall, on a specific industry (electronics) in order to contrast it with the wider national picture.

Outside of economics and employment patterns it has been important to consider existing work that focuses specifically on changing perceptions of sex and gender over the interwar years. Lesley A. Hall's 2000 book *Sex, Gender and Social Change in Britain since 1880*[137] is a good example of such a study. Lesley A. Hall's book focuses on marriage, reproduction, sexually transmitted diseases and censorship, however, it is structured chronologically by decade, a method Hall describes as 'a somewhat artificial arrangement which enables the juxtaposition of contemporaneous phenomena, the indication of the ebb and flow of the importance given to particular elements in the complexity of British sexual culture' and the 'apathetic forces in the creation of policy and the dissemination of knowledge'.[138] Expansive studies of gender and sexuality like Hall's reveal how women's roles were changing or being maintained at a national level in the early years of the twentieth century in relation to social and scientific trends such as eugenics and the use of birth control. However, these kinds of studies lack the space to look into

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[137] Lesley A. Hall, *Sex, Gender and Social Change in Britain since 1880* (London: Macmillan Press Ltd, 2000).

[138] Hall, *Sex, Gender and Social Change in Britain since 1880*, p.8.

specific areas in a thorough or nuanced manner, such as employment, and certainly not at individual industries in any great detail; Hall does not focus on the changing employment of women. My thesis expands on such work by highlighting the importance of women's employment within the electronics industry in relation to the continuities, changes and confrontations that took place regarding sex, gender and social change in Britain's interwar years.

0.3 Chapter Outlines

Following this introduction, this thesis consists of five chapters that are divided thematically. These chapters, as far as possible, also provide a chronological account of Britain's interwar years beginning with the end of the First World War and the wireless technology that emerged from it, followed by the development of the peacetime and consumer focused electronics industry. I have chosen to end the scope of the thesis with the widespread adoption of wireless technology by women in the 1930s. This provides a conclusion to a major narrative of this thesis and bookends it with the production and consumption of wireless technology by women. Below is a summary and justification for each chapter's primary focus and relationship to the three sets of research questions posed by this thesis.

Chapter 1

This chapter offers a historical framework for the rest of the thesis and its subjects by examining the lasting impact of the First World War regarding the employment of women and the development of wireless technology that took place during these years. This provides the context for an analysis of the emergence of the interwar British electronics history. Through this I ask in what ways this constituted a lasting impact from the war or constituted an entirely new development. Key figures in the

development of wartime technology, such as Sir John Ambrose Fleming and his 1919 book *The Thermionic Valve and Its Developments in Radio-Telegraphy and Telephony*[139] are highlighted alongside those who directly tackled the war's lasting impact regarding the employment of women, such as Katharine Parsons. In doing so I highlight the expectations regarding employment opportunities expressed by prominent public women that led into Britain's interwar years and show to what extent this was managed or undermined by the state, corporations and trades unions. The second half of this chapter deals specifically with the electronics companies that came to prominence in the interwar years and how this was achieved. This chapter compares four electronics companies (Marconi, Metropolitan-Vickers, Mullard and GEC) that were successful after the First World War. Company records are used to show the key issues these companies faced such as patents, pricing, employment and the health of the industry. This chapter also draws on the records of the Valve Manufacturers Association to provide an examination of prominent patents of the period. These detail who owned the rights to which technology, how companies operated with these patents and to what extent this was a lasting impact of the war. This chapter also sets up the initial influx of women employees within the industry which the following chapters will analyse.

Chapter 2

This chapter provides my findings and answers to the first set of research questions of this thesis. In this chapter I place the interwar electronics industry and its use of female labour in the context of the various groups, such as eugenicists, that opposed women staying in the industrial workplace following the end of the war. I examine

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[139] John Ambrose Fleming, *The Thermionic Valve and its Developments in Radio-Telegraphy and Telephony* (London: The Wireless Press, 1919).

why and how social, scientific and political opposition to the interwar use of female labour existed and how this evolved over the interwar years. In this chapter I detail the complicated relationship between the AEU's opposition to female labour throughout the entirety of the interwar years in contrast to the changing attitudes of the wider trade union movement, which resulted in women working in the electronics and engineering industries having little to no trade union representation. This chapter also analyses the other side to this opposition, that is, how women were organised within the industry, what kinds of industrial action were taken and how this was represented by the press and trade union publications. I explore the various ways women attempted to organise themselves and I argue that groups such the WES and its members used a similar language of 'skill' as the AEU to organise a subset of women across the engineering industries, which still excluded 'unskilled' women workers in the electronics industry. I use recollections to argue that industrial action took place among women on the factory floors in a less formal, more spontaneous and less sustained way due to a lack of trade union involvement. I also argue in this chapter that the major reason the AEU finally accepted women as members was not due to a transformation in their views of gender but due to the material differences at the end of the interwar period compared to the beginning. The acceptance of women members by the AEU was the final union to do so and marks a significant symbol of the public acceptance of women's position in the industry. I argue that despite this, and the widespread adoption of female labour in the electronics industry, gendered divisions regarding work were altered rather than completely re-evaluated during the emergence of Britain's 'new' interwar industries. This chapter is placed at the beginning of this thesis as it provides a narrative of the opposition to women's involvement in the industry amongst some groups across the entire period and covers the longest amount of time of any chapter within this thesis.

Chapter 3

In this chapter and the following one I answer my second set of research questions regarding women's roles and representations within the industry. In this chapter I analyse why, how and to what extent women were visually represented by the interwar electronics industry in relation to mass production techniques. I analyse visual sources published by the electronics companies and recollections of women manufacturers to achieve this. I show that while working with technology often directly contradicted some traditional views regarding women, the electronics companies use of cheap female labour feminised the manufacturing of electronics such as radio valves (and similar work). I also analyse to what extent women workers themselves actively embraced the gendering of electronics work and explore electronics manufacturing's continuities with more traditional 'women's work'. By analysing company magazines, I show how traditional gender views were still prevalent in the industry despite the 'new' opportunities electronics offered for women workers. This chapter also examines the sexual divisions of the workplace and how women were shaped by and in turn shaped the workspace of the British interwar industries. I analyse a broad range of company sources and personal recollections in order to highlight both how the companies treated their female workforce and how the women themselves viewed the 'progress' in their working conditions during the period, such as the introduction of fire safety precautions and canteens.

Chapter 4

This chapter focuses on women who marketed and demonstrated wireless technology in public-facing technology exhibitions and publicity events outside of the factory floor, expanding upon my answer to the second set of research questions. More

specifically, this chapter examines the National Radio Exhibition held at Olympia, beginning in 1926, analysing how women were integrated visually into the public-facing image of electronics companies and how this simultaneously challenged and re-enforced pre-existing stereotypes. To achieve this, I place the new interwar exhibitions and imagery of women and the wireless set into the wider historical context of pre-existing social perceptions of women and technology. This chapter analyses publicity and press photos of corporate and public events which were disseminated across the country in order to examine the relationship between women and wireless technology. I ask to what extent this constituted a new form of marketing using the 'modern woman' archetype and how it was reinforced or undermined by the fact that working-class women were in large part also manufacturing the technology being demonstrated at such exhibitions.

Chapter 5

This chapter focuses on answering my third set of research questions. This chapter shows that working-class women earned more in assembly line jobs and therefore could afford to buy some consumer products themselves by the 1930s, with wireless being one of the most popular consumer products among the working-classes. This chapter complements the previous chapters by focusing on the 'other end' of the mass production cycle, the mass buying and consumption of the industry's products. It accomplishes this by framing both middle-class and working-class women as key consumers during the interwar period and by examining how new consumer technologies shaped the dynamic between middle-class and working-class women. An important context discussed in the chapter is the decline in domestic servants for middle-class families due in part to more working-class women now working in industry. As a result, middle-class women bought products to assist in housekeeping

made by the working-class women who would have previously been their servants. Another important aspect of this chapter is showing how wireless itself became gendered due its changing position in the British household from a male hobbyist activity to a common feature of the 'feminine' domestic living space. Alongside an analysis of the wireless set as a cultural object, a key methodology deployed in this chapter is an analysis of advertisements aimed at women during the interwar period, particularly advertisements for wireless and its associated technologies. Much as the previous chapters posit the mass adoption of female industrial workers as the key development of the interwar electronics industry, this chapter suggests that the same is true for women becoming the crucial consumer base for the electronics industry and broadcast media. In summary, this chapter examines the 'intrusion' of wireless into the family home and the domestic sphere. This chapter is placed at the end of my thesis as it completes my analysis of women's roles at both ends of the production and consumption cycle of interwar wireless technology and details the overall transition of the technology during this time and the role women consumers had in that transition. I then bring the key points raised in each chapter into an overall conclusion.

Chapter 1: The Emergence of Wireless Technology during the First World War and the development of the British Interwar Electronics Industry

In this chapter I analyse how the opportunities, resources and challenges of the First World War influenced the development of wireless technology and to what extent it shaped the development of the interwar electronics industry and the employment of women workers. I show how opportunities for women working in electronics starting in the war continued and expanded after its conclusion. The lasting impact of the First World War on technology, culture and employment has been contested and debated by historians for decades. This is particularly true in relation to its impact on women workers. Historians such as David Mitchell and Arthur Marwick positioned the First World War as a truly transformative moment in Britain for women, whereas historians such as Gail Braybon and Deborah Thom challenged this view.[140] Previous conclusions have also been challenged or nuanced by many more recent studies. For example, in her 2020 article Elizabeth Bruton examines the First World War in relation to the creation of opportunities for women to work in wireless telegraphy. Bruton points out that during the war opportunities for women in wireless telegraphy 'came about almost entirely through the actions and agitation of one woman: Agnes del Riego, commandant and founder of the Women Signallers Territorial Corps (WSTC), one of Britain's many volunteer quasi-military organisations in operation during the First World War'.[141] Undoubtedly, the conditions created by the war brought about new opportunities and facilitated social

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[140] Mitchell, *Women on the War Path*. Deborah Thom, *Nice Girls and Rude Girls* (London: I.B. Tauris and Co Ltd, 1998) Braybon, *Women Workers in the First World War*.

[141] Bruton, 'Uncertain at Present for Women', p.60.

and cultural changes. However, as many feminist historians have concluded, Bruton argues that many of these changes proved to be temporary and the 'the post-war working cultures of many institutions'[142] attempted to bring about a return to pre-war conditions despite this not being entirely possible. That said, the emergence of the consumer electronics industry as a significant employer of women is one of the clear differences between pre and post war Britain. Of course, as I have previously mentioned, despite this difference there are some clear continuities with employment in telegraphy before the war and the eventual emergence of wireless voice broadcasts, such as the fact that 'by 1870, the year after the GPO took over the telegraph network, almost a third of telegraphists were women'.[143]Taking the historical debate around the 'impact' of the war into consideration this chapter examines to what extent the war shaped the development both of wireless technology and of the British electronics industry in the interwar years.

It is not the case that all the technologies that were utilised for the first time in the context of the First World War remained defined by it. The most striking example of this is the wireless, or as it came to be known in later years, the radio.[144] The term radio was initially used in America following the first ever broadcasts of speech performed there. The use of telegraphy and subsequent development of wireless technology during the war was borne out of the same military objectives and

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[142] Bruton, 'Uncertain at Present for Women', p.68.

[143] Bruton and Hicks, 'A History of Women in British Telecommunications, pp. 1-9 (p.4).

[144] Lewis Coe, *Wireless Radio A History* (Jefferson: McFarland and Company, 2006), p.3. Edward C. Hubert, 'Radio vs. Wireless' *Radio News* January 1925, p.1165. In Britain context during the war and throughout the early interwar years the technology was known as 'the wireless' due its legacy of being the airborne extension of the wired telegraph and the transmission of Morse code.

requirements of the other technological advancements that took place during these years. While wireless today may be defined by its ability to provide a unique form of entertainment, military personnel still consider wireless to be 'one of the most important bits of kit.'[145] A soldier is required to know how to properly use radio on the battlefield because of its ability to facilitate planning operations and in relaying orders. The two decades following the initial military adoption of the technology in the First World War saw the widespread production of wireless sets and component parts specifically for civilian use and consumption. Alongside this, in Britain the BBC was founded in 1922 to provide a consistent amount of programming for the growing numbers of British wireless owners to tune into.

Despite the technology's extensive military use and the initial expansion of its production being linked directly to the war, the technology thus found its way into the mainstream during the interwar years and became a culturally significant outlet for entertainment, news, politics and education under the auspices of the BBC charter.[146] Because of this, during the interwar years the wireless set found a permanent position in British homes as the primary source of entertainment; at the same time, hobbyist wireless culture grew as components became more readily available due the increased level of production. The broadcaster and historian Dennis Gifford recalls how 'in the thirties going to the pictures was a rare treat, almost on par with pantomimes, so listening to the wireless was my -our- only entertainment' and how with the early wireless sets 'you had to work at it too, in

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[145] Charlotte Dubenskij, 'World War One: How Radio Crackled into Life in Conflict', *BBC News* < World War One: How radio crackled into life in conflict - BBC News > [Accessed 24 November 2020].

[146] BBC, *Charter and Agreement*, <Charter and Agreement - About the BBC> [Accessed 1 December 2020].

those days. And not just turning knobs to change wavelengths and tune in: there were batteries to be bought and accumulators to be topped up'.[147] Susan M. Squier judges the popular acceptance and mainstream adoption of wireless technology to be a pivotal moment in the history of technology: 'Think of the ramifications of the invention. It was followed by the invention of TV, radio navigation, satellite navigation, police radar and so on. It has led to instant communication around the world'.[148] As a disseminator of culture, this development also had a profound implication for the creation of national identities. Susan Douglass argues for example that in the interwar years American radio was used 'so powerfully, through comedy and drama, sports and news, to forge a powerful sense of national identity'.[149] It was during these years that the technology first grew from a niche amateur hobby that had proved useful in the war years to a mainstream consumer product that disseminated, news, politics and entertainment into British homes in an entirely new way. Historians of technology and nostalgic wireless enthusiasts have dubbed the 1920s to the 1950s as the 'golden age of radio'.[150] This period has been designated a 'golden age' for a variety of reasons, such as the establishment of the BBC and its extensive programming in the 1920s, and the hobbyist and enthusiast culture that had built up around the technology. Most significantly it was in these years that the wireless set stood alone as the central piece of technology in the

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[147] Dennis Gifford, *The Golden Age of Radio: An Illustrated Companion* (London: B.T Batsford Ltd, 1985), p.1.

[148] Susan M. Squier, 'Communities of the Air' in *Communities of the Air: Introducing the Radio World,* ed. by Susan M. Squier (Durham: Duke University Press, 2003), pp.1- 33 (p.1).

[149] Susan Douglass, *Listening in: Radio and The American Imagination* (Minneapolis: Minnesota University Press, 2004), p.357.

[150] Gifford, *The Golden of Radio,* p.1.

domestic space before other electronic goods began to challenge this position. It was
not until the 1950s that television sets began to supersede the wireless set in this
regard. This chapter provides an overview of the development of the industry and its
technology before, during and after the First World War.

1.1 Developments of Wireless Technology before the First World War

The wireless and its associated technologies emerged to prominence during the
years of the First World War and then led to the growth of a new domestic British
industry during the interwar years. However, the desire and obvious practical
applications for long distance communications did not just emerge into the zeitgeist
in the twentieth century but predate the First World War by many years. As
Jonathan Hill summarises 'it was in the last few years of the nineteenth century that
the beginning of an efficient wireless communication began to emerge, an offshoot
of which ultimately led to the development of radio broadcasting in the 1920s'.[151]
Perhaps the most significant development for the eventual establishment of wireless
technology was in 1887, when Heinrich Hertz provided visual proof of electro-
magnetic waves. This demonstration paved the way for physicists such as Oliver
Lodge and electrical engineers such as Guglielmo Marconi to develop their ideas
regarding wireless telegraphy. Through the various permutations and attempts to
develop genuine wireless communication of a useable quality by the beginning of
the 1900s Marconi became the public face of the early developments of the

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[151] Jonathan Hill, *Radio! Radio*! (Bampton: Sunrise Press, 1986), p.7.

technology. A major reason for this was Marconi's effective use of the patent system that granted him strong protections against others use of the technology.[152]

In 1905 the Marconi Wirelesses Telegraph company brought a case against the Deforst Wireless Telegraphy Company in the Unites States, with a key issue of contention being the answer to who invented wireless technology. Judge William Townsend declared that 'other inventors, venturing forth on the sea of electrical movement, met the rising tide of the Hertzian waves and allowed them to roll by without appreciating that this new current was destined to carry onward the freight and traffic of world commerce' and that they had merely 'noted the manifestations, suspected their possibilities, disclosed their characteristics, and hesitated, fearing the breakers ahead, imagining barriers of impracticable channels and shifting sand bars. Marconi, daring to hoist his sail and explore the unknown current, first disclosed the new highway'[153]. Despite his hold over patents, the prominence of his company and his triumphant legal cases in the United States, Arapostathis and Gooday argue that in the case of Marconi 'there was a trade-off between patent rights and credit'.[154] Gooday highlights that while Marconi may have gained legally and financially from the perception of him being the inventor of wireless technology, he was not 'so successful in winning credit from the scientific establishment or the contemporary British periodical press'.[155] Despite this, it is clear that by the outbreak of the First World War, the Marconi name had become directly linked to the 'invention' of

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[152] Arapostathis, and Gooday, *Patently Contestable*. Marc Raboy, *Marconi: The Man Who Networked the World* (Oxford: Oxford University Press, 2016), p.248.

[153] Hill, *Radio! Radio*! p.12.

[154] Arapostathis and Gooday, *Patently Contestable,* p.202.

[155] Arapostathis and Gooday, *Patently Contestable,* p.202.

wireless throughout the world whether this was deserved or not. For example, following the sinking of the *Titanic* in 1912 the *New York Times* wrote 'there is hardly a chance that one member of the *Titanic*'s great company would be alive today had there been no wireless telegraphy…the personal achievement of Mr Marconi in a sense and to a degree that few other such achievements are the work of a single man…he stands alone as the originator of ethereal communication'.[156] Furthermore, another key change regarding the trajectory of wireless telegraphy emerged with the initial development and test use of a thermionic valve to detect wireless signals and amplify signals by the British scientist John Ambrose Fleming in 1904.[157] In 1919 Fleming wrote his own history of the thermionic valve and its many developments since his initial application of the technology, in which he acknowledged the importance of the valve and states 'the thermionic valve and its various derivatives such as the three-electrode amplifier and also the thermionic oscillation generator, have become […] valuable appliances in wireless telegraphy' and that 'the various stages by which inventors have produced appliances of great sensitivity for the detection of electromagnetic waves forms a fascinating chapter in the history of electrotechnics'.[158]

Here, the inventor of the thermionic valve saw the necessity of documenting the developments of the technology since his initial successful demonstration in 1904. This reveals the significance the valve holds in the history of wireless, and how the valve was a piece of technology that continued to be trialled and improved upon

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[156] Roby, *Marconi the Man Who Networked the World*, p.355.

[157] Keith R. Thrower, *History of the British Radio Valve to 1940* (Hampshire: MMA International, 1992), p.9.

[158] Fleming, *The Thermionic* Valve, p.1.

throughout the war years. The valve saw a variety of permutations and improvements in the years after Fleming's success. In 1906, the US engineer Lee de Forest invented the triode valve by adding a grid between the filament and the anode which proved to be more sensitive. Marconi engineer Henry Round's work on a triode valve was also significant. This valve added a third electrode which acted as 'as sort of tap to control the flow of current between cathode and anode'.[159] This provided greater amplification and the triode became widely adopted as the standard valve. Another important development in the technology's history was achieved during the First World War by the French Military Telegraphic Service. They developed a 'small general purpose receiving valve with a bright tungsten filament, cylindrical grid and anode, all mounted in a spherical bulb' which was 'a valve on entirely new construction'.[160] This valve was also used in Britain and was mass produced as the type R valve until the early 1920s. The rapid development of valve technology increased even more in the interwar years, as I shall demonstrate later in this chapter.

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[159] M. G. Scroggie, S. W. Amos, *Foundations of Wireless and Electronics* (London: Newnes Technical Books, 1971), p.151.

[160] Thrower, *History of the British Radio Valve to 1940*, p.9.

1.2 The Development and Use of Wireless Technology During the War

The British government anticipated that wireless communication would play a major role from the early days of conflict. This can most explicitly be seen in the passing of Regulation 22 of the Defence of the Realm Consolidation Act in 1914 which banned the purchase, the sale and the possession of wireless telegraphy.[161] This demonstrates the British Government's awareness that the Central Powers would be attempting to use wireless communications to their advantage. Evidently, wireless technology had profound implications for wartime planning and promoted the defensive measures taken by the government. During the war wireless was positioned by the government entirely as a tool needed for the military war effort first and foremost, evidenced by the banning of private broadcasts.

Wireless valve technology developed quickly during the First World War when 'the first serious scientific experiments were conducted in Britain into wireless telephony and the success of these was due to the rapid development of the valve'.[162] For example, 'in the summer of 1915 the first one-way spoken message from an aeroplane to a ground station was achieved by the experimental section of the Royal Flying Corps (RFC) at the Wireless School' which 'employed a single Round valve'.[163] Despite the increasing development and use of the technology, those in charge of operating them during the war received little attention in publications and news reports. Initially during the war communication was not

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[161] Hill, *Radio! Radio*! p.12.

[162] Hill, *Radio! Radio*! p.25.

[163] Hill, *Radio! Radio*! p.25.

wireless, and men were forced to lay wires under dangerous conditions to ensure any form of long-distance communications. While those involved with such work may not have received much public attention, military correspondence from the time shows that those inside the military perceived the work being done to establish communication links as valuable and crucial. A document sent to the Treasury in 1918, for instance, professes that 'the number and agency of the Cable Operations for which the Post Office had to undertake responsibility during the war resulted not only in the Post Office ships remaining in a state of constant transmission but in the chartering by this Department of a number of privately owned Cable Ships'.[164] This note also argues that in the case of some junior officers they had 'performed duties more resembling those of Naval officers than Post Office officials'[165] and asks they receive suitable substation pay.

Evidently, more effective wireless communications were a desirable alternative to the dangers of laying and maintaining cables and wires across land and sea. The recognition of the vital importance communications were to play across the war meant there was a major effort to establish the use of wireless telegraphy and radio across the British military. This is evidenced in the enlistment of wireless experts and hobbyists who were brought in to help. An example of this can be seen in the case of Bayntun Hippisley, whose interception of German wireless transmissions led to the installation of an interception apparatus at the Hunstanton coastguard station

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[164] *Documents to the Treasury Proposing Substitution Payments for Cable Ship Workers*, NA/T1/12393/4382, BT Archives, p.1.

[165] *Documents to the Treasury Proposing Substitution Payments for Cable Ship Workers*, NA/T1/12393/4382, BT Archives, p.3.

that was used throughout the war to monitor enemy radio activity.[166] Furthermore,

the war brought a large group of men into contact with wireless who may otherwise

not have encountered it. As a result, 'after the war a significant number of amateur

radio operators emerged from the armed services'.[167]

   In short, wireless quickly developed during the war. It then transitioned into one of

the first British mainstream consumer electronics products, giving rise to a new

interwar electronics industry alongside an emerging broadcasting industry.

However, as a technology it remained subject to some state control that had its roots

in the war. The development and production of wireless technology and thermionic

valves gained national importance due to the requirements of the First World War.

As Keith Thrower points out in his extensive history of the valve: 'with the out-

break of war in 1914, there was an urgent need by the British armed forces for

improved communications'.[168] Thrower explains further that 'radio was ideal for

this; but in order to meet the requirement for field equipment, particularly for radio

telephony, valve transmitters were required, and the receivers needed valve

amplifiers and detectors to improve their sensitivity'.[169] Graeme Gooday

demonstrates through his examination of patents how during the war years

companies such as Marconi's expanded and grew their capability for manufacturing

large numbers of wireless sets and technology for the war, alongside quickly

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[166] James Wyllie, and Michael McKinley, *The Codebreakers: The Secret Intelligence Unit That Changed the Course of the First World War* (London: Ebury Press, 2015), p.18.

[167] J. Emmett Winn and Susan Lorene Brinsones, *Transmitting the Past: Historical and Cultural Perspectives on Broadcasting* (Tuscaloosa: Alabama University Press, 2005), p.16.

[168] Thrower, *History of the British Radio Valve to 1940,* p.1.

[169] Thrower, *History of the British Radio Valve to 1940,* p.1.

training up male wireless operators.[170] Histories of specific companies emphasise

the demands of the war had in relation to their internal development of wireless

technology and manufacturing. W.J. Baker explains in his history of the Marconi

company that by the end of the war 'the valve emerges in 1919 as a relatively robust

stable performer with a useful amplification factor (at least, at audio frequencies)

and capable of being manufactured quantity to close tolerances in characteristics.

This is in turn made possible the design of new circuits and permitted applications

that were impossible in 1914'.[171] Noticeably, despite the development of

manufacturing techniques and the expansion of the company's scale the workforce

employed in this time of growth is not described or mentioned at all. Evidence

shows that women were employed in both the manufacture and testing of valves and

wireless sets. Companies such as Metropolitan-Vickers had clubs and activities

established for its wartime female employees[172] while the Women's Royal Naval

Service (WRNS) was deployed on testing the valves used in military

communications.[173] Evidently though, the lack of media focus and promotion of

these women, both at the time and in retrospect, stands in direct contrast to the

national narratives around the work done by women working in munitions factories.

This can be attributed to the assumption by the state and employers that the women

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[170] Graeme Gooday, 'Combative Patenting: Military Entrepreneurship in First World War Telecommunications' *History and Philosophy of Science Part A*, 44 (2013), 247-258, (p.255).

[171] W.J. Baker, *A History of the Marconi Company 1874-1965* (York: Methuen, 1970), p.177.

[172] 'British Westinghouse H Screw Ladies Football Team 1917' *The British Westinghouse Gazette*, YA2012.27, August 1917, MSI, p.5.

[173] Arthur David McCormick, Valve Testing: The Signal School, RN barracks, Portsmouth, 1919, Art. IWM ART 2620, IWM.

employed in the munitions were a temporary necessity not a significant change in employment, and to their work being more directly tied to the war effort in the public perception. In the third chapter of this thesis, I demonstrate how and why the electronics industry not only kept its female wartime employees but increasingly shifted to employing a higher proportion of women workers to manufacture wireless technology.

1.3 The Wireless and the Transition into Peacetime

Despite the growing popularity of the technology and the number of private broadcast tests that took place during the early 1920s, such as those undertaken by the Marconi Company in Chelmsford, the government feared their potential to interfere with military communication even after the end of the war[174] and was wary if not outright concerned about the growing amateur culture around wireless technology because of its potential to interfere with military communications and being used as a tool for subversion as it had been by the Bolsheviks in 1917.[175] While it is true that the war was transformative for the increased production of valves, in response to the growing importance of wireless technology in military communications, peacetime did not alter this trajectory, rather it widened the commercial potential uses of the technology. The ability to broadcast speech rather than just Morse code was the key factor in this peacetime transition for the technology. While it is unclear exactly when the first broadcast of speech took place,

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[174] Asa Briggs, *The BBC The First Fifty Years* (Oxford: Oxford University Press, 1979), p.50.

[175] James Curran, Jean Seaton, *Power Without Responsibility: The Press and Broadcasting in Britain* (Oxford: Routledge, 2018), p.200.

it is apparent the most notable demonstration of such a test took place during the First World War. As John G. Truxal explains 'voice communication was much more difficult than telegraphy and really had to wait until the invention of vacuum tubes by Lee Deforest in 1906'.[176] In 1915 this eventually led to speech for the first time being 'transmitted across the continent (from New York City to San Francisco) and across the Atlantic Ocean (from Naval radio station NAA Arlington, Virginia to the Eiffel tower in Paris)' with it also being noteworthy that 'there was some experimental military radiotelephony in World War I between the ground and aircraft'.[177] Following the end of the war, as the ability to broadcast speech and music became commonplace and the potential of the wireless set became increasingly evident there was a growing public fascination and demand for the technology. In turn, this eventually led to the American naming convention of radio becoming commonplace internationally, despite 'the wireless' remaining in common usage throughout Britain in the interwar years.

Alongside the potential commercial opportunities and appeal of the technology increasing due to the ability to broadcast speech, the initial transition of the technology from a wartime tool to a peacetime technology was brought about by the large number of veterans who had come into contact with wireless technology during their service in the First World War. James Curran and Jean Seaton argue that it was in this period after the war and before its mainstream adoption that the 'wireless was regarded as little more than an experimental toy'.[178] It is in this

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[176] John G. Truxal, *The Age of Electronic Messages* (Cambridge: MIT Press, 1990), p.317.

[177] Truxal, *The Age of Electronic Messages*, p.317.

[178] James Curran and Jean Seaton, *Power Without Responsibility: The Press and Broadcasting in Britain* (Oxford: Routledge, 2018), p.197.

'experimental toy' period that a hobbyist culture was formed in large part by First World War veterans using surplus parts from the war. This was a trend across the nations that had developed and used wireless technology during the war. Peter J. Hugill points out how the demands of the war directly 'created both a larger market for trained engineers and a cadre of engineers who created a domestic radio market in the aftermath of World War 1'.[179] This influx of both experience and surplus parts back into Britain proved crucial in incubating and growing the early male centric hobbyist culture around wireless and broadcasting. For example, early editions of magazines such as *Wireless World* published instructions for adapting surplus technology such as 'the RAF Type 10 receiver, a five-tube wireless telephone receiver for aircraft'.[180] This phenomenon also helped foster the wireless community as surplus valves were much cheaper than new ones: 'a four-tube set using war surplus components in the 1920s cost less that £10; a new one of equal performance would have cost nearly £45'.[181] The war also provided another clear and immediate use for wireless in the immediate years following its end. Men suffering from serious injuries and disabilities came to be perceived by healthcare professionals as a group that could benefit immensely from the technology. This was the case across Europe: in particular wireless held great appeal and serviceability to those blinded in the war. In 1931 the French poet and journalist René Bruyez argued for wireless's

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[179] Peter J. Hugill, *Global Communications Since 1844: Geopolitics and Technology* (Baltimore: John Hopkins University Press, 1999), p.158.

[180] Hugill, *Global Communications Since 1844*, p.158.

[181] Hugill, *Global Communications Since 1844*, p.158.

suitability for 'blind veterans, the war's most pitiable victims, whose reliance on sighted guides limited their dependence and restricted their movement in society'.[182]

From the above three examples it is clear that the immediate aftermath of the war provided multiple catalysts for the development of a male-dominated culture and community around wireless and its technology. The existence of this rather niche sub-culture can be seen most explicitly in the various clubs and organisations that sprang up around the hobby of using and tinkering with the technology in the early interwar years alongside the various publications that emerged to support and promote this developing culture. Most towns had clubs and societies for wireless enthusiasts by the early interwar years such as the Bolton Wireless Society and the Sussex Wireless Club.[183] A common sight in early interwar wireless exhibitions was the 'Secretary from a provincial wireless club with his notebook well filled against the night when he shall have to answer innumerable questions as to what he saw at the show'.[184] Clubs and societies began to demand official broadcasts and an expansion of the industry. One such example of one these is the Wireless Society of London who in 1921 insisted to the Postmaster General that 'they needed a central, reliable and independent transmitter of Morse and telephony against which to judge the quality and performance of their apparatus. Experimental work could then be based on a scientific footing'.[185] These clubs and the developing culture around

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[182] Rebecca Scales, *Radio and the Politics of Sound in Interwar France, 1921-1939* (Cambridge: Cambridge University Press, 2016), p.64.

[183] *Year-book of Wireless Telegraphy & Telephony* (London Marconi Press Agency Limited, 1922), pp.1451-1453.

[184] *Popular Wireless,* 21 October 1922.

[185] Brian Hennessy, *The Emergence of Broadcasting in Britain* (Lympstone: Southerleigh, 2005), p.79.

wireless remained a male dominated space during the war and in the years immediately following it. However, as Maggie Andrews argues, this evolved as wireless became a feature of the middle-class living room in the 1920s and 1930s. Further, the designs of wireless sets changed alongside the fact that 'in the interwar era, the perceived female listener and her concerns influenced the nature of broadcasting, dictating the tone and linguistic framework of interwar broadcasts'.[186] I will expand on this in the final chapter, but it is important to note here that the major development that allowed for this evolution of the technology and women's relationship to it was the establishment of the BBC.

1.4 Broadcasting and the BBC

One of the events that demonstrated the potential of using wireless to receive nationally broadcast entertainment occurred on 15 June 1920 when 'the Australian soprano, Nellie Melba sang a concert' from Marconi's factory in Chelmsford and was 'heard by listeners all over the British isles and many countries abroad'.[187] Significant events such as this were organised by Marconi to raise the public profile of wireless and its commercial potential and were often promoted by the press as 'firsts'. The success and promotion of these initial broadcasts solidified Marconi, in the public perception, as the inventor of wireless as the public had come to know it. This resulted in him receiving thousands of letters and telegrams of praise. But outside of experiments and one-off events it was the establishment of the BBC that did the most to facilitate the mainstream adoption and use of wireless technology

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[186] Andrews, *Domesticating the* Airwaves, p.1.

[187] Hill, *Radio! Radio*! p.31.

across Britain. James Curran and Jean Seaton explain that what brought about the BBC was the fact that British electronics manufacturers were established soon after the war, and 'in 1922 there were nearly a hundred applications to the Post Office from manufacturers who wanted to set up broadcasting stations'[188]. This demand 'created the need for control'.[189] The BBC was established in 1922 and brought about a large expansion of wireless stations and receivers across the entire country. As Charlie Connelly points out 'in the years prior to 1920 enthusiasm for listening to a wireless set far outstripped the entertainment value of the signals whizzing through the atmosphere'.[190] The establishment of consistent broadcasts through the BBC, as well the broadcasts from across Europe, dramatically altered this dynamic. The formation of the BBC was therefore the result of government's desire for a public broadcaster, alongside the emerging interwar electronics industry searching for a new opportunity that would ensure its continued growth through an expansion of programming, content and potential audiences.

As Martin Dibbs explains, in 1922 'the Post Office- anxious to avoid the American experience of lack of control over allocation of wavelengths leading to too many stations drowning each other out-invited the leading wireless manufacturers to form a broadcasting partnership whose service it was hoped would encourage sales of wireless'.[191] It was agreed that the six largest manufacturers would form a committee to decide on organising and running the service. These six manufacturers

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[188] Curran, Seaton, *Power Without,* p.112.

[189] Curran, Seaton, *Power Without,* p.112.

[190] Charlie Connelly, *Last Train to Hilversum* (London: Bloomsbury, 2019), p.87.

[191] Martin Dibbs, *Radio Fun and the BBC Variety Department, 1922—67* (London: Palgrave Macmillan, 2018), p.15.

were Marconi's Wireless Telegraph Company, Metropolitan-Vickers Electrical

Company, Radio Communication Company, The British Thomson-Houston

Company, The General Electric Company and Western Electric Company.

Following this the BBC was granted a monopoly over the entirety of broadcasting in

Britain. The BBC *Yearbooks* from the interwar years track the major developments

that took place relating to the new corporation, including the establishments of more

broadcasting stations, the adoption rate of wireless licences and the developing

trends in the BBC's programming initiatives. The 1929 edition details the

corporation's initial efforts in implementing regional broadcasting in the north of

England following the expansion of broadcast stations there. The *Yearbook* reports

that 'measures have been taken to co-ordinate the activities of the Lancashire,

Liverpool, Leeds-Bradford, Sheffield and Hull stations - and to offer to northern

listeners a liberal interchange of programmes between these stations' and noted that

the establishment of a regional administration in Manchester in that year had showed

'listeners the advantage of linking the various stations to each other'.[192] This

demonstrates that by the end of the 1920s the BBC considered that it had established

enough stations across the country, and had enough legal listeners, to consider such

regional plans.

The BBC perceived its own position in 1929 as a positive one and argued 'the

standard of the everyday programme of entertainment has risen appreciably - and all

this had gone hand in hand with a technical perfecting of resources which had

brought efficient and faithful reception within the reach of anyone who was

normally careful in choosing and maintaining his set' alongside a 'constant growth

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[192] 'The North of England' *BBC Yearbook,* 1929, p.99.

of a body of listeners'.[193] The expansion of the size of the audience brought about

more advancements in the technology as the types of receivers being used by the

public evolved significantly throughout the interwar years. Gordon Bussey explains

that 'most listeners used crystal sets, indeed BBC policy was to place their

transmitters so that the majority of the population was in the crystal range' while by

the 'the late 1920s a 4 valve set became almost standard, consisting of an H.F

amplifier, a detector and one or two L.F amplifying stages'.[194] The initial

prominence of the crystal wireless sets can be attributed to the price differential

between the two types of receivers ― for example in 1923 a set of McMichael

receiver equipment cost around £25, including only a 4 valve detector amplifier and

a tuner panel. In comparison a Fellows 'Fellocryst' crystal set included a set of

headphones and an aerial that could be bought for £3.7.6.[195] Despite this, the

eventual mass production of valves and the higher quality signals they were capable

of receiving rendered the crystal set obsolete in terms of the mainstream consumer

by the late 1920s.

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[193] 'The Year' *BBC Yearbook* 1929, p.55.

[194] Gordon Bussey, *Wireless: The Crucial Decade History of the British Wireless Industry 1924-34* (London: Peter Peregrinus, 1990), p.16.

[195] *Wireless World,* 17 October 1923, p.xvii.

1.5 Valves and the Interwar Electronics Industry

In 1997 London's Victoria and Albert Museum in conjunction with the British Vintage Wireless Society defined Britain's 'classic' wireless receivers as those that had been produced between the years 1922 and 1957. This 35-year period spanned the years that included the establishment of broadcasting to the cessation of the manufacture of valve-operated radios in Britain.[196] The years when the radio valve was the predominant provider of home entertainment remain significant in British popular memory and cultural nostalgia. The development of this culture around the valve is evident in the enthusiast press of the time. The language used in relation to valves shows a level of admiration and reverence regarding the technology at the heart of the enthusiasts' chosen hobby. The January 1924 edition of *Amateur Wireless*, for example, dismisses the 'the amateur who merely purchases valves, inserts them in the holders on his set, and waggles the filament resistance knob in the pious hope they will get the best results' because from their readers' perspective 'he loses a very fascinating side of his hobby and fails to realise what a beautifully delicate and accurate instrument the valve is — knowledge which is only really appreciated after a careful study of what are known as the characteristic curves of the valve'.[197] It is also noticeable that language used within these early interwar enthusiasts publications consistently assumes an exclusively male readership. A regular article in *Popular Wireless* called 'Recent Valve Developments' detailed the developments of valve technology that had taken place between each issue. The

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[196] John Whitley Stokes, *The Golden Age of Radio in the Home* (Invercargill: Craigs, 1986), p.26.

[197] David Autton, 'The Valve a Word of Introduction' *Amateur Wireless,* 12 January 12, 1924, p.32.

January 1929 edition highlighted the development of the pentode valve which the article states 'has already marked a tendency towards a departure from the ordinary design in the manufacture of valves' and that 'the valve of the future is discussed in this article'.[198] These valves were mass produced by the British electronics industry until the 1950s.

Figure 1 Valves manufactured by Ferranti 1931-1936[199]

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[198] 'Recent Valve Developments', *Popular Wireless,* 5 January, 1929, p.911.

[199] 'Ferranti Valves Photograph 1', *Ferranti Photographs*, MSI/3/139/8, MSI.

Figure 2 Valves manufactured by Ferranti 1931-1936[200]

Figure 1 and 2 show some of the different types of valves manufactured by the

Ferranti company between 1931 and 1936. These images show the visual differences

between the D4, HD4, R4, VPT4 and VHT4 valves. The interwar electronics

companies produced many different types of valves that served the same basic

function but differed in size, shape, capabilities and in price. The other large

companies also produced a wide variety of valve types. Keith Thrower argues that

the companies that produced valves in the interwar years can be categorised into

three distinct sizes: 'major manufacturers, secondary manufacturers or suppliers and

minor manufacturers or suppliers'.[201] The companies that emerged immediately

following the end of the war were the major manufacturers of wireless parts and

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[200] 'Ferranti Valve Photograph 2', *Ferranti Photographs*, MSI/3/139/8, MSI.

[201] Thrower, *History of the British Radio Valve to 1940*, p.9.

valves. The major manufacturers of valves during the interwar years were: Mullard, Associated Electrical Industries (AEI), British Thomson-Houston Ltd, Metropolitan-Vickers, Edison Swan Electric, A.C Cossor, M.O Valve and Standard Telephone and Cables. The smaller secondary manufacturers and suppliers of valves included Electron Company, E.K Cole, the Ever-Ready Radio Valve Company, British Tungsram Radio Works and the High Vacuum Valve Company. Most of these companies operated for a significant number of years and manufactured a high number of valves and a wide variety of different types. Alongside these larger companies, a sizable number of smaller and minor manufacturers that had begun as valve repair shops emerged throughout the interwar years. These smaller manufacturers tended to produce a smaller number of valves with a limited variety - such as H.W Sullivan which produced one kind of valve in 1921.[202] Some of the companies that manufactured valves in the interwar years, such as Ferranti, did not become established valve manufactures until into the 1930s, while some of the major companies that had been prominent manufacturers of valves initially, such as Metropolitan-Vickers, ceased to do so in the 1930s. This does not mean these large companies failed or that the industry struggled during the depression; many of these companies stopped manufacturing their valves following a major merger with another company. A significant merger that took place in the middle of the interwar years was when then 'Associated Electrical Industries (AEI) formed in 1928 out of the merger of British Thomson-Houston and Metropolitan-Vickers'.[203]

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[202] Thrower, *History of the British Radio Valve to 1940*, p.6.

[203] Bernard Elbaum and William Lazonick, *The Decline of the British Economy* (Oxford: Clarendon Press, 1984), p.198.

<u>Figure 3 Gem Mill Factory at Oldham</u>[204]

<u>Figure 4 Gem Mill Factory Valve Department Oldham</u>[205]

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[204] 'Gem Mill factory at Oldham' *Ferranti Photographs*, MSI/3/139/8, MSI.

[205] 'Gem Mill Factory Valve Department Oldham' *Ferranti Photographs*, MSI/3/139/8, MSI.

Figures 3 and 4 show Ferranti's Gem Mills factory at Oldham in 1959 and the interior of its valve department in March 1943. These images exemplify the fact that the interwar electronics manufacturers, even those considered of secondary status, tended to operate out of large factories that employed a sizeable number of people in a single location. The rapid growth of companies in conjunction with mergers meant 'production was concentrated in a small number of large sized factories for the purpose of achieving economies of scale from mass production'.[206] Miriam Glucksmann argues that this trend was similar across most of Britain's new interwar industries. For instance, over 40 percent of the workers in the electrical machinery, motor and cycle manufacturing, artificial silk and sugar confectionary industries 'worked in plants employing over 1,000 workers, and by 1935 nearly half the labour force were found in firms employing over 500 workers'.[207] In the electronics industry this pattern can be attributed to the fact that more complex 'skilled' jobs were broken down, automated and completed by 'unskilled' workers who were increasingly employed within the industry. However, this did not mean the electronics industry simply mimicked the mass production techniques that other industries were developing. As Peter Scott explains 'radio was also distinctive in its nature of its production technology' and because of that 'Fordist mass production technologies were not appropriate — owing to highly unpredictable demand for new models, technical innovations that could suddenly render existing stock obsolete'.[208] The electronics industry managed to semi-automize the mass production process by

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[206] Glucksmann, *Women* Assemble, p.74.

[207] Glucksmann, *Women Assemble,* p.74.

[208] Peter Scott, *The Market Makers*: *Creating Mass Markets for Consumer Durables in Interwar Britain* (Oxford: Oxford University Press, 2017), p.98.

'simple assembly operations, modular components' and by 'mounting components onto boards or chassis — by hand or using simple generic tools'.[209]

This process allowed for the employment of increasing numbers of so-called 'unskilled' women workers who could be paid less than a qualified worker. In the case of the electronics industry this resulted in the mass employment of women in the manufacture of components, wireless sets and valves. Despite the turbulence of the economy during the interwar years and the regional disparity in the distribution of electronics companies there was a common trend across the country of an increasing number of women being employed. Miriam Glucksmann explains how electronics and electrical engineering as a whole 'was one of the fastest growing industries in the interwar period in terms of employment: in 1907 it accounted for only 5 percent of all engineering workers, but this had grown to 15.5 percent by 1924, and to 22.5 percent by 1935'.[210] In conjunction with this development the proportion of women working in the industry was increasing even faster: 'in terms of absolute expansion the number of women employed in electrical engineering in England and Wales rose by 123 percent between 1921 and 1931'.[211]

Throughout the interwar years valves were made more durable and 'the machinery used in their manufacture ensured more precise construction'[212] and this resulted in valves having improved performance and greater durability and reliability. From company records and publications it is clear how important mass production

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[209] Scott, *The Market Makers*, p.98.

[210] Glucksmann, *Women Assemble,* p. 57.

[211] Glucksmann, *Women Assemble*, p.58.

[212] Thrower, *British Radio* Valves, p.1.

techniques, adopted after the war, were in producing a large number of valves of a similar level of quality. Valve brochures for Ferranti detail how 'uniformity of characteristic is of vital importance and in the manufacture of Ferranti valves extraordinary care is taken to ensure this'.[213] An example of how this uniformity was achieved through mass production is the 'extremely accurate manufacture of grids' which in turn was accomplished by the fact 'special high thermal conductivity materials are used in the construction of Ferranti valve grids, to prevent grid emission, and the various mica portions are treated by a special process, to prevent leakage which gives to valve noise'.[214] Records from Ferranti show that new valves were rigorously tested before being mass produced, one such test included using a valve for 1066 hours.[215] Despite this, internal company memorandums as late as 1947 reveal that 'after a review of the faults of in radio receivers returned to us for service, we find that the bulk of the trouble is caused by faulty valves'.[216] Production statistics highlight that despite the efforts to make the mass production of valves as profitable as possible there was a significant number of faulty valves produced that were spotted at the testing phase while some simply did not make it through the production process.

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[213] *Departmental Memorandum*, 26 March 1947, MSI/SM8/30, MSI, p.1.

[214] Dr S.W Milverton, *Ferranti Valves*, MSI/SM8/30, p.3.

[215] Dr S.W Milverton, *General Notes of Experimental Valves*, MSI/SM8/30, MSI, p.7.

[216] *Departmental Memorandum*, 26 March 1947, MSI/SM8/30, MSI, p.1.

Table 1 Output for different Ferranti valves for 1932[217]
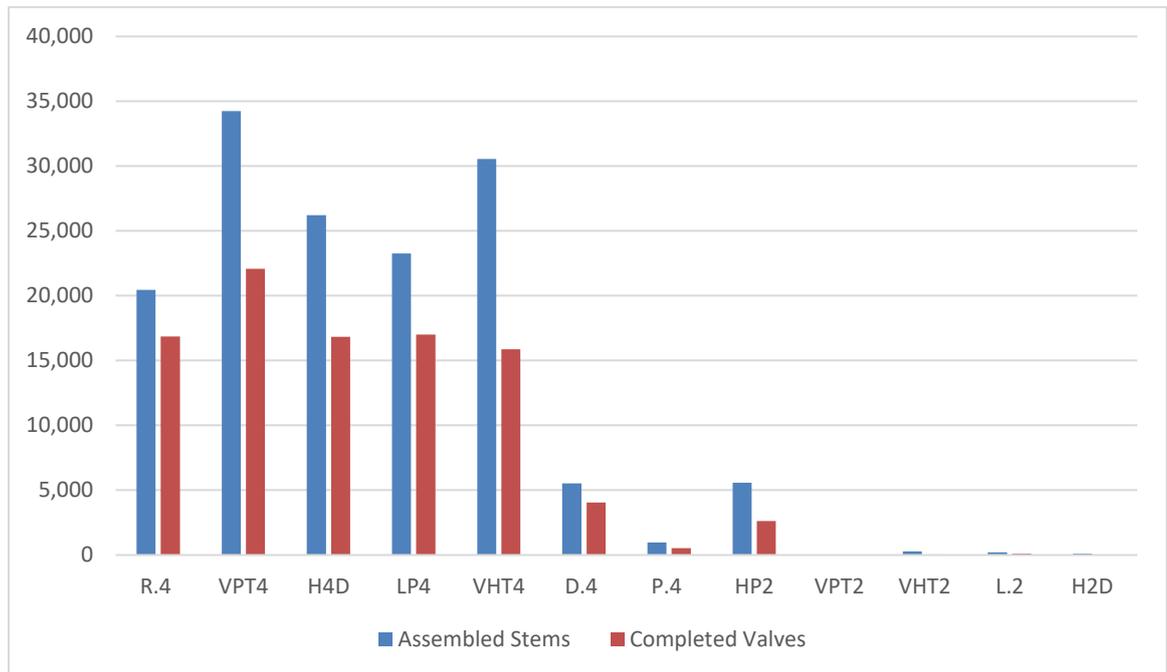
Table 1 shows the amount of various types of valves manufactured by Ferranti in 1932. It also highlights the difference between the assembled stems at the beginning of the manufacturing process and the actual number of completed valves at the end of the production line. This shows that during the process of mass production that was employed in the 1930s a significant number of valves were lost in the process, for instance in the case of the VPT4 valve which was the most manufactured that year. Ferranti began with 30,557 assembled stems for this kind of valve but produced 15,874 completed ones at the end of the process. This was a shrinkage of 48%, meaning a significant amount of materials were lost during the manufacturing of these valves. This highlights that the mass production techniques used by these electronics companies was not an entirely efficient use of raw materials. Despite

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[217] *Valve Output for 1932,* MSI/C8/5.2, MSI, p.1.

this, the industry was profitable enough to sustain these losses. The importance of the valve meant manufacturing processes, research and pricing were all important to the interwar electronics companies. This, alongside competition from American imports, brought about the formation of the Valve Manufacturers Association (VMA) in 1924. This cartel of the manufacturers set prices across the country and devised a consistent numbering system for valve types across companies. Furthermore, according to Ferranti records 'all members of members of the V.M.A have the benefit of Patents relating to valves'. It detailed for example that all members were licensed to make the screened grid valve, but a manufacturer outside of the Association would not be licensed.[218] The terms of membership agreement for the V.M.A lists the major disadvantages the group leveraged against non-members to force compliance, as 'limited market, stigma of lower prices, an inferred inferiority, public believe the association' and that members' valves 'have the benefit of pooled research knowledge'.[219] The removal of competition over prices explains the dominance and longevity of the few major manufacturers, outside of mergers, that persisted throughout the entirety of the interwar years. It also reflects the fact that while British valves were not exported in any significant amount, there was a big enough domestic demand for cheaper American valves that the VMA had to actively prevent this from being fulfilled in order to maintain higher prices.

The initial push for a national broadcaster and the subsequent emergence of the BBC was reliant on and built upon the initial success of the pre-war companies that had begun to manufacture electronics during and after the war, and the new interwar

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[218] *Departmental Memorandum,* 10 May 1929, MSI/C8/5.2, MSI, p.1.

[219] *V.M.A Terms of Membership,* MSI/C8/5.2, MSI, p.1.

companies that continued to do so. Yet the relationship was reciprocal: the establishment of the BBC provided a large area of growth and a massive increase in the amount of content available on the airwaves which increased demand for wireless sets and components. In total, the exact number of valves produced in 1924 was 2.5 million, by 1930 this had increased to 5.6 million and by 1935 the number produced was 11.8 million with over 90% of them being used in broadcast receivers. In 1956 with the growth of industrial electronics and computers, about 88% of all valves manufactured in Britain were used in domestic apparatus.[220] The electronics industry was not an exports heavy industry and the valves it manufactured were primarily sold and used domestically. Duncan Burn clarifies that in terms of exports 'the new industries were an inadequate substitute for such declining staples as cotton and coal'.[221] He notes that the electronics industry in 1931 had exports valued at 'barely one million and the slow improvement that followed left them at only two million in 1938'.[222] The fact that the British electronics industry was predominantly serving a domestic demand for wireless sets and wireless components demonstrates that the interwar demand for such technology was strong enough within Britain to maintain multiple companies manufacturing these consumer goods. The variety of valves produced across companies grew to such an extent that the industry came together to host the annual Radiolympia exhibition which publicly displayed valves and wireless sets. These exhibitions were also another area of the industry that relied upon women employees and their representations as I show in chapter 4. In sum, the

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[220] Thrower, *History of the British Radio* Valve, p.9.

[221] Duncan Burn, *The Structure of British Industry: A Symposium* (Cambridge: Cambridge University Press, 1961), p.173.

[222] Burn, *The Structure of British* Industry, p.173.

'golden age' of wireless in Britain is defined as a period when the image of the valve became associated with the wireless set and wireless components were the object of hobbyist fascination; as well as a time when the electronics industry was fulfilling a growing domestic demand. Evidence for this domestic demand can be found in the sheer number of valve advertisements found across interwar British publications.

Figure 5 Absolutely Indispensable Marconi Valves 1923[223]

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[223] 'Marconi Valves' *Popular Wireless Weekly*, 19 May 1923, p.513.

Figure 6 'Ora' for Perfect Reception, 1923[224]

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[224] 'Ora for perfect Reception' *Popular Wireless Weekly,* 11 April 1923, p.200.

Figure 7 Mullard: The Master Valve, 1929[225]

Figures 5, 6 and 7 show a variety of valve advertisements from the 1920s by the manufacturers Marconi and Mullard. Adverts such as these were commonplace in the enthusiast press as well as in the mainstream press outlets during the interwar years. These advertisements demonstrate how valves were presented visually in order to promote their capabilities in relation to reception quality to sell them to consumers. The reliance in Figures 5, 6 and 7 on appealing visuals and marketing

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[225] 'Mullard The Master Valve' *Popular Wireless,* 5 January 1929, p.949.

techniques, rather than on in-depth technical details, demonstrates that the target audience had quickly become the inexperienced mainstream consumer and not just experienced First World War amateurs and enthusiasts. This was the case even in the advertisements found in the hobbyist press.

Table 2 Number of Valve Types Produced 1927-1931[226]
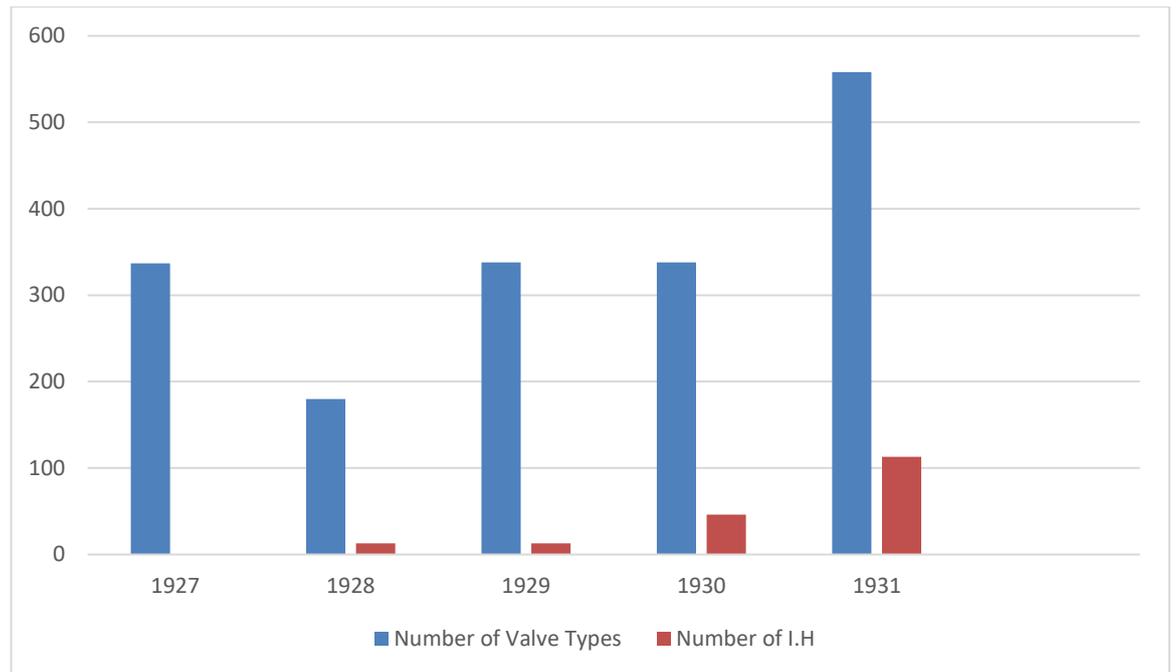
Table 2 highlights how many different types of valves were being produced in Britain between 1927 and 1931, and that this number was increasing by a significant amount. This can be attributed to competition between the various companies. As Figure 5, 6 and 7 show, despite the sharing of research permitted through membership of the VMA, companies attempted to present valves as visually unique and possessing distinct features and quality in comparison to others. By 1931 there were 518 different types of valves being manufactured in Britain. The end of the war and the commercial success of wireless meant that from 1925 onwards there was

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[226] Bussey, *Wireless, The Crucial Decade,* p.34.

rapid progress in valve design such as the 'change from the thoriated filament to oxide-coating, which, in turn, led to the indirectly-heated cathode'.[227] Gordon Bussey highlights the importance of the development of the 'indirectly heated' valves, as they were capable of 'having their electronic-emitting surfaces heated by raw A.C'[228]. This solution is detailed in 'British Patent No. 213,605 taken out by N.V, Philips describing 'in all essential detail the solution eventually adopted, of a separate heater cathode assembly'.[229]

The wide variety of valves that proliferated throughout Britain in the interwar years were mainly brought to the attention of retailers and consumers in printed advertisements across newspapers, catalogues and variety of magazines. The 1934-1935 radio catalogue for the London based wholesalers R. Cadisch and Sons details available 'receivers, radiograms, components and accessories'.[230] Catalogues such as this provide a detailed listing of the variety of valves for sale and the specific differences between them. The catalogue lists Mullard, Cossor, Marconi, Osram and Mazda valves alongside an extensive range of different valve holders. 83 different types of valves are listed within the catalogue, manufactured by Mullard with some of the differences between them specified as: 'Variable-mu H.F Pentode, H.F Pentode, Screened Grid, Multi-mu Screened Grid, Double-diode-triode, R.C Triode, H.F or detector, super-power, low-consumption Pentode, high magnification

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[227] Bussey, *Wireless, The Crucial Decade,* p.34.

[228] Bussey, *Wireless, The Crucial Decade*, p.34.

[229] Bussey, *Wireless, The Crucial Decade,* p.34.

[230] R.Cadisch and Sons, *Radio Catalogue: Receivers, Radiograms, Components and Accessories 1934-35* (London: R. Cadisch and Sons, 1934).

detector'.[231] This shows the wide variety of valves that were being manufactured

and the specific needs they were being made to fulfil, such as those designed for low

power consumption. Furthermore, wholesalers' catalogues such as these provide

annual information on the major companies which were manufacturing and selling

valves throughout the interwar years. Brochures and booklets were produced en

masse by some major manufacturers such as Osram in an attempt to provide clear

details to a mainstream audience regarding the growing number of different valve

types. Osram published an information booklet in 1939 that was aimed at every

potential type of buyer - including the radio service engineer, the amateur,

experimenter and the user of a commercial broadcast radio.[232] Osram states that the

purpose of booklets like this was to inform the mainstream user of commercial

wireless by containing 'a tabulated description of each type of Osram Valve

normally used in broadcasts sets, with its list price and a useful table of comparative

types showing where an Osram Valve can be used'.[233] Many companies published

similar types of information and instructional booklets in the 1930s to help the now

growing new owners of wireless sets to understand the importance of the valve and

the differing types, including Ferranti, Tungsram and Mullard.[234] Mullard's

instructional booklet *Where does a Wireless Set Wear?* describes to an

inexperienced readership that 'the most important part of any set are the valves' and

details how 'one doesn't have to be an expert to remove valves from a set but here

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[231] Cadisch, *Radio Catalogue*, p.15.

[232] *Osram Valve: Every Radio Man's Pocket Reference*, MSI/SM8/30, MSI.

[233] *Osram* Valve, p.2.

[234] *Ferranti Valves, Where Does the Wireless Set Wear? An Aid to Better Radio by the Makers of Mullard Master Valves, Tungsram Valves: A Passport to Better Radio*, MSI/SM8/30, MSI.

are a few hints. First, make sure the set is switched off from the mains. Second, take

of the back of the set and remove any leads attached to the valves. Third, draw out

each valve with a straight, steady pull. Hold one hand above the valve to prevent it

hitting the top of the cabinet as it frees from the socket'.[235] As the different number

of valves grew due to competition between manufacturers and the potential of

advertising in relation to valves was realised, commonplace booklets like this

attempted to simplify the technology. It is clear the electronics industry was

specifically targeting new adopters as its consumer base. Thus, in the interwar years

there was an effort on the part of the electronics companies to educate the

mainstream commercial wireless listener by providing information related to the

importance of valves.

It should be noted that the production of valves increased even more in Britain

after the Second World War. As Richard Evely points out, Mullard became the

largest producer of valves and 'increased its share of the trade in valves and cathode

ray tubes from 40 percent pre-war to nearly 60 percent in 1954'.[236] By the 1930s it

was apparent to those concerned with the technology that 'wireless communication

and the great industry which has grown up as a result of the application of wireless

to entertainment is definitely as a result of the perfection of the valve' and that

'without the three-electrode valve there would be no broadcasting stations

disseminating amusement and no instruction short-wave communication across

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[235] *Where Does the Wireless Set Wear? An Aid to Better Radio by the Makers of Mullard Master Valves*, MSI/SM8/30, MSI, p.6.

[236] Richard Evely and I.M.D Little, *Concentration in British Industry an Empirical Study of the Structure of Industrial Production 1935-51* (Cambridge: Cambridge University Press, 2011), p.128.

entire continents'.[237] By the 1930s the all the valve manufacturers were targeting a significant consumer culture based around wireless technology rather than any military demands. The contemporary enthusiast press perceived that 'in the last and final analysis it is the valve which is responsible for the present state of wireless'.[238]

1.6 The Employment of Women in the Manufacturing of Electronics

Table 3 Distribution of total employment in the electrical engineering trade in the UK, 1935[239]
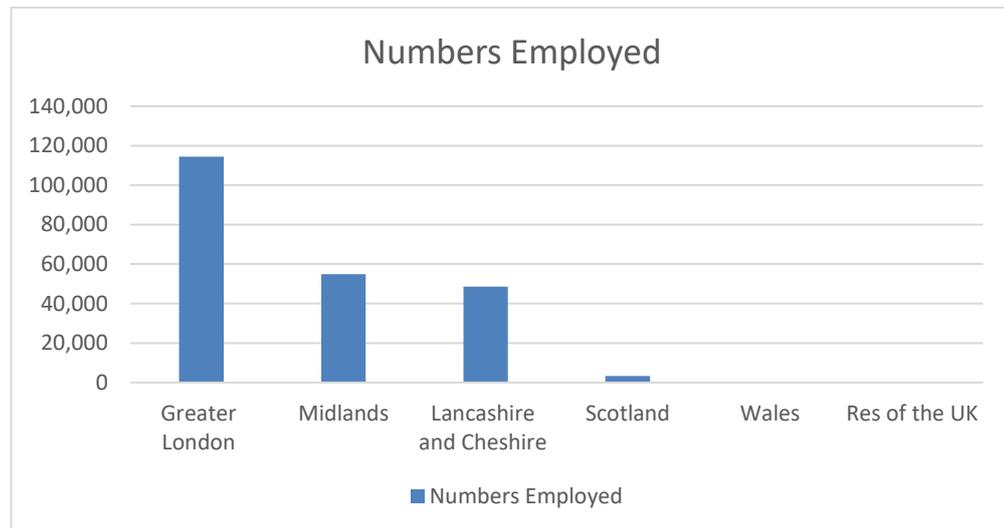
The increasing demand for electronics, including valves, during the interwar years ensured that the industry needed a steady flow of labour for its manufacturing process. When comparing the notable electrical engineering companies active in the interwar years is apparent that a majority of employees – around 115,000 - were

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[237] 'The Valve Yesterday and Today' *Wireless Magazine,* April 1932, p.292.

[238] 'The Valve Yesterday and Today' *Wireless Magazine,* April 1932, p.292.

[239] Catterall, 'Electrical Engineering', p.270.

based in the south of England, while another 100,000 people worked in the industry

in the Midlands and in Lancashire (Table 3). R.E Catterall points out that statistics

from the 1935 *Census of Production* reveal that 'the British electrical engineering

industry was not really a British industry at all, but an English one. In 1930 about

1.0 percent of gross output came from Wales and a little over 1 percent from

Scotland' and also that 'about 40 percent of total employment in the industry in

1930 was in the Greater London area and by 1935 this had risen to about 46

percent'.[240] This can be attributed partially to the initial demands on specific

companies during the First World War and the fact that defence policies and

wartime experience of companies working with the government exacerbated the

concentration of Britain's electronics industry in the south of England. Many of the

companies based in the south had experience of working with the technology

through direct deals with the government during the First World War. For instance,

'Stanley R. Mullard had been working on the design of transmitting valves for the

Admiralty and thereby gained considerable knowledge of the technology involved'

while at the same time Edison Swan was an important manufacturer of valves during

the war.[241] While it is true that the northern companies also manufactured valves

during the war, such as Metropolitan-Vickers, they did not receive the same

government contracts to do so. One reason for this is the fact that Metropolitan-

Vickers was limited by US control during the war. A series of letters exchanged

between Ferranti and the War Office show the kinds of work being done in their

factory during the war. Ferranti states they were contracted to manufacture '50,000

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[240] Catterall, 'Electrical Engineering', p.270.

[241] Thrower, *History of the British Radio Valve to 1940*, p.2.

shrapnel shells'.[242] The War office hoped Ferranti could help to manufacture aerospace engines, however, Ferranti was not in a position to do so and made it clear 'if we were required to do further work for the Government we would not be able to do so without financial assistance from them'.[243] This correspondence shows that Ferranti was entirely dedicated to a specific type of war work and could not extend themselves further even when asked to do so by the government. This explains why, in comparison to companies based in the south, Ferranti did not initially come out of the war as a valve manufacturer.

Out of the major valve interwar manufacturers Mullard was initially manufacturing valves in Hammersmith and Balham, Edison Swan in Ponders End, Cossor in Highbury, M.O Valve in Hammersmith and Standard Telephones Cables in Kent. In addition, large and important manufacturers did make valves elsewhere in the country, such as the General Electric Company (GEC) in Coventry and Metropolitan-Vickers in Manchester. More manufacturing plants were opened in the north of England throughout the interwar years through company mergers and expansion such as Mullard opening a new factory in Blackburn in 1938. Smaller manufacturers also tended to establish themselves predominantly in the south of England, but they also existed across the country, such as Midland Valves in Birmingham and Radion in Macclesfield. Metropolitan-Vickers and Ferranti manufactured valves in the north of England for a significant number of years while factories owned by the Marconi-Osram Valve Company began to manufacture valves in the north towards the end of the interwar years. As Table 3 shows, 48,542

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[242] *War Office Correspondence,* MSI/SM8/30, MSI, p.6.

[243] *War Office Correspondence,* MSI/SM8/30, MSI, p.6.

people were employed within the electrical engineering industry across Lancashire and Cheshire by 1935. While this is considerably lower than in London it still represented 19.6 percent of total employment across the entire industry. As of 1921 the electrical engineering industry's 'labour force had risen more than two-and-a-half-fold, to reach 90,311 [while] jobs for women had grown more quickly than for men and they now compromised 31 per cent of the total'.[244] Furthermore, by 1935 the proportion of women working within the industry had grown further, 91,013 women were employed across the industry while 169,252 men were[245], and by that time '81 percent of women were manual operatives, as opposed to administrative, technical or managers, or clerical staff, compared with 76 percent of men'.[246]

Despite the growth of the industry during the early interwar years, within the context of the rest of the British economy the wages employees received at Metropolitan-Vickers in the early 1920s were not much higher than they had been just before the war. An internal report by the company in 1923 concluded that 'the present rates of wages have practically the same purchasing value' as in 1913, i.e. real wages had neither decreased nor increased to any noticeable extent'.[247] On the other hand, the new industries fared better than the traditional ones during the interwar years, including during the depression. For the electrical engineering industry as a whole 'employment rose particularly fast during the 1930s, the number

[244] Geoffrey Timmins, *Made in Lancashire: A History of Regional Industrialisation* (Manchester: Manchester University Press, 1998), p.303.

[245] *Census of Production,*,1935, p.346.

[246] Glucksmann, *Women Assemble*, p.63.

[247] 'International Rates of Wages in the Engineering Industry' *Metropolitan-Vickers Research Department Report,* August 1923, 2003.50/7/2/71, MSI, p.3.

of insured workers increasing from 173,00 in 1924 to 367,000 in 1935.[248] These

trends can be attributed to the employment opportunities large manufacturers such

as Metropolitan-Vickers, Ferranti, Mullard and Marconi-Osram offered in areas like

Lancashire where the older industries such as textiles were experiencing downsizing

and unemployment, a pattern exacerbated by the depression of the 1930s.

Table 4 Average numbers employed in the UK cotton and wool industries 1912-1937[249]
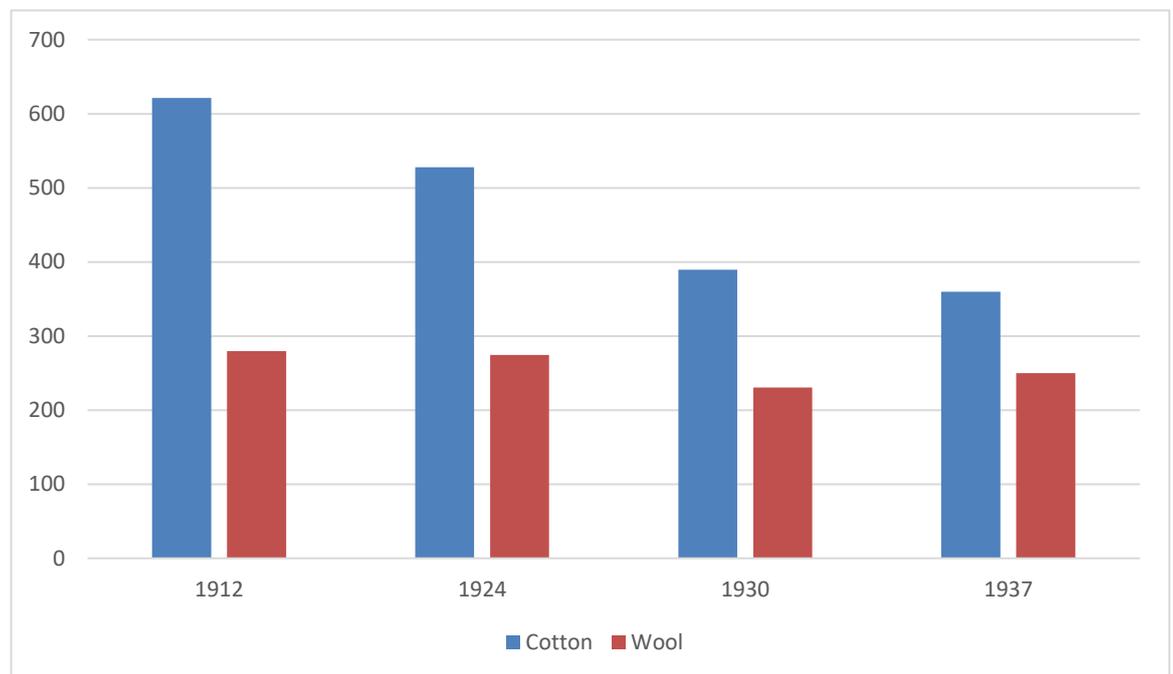
Table 4 shows the average number of employed in the wool and cotton textile

industries throughout the interwar years. The textiles industry had always relied on a

proportionally high number of working-class women, long before the First World

War. In the nineteenth century 'female labour in cotton factories grew in

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[248] Glucksmann, *Women Assemble*, p.57.

[249] J.H Porter 'Cotton and Wool Textiles' in *British Industry Between the Wars: Instability and Industrial development 1919-1939* ed by Neil K. Buxton and Derek H. Aldcroft (London: Scolar Press, 1979), pp. 25-47 (p.27).

importance, providing 48 percent of employees nationwide in 1835 and nearly 61 percent by 1907'.[250] According to the census of production, as of 1935 432, 900 men were employed across the entirety of textiles industry while 622,000 women were.[251] Geoffrey Timmins attributes this to 'rising wages for women' and as a potential 'response to a fall in the proportion of child labour'.[252] From the statistics in table 4 it is evident that employment across the textiles industry fell consistently as industrialization began to spread to countries which previously had been important textile and clothing importers.[253] J.H. Porter attributes this interwar decline to the decrease in exported products due to the 'loss of overseas markets'.[254] Porter cites the fact that 'the loss of the Indian markets was drastic: as Indian tariff barriers rose so Lancashire exports declined'.[255] Employers such as Ferranti and Metropolitan-Vickers provided Lancashire with important alternative employment options for those no longer able to enter the declining textile industry as easily, particularly young women. During the interwar years 'heavy unemployment discouraged recruitment to the industry and consequently the average age of those employed rose from 29 in 1911 to 34 in 1931'.[256] This created a significant labour force of young women in Lancashire willing to enter the electronics industry.

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[250] Timmins, *Made in Lancashire,* p.226.

[251] *Census of Production,* 1935, p.15.

[252] Timmins, *Made in Lancashire,* p.226.

[253] William Paca Kennedy, *Industrial Structure, Capital Markets and the Origins of British Economic Decline* (Cambridge: Cambridge University Press, 1987), p.46.

[254] Porter, *British Industry Between the Wars,* p.28.

[255] Porter, *British Industry Between the Wars*, p.28.

[256] Porter, *British Industry Between the Wars*, p.28.

Employers recognised this development as an opportunity and even the companies based in the south of England opened new factories in the affected areas like Lancashire. For example, Mullard opened a new factory in Blackburn in 1938 with assistance from the local authorities in a direct effort to lower local unemployment. This factory would go on to become the largest valve manufacturing plant in Europe by 1962.[257] The existing firms in Lancashire at the start of the interwar years were also a consistent source of employment for people in the area. For Metropolitan-Vickers, based in Manchester, as early as 1920 output had increased by 30 per cent and the total number of people employed by the company had risen to nearly 10,000.[258] It is clear that the decline of older industries helped electronics companies like Metropolitan-Vickers to recruit large number of young women. John Dummelow's history of the company describes how young women were so prominent within the company due their shift away from textiles that as early as 1920 the company had 'one of the few all-women committees in the industry' that helped 'promote goodwill and cooperation and thus keep up productive efficiency'.[259]

During the early 1930s Britain experienced 'the see-sawing of trade, employment and investment' as a result of the depression.[260] The unemployment experienced across the country during this period had significant and long-lasting consequences

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[257] *Mullard - The Blackburn Vacuum Tubes Factory* < Mullard - The Blackburn Vacuum Tubes Factory (Full) - YouTube> [Accessed 25 January 2021].

[258] John Dummelow, *1899-1949 Metropolitan-Vickers Electrical Company* (Manchester: Metropolitan-Vickers Electrical Company, 1949).

[259] Dummelow, *1899-1949 Metropolitan-Vickers Electrical Company*.

[260] Nicholas H. Dimsdale, *British Financial Crises Since 1825* (Oxford: Oxford University Press, 2014), p.13.

on those who lived through it. Ian Gazeley highlights the fact that 'many of the

retired in the 1950s would have been prime working age during the depression. This

would help explain why in the 1950s about 30 percent of old people had no assets at

all and another 20 percent had only trivial assets'.[261] Despite this and the popular

imagery of the depression years, industries such as electronics provide a different

narrative of the decade in Britain. As Chris Cook and John Stevenson posit 'the very

pervasiveness of the image of the hungry thirties has done much to distort our view

of the period and its more constructive and substantial achievements. A

concentration upon unemployment and social distress does not represent a complete

portrayal of the decade'.[262] The condition of the British electronics industry

throughout the 1930s demonstrates the accuracy of Cook and Stevenson's argument.

Reactions to the economic slump from those connected to the engineering industry

were not ones of drastic concern. Groups such as the WES which was primarily

concerned with the continued employment and training of women within

engineering were not dissuaded from their activity by the initial impact felt by the

depression. Writing in the Society's journal in 1932 the one-time actress turned

electrical engineer Edith (Maysie) Pender Chalmers optimistically predicted that

'the trade depression of last year or so has delayed progress considerably but with

the coming revival and the determination of the people to 'Buy British' our

production must go up and in so will create the demand for trained engineers'.[263]

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[261] Ian Gazeley, *Poverty in Britain, 1900-1965* (Basingstoke: Palgrave Macmillan, 2003), p.178.

[262] Chris Cook and John Stevenson, *The Slump: Britain in the Great Depression* (London: Routledge, 2013), p.11.

[263] Mrs Pender Chalmers, 'Aeronautical Training for Women' *The Women Engineer* 10 (March 1932), 145- 176 (p.147).

This prediction may have seemed optimistic at the time but the success of the electrical engineering industry during the years of the depression justifies the optimism. However, it was the supposedly 'unskilled' women workers that the industry relied upon and employed in large numbers during these years rather than fully trained women engineers whose opportunities remained limited.

That said, the industry was impacted by the depression of the early 1930s to some extent, although not to the extent of other industries and the electronics companies managed to rebound from its effects relatively quickly, including in the north of England. For example, the Ferranti company's numbers of employees dropped from over 3,000 in 1932 to under 2,000 in 1933 but was employing almost 5,000 people by 1935. [264] A quick recovery from the impact of the depression was commonplace across the industry and its manufacturers. Soon after the formation of the AEI in 1928 it was faced a with 'slump in trade: unemployment increased, eventually approaching the three million-mark, world trade became disorganised, and Britain was forced off the gold standard'.[265] However, as Dummelow notes in relation to Metropolitan-Vickers, the fears over these developments were not held for long as by 1933 trade began improving and 'more orders came in, employment increased, and the works output rose to a record value in 1934. Two years later came the first Government contracts in connection with the rearmament programme, and by 1938 the Company was employing nearly 16,000 people, twice as many as in the worst days of the slump'.[266] Evidently, the British electronics industry proved capable of

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[264] John F. Wilson, *Ferranti A History Volume* 2 (Manchester: Manchester University Press, 2013), p.302.

[265] Dummelow, *1899-1949 Metropolitan-Vickers*, p. 120.

[266] Dummelow, *1899-1949 Metropolitan-Vickers*, p. 120.

sustaining the losses that occurred following the financial crash and depression. From this it can be surmised that the demand and popularity of wireless components like the valve did not decrease during the depression. Wireless production grew across the industry and, unlike many other industries that were still struggling from the economic slump, it managed to achieve a higher gross output in 1935 than ever before.

Table 5 Gross output wireless apparatus and thermionic valves 1924-1935[267]
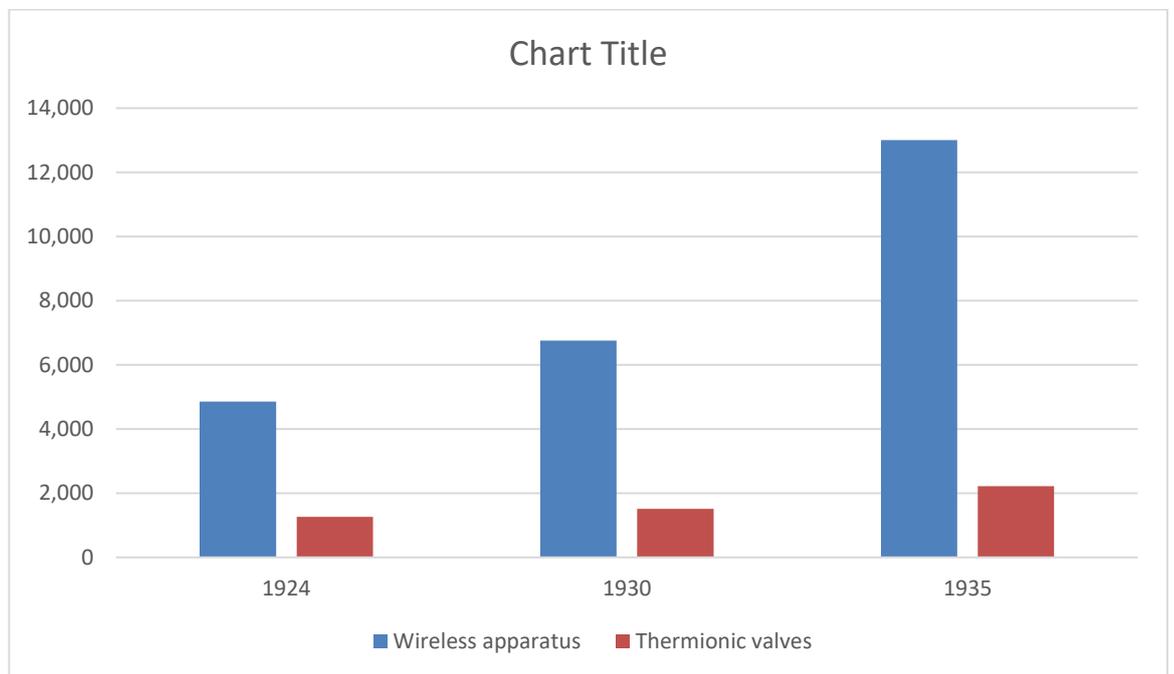
Table 5 shows that the gross output of both wireless apparatus and thermionic valves was not hindered much by the depression and was growing rapidly by 1935. The discrepancy between the number of sets and thermionic valves produced can be attributed to crystal sets also being manufactured and valves being reused across sets. Table 5 reflects the success of the electrical engineering as a whole during the decade, a success of which wireless and its components were an increasingly

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[267] *Census of Production,* 1924, 1930,1935.

significant part: 'in 1914 output of radio equipment and valves had been minimal but by the mid-1930s this section of the industry was contributing nearly 15 percent of the industry's output'.[268] As a result the industry expanded, and new factories were being opened by companies like Mullard in the 1930s. Evidently, the domestic demand and interest in wireless insulated the industry from the worst effects of the depression. In the late 1930s, the military importance of wireless and its valves became evident once again as the country began preparing for another possible war, and the technology would return to the forefront of military operations during the Second World War. However, by then it was a technology that had been fully embraced by the government and the public and had successfully sustained the vital British electronics industry during difficult economic years for the country. Equally, it was an industry that provided a new kind of employment for thousands of working-class women during a period of high unemployment and limited opportunities for working-class women. To conclude, by the end of the 1930s wireless set had become an important piece of technology that was adopted across Britain. The interwar years saw the successful growth of a domestic electronics industry, the establishment of a public broadcaster and the adoption of wireless technology into mainstream British cultural life. It was the development of the valve which made this possible because, for the most part, they were manufactured and used domestically. The emergence of the interwar electronics industry and the developments that took place within it can be attributed directly to the impact of the First World War. Wireless technology and valves were developed before the war, however wartime demands brought about their development and application on a

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[268] Catterall, 'Electrical Engineering', p.270.

scale not seen before. This resulted in some companies such as Tunsgram and Metropolitan-Vickers gaining experience of directly manufacturing valves which they then continued to do in the interwar years. Other companies such as Mullard were founded immediately following the war by owners who had encountered the technology through their military work. Unlike much of the new technology deployed during the war wireless quickly transitioned into a peacetime consumer product. The example of the British electronics industry demonstrates that the 1930s depression was not always a significant detriment to emerging new industries. The enduring nature of the British electronics industry through the economic slump can be attributed in part to the establishment of the BBC which increased mainstream demand for wireless set ownership and the prominence of the VMA which controlled prices, organised valve numbering and pooled their research into valve technology. Advertisements and booklets published on behalf of the valve manufacturers show how a wider demographic was being targeted even in the early interwar years which expanded the appeal of the thermionic valve beyond the hobbyists and enthusiasts. The industry was mainly based in the south of England due to the impact of the First World War, although large manufacturers also existed in the Midlands and North of England. The electronics industry was dominated by sizeable factories that employed a large number of people in a single space to produce a high number of different valve types. The adoption of mass production techniques facilitated the uniform production of valves in high numbers. This new industry establishing itself in Britain coincided with the decline of the more traditional ones such as textiles. This brought about a preference within the electronics industry for readily available cheap female labour that persisted and became synonymous with the industry throughout the interwar years. As I will analyse in the next chapter, however, this was a development that also created a

largely un-organised female labour force that faced opposition from certain sectors of society.

Chapter 2: Interwar Opposition to and Organisation of Women Workers in the Electronics Industry

As I detailed in the previous chapter, the employment of women remained a constant within the electronics industry from the First World War and throughout its growth in the interwar years. This trend coincided with an effort by the state and some sectors of society and social commentators to return to a restoration of pre-war normality. This desire to implement pre-war norms involved the projection of traditional gender stereotypes and social expectations onto women, which prioritised their domestic role as wives and mothers. Yet it did not match the reality that women were increasingly employed in the electronics industry and therefore experienced their own specific forms of labour relations. In this chapter of this thesis, I will examine and explain the most prominent forms of opposition and organisation that surrounded women's growing and increasingly solidified position within the British interwar electronic industry.[269] In doing so I will analyse in what ways this was similar or different to the wider patterns of opposition and organisation that women were experiencing across the other interwar industries. Firstly, I will demonstrate the general opposition that emerged regarding women industrial workers across most industries following the end of the First World War, which encompassed political, scientific, and social justifications such as eugenics. This puts the specific trade union opposition that women within engineering and electrical engineering faced in the wider context of social trends based upon the idea of upholding traditional gender norms in relation to work. Despite the electronics industry increasing the number of female employees, other sectors dismissed their

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[269] Glucksmann, *Women Assemble*, p.47.

female workforce as the men returned from the war.[270] This chapter will further

explore that context in order to explain what kinds of opposition and organisation

both middle-class and working-class women workers experienced in the interwar

electronics industry.

To achieve this, after examining wider social concerns such those expressed by

political parties and socially conservative groups such as the Mother's Union, I

consider how middle-class and working-class women enacted their own different

forms of organisation. I analyse visual representations of female skill, and industrial

action in reaction to male opposition and working conditions. After this, I examine

to what extent the general trades unions represented and organised women working

in the electronics industry. Finally, I focus on the major opposition and practical

hurdles that women in the electrical engineering and electronics industry faced

directly, which I argue emanated predominantly from the trades unions, specifically

the Amalgamated Engineering Union (AEU) (later the Electrical, Electronic,

Telecommunications and Plumbing Union).[271] I explain in detail why such

opposition existed within the AEU and how it was manifested. I will also extrapolate

on why and how this changed. This chapter focuses on a skilled trade union, the

AEU, which will also allow for a direct comparison between the skilled trades

unions and the general unions on their position regarding all women workers within

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[270] 'Women Engineers' *Sheffield Daily Telegraph*, 1 July 1922, p.10.

[271] Richard Croucher, *Engineers at War 1939- 1945* (London: The Merlin Press, 1982), p.251, J. David Edelstein, Malcolm Warner, *Comparative Union Democracy: Organisation and Opposition in British and American Unions* (Piscataway: Transaction Books, 1975) p.263. Boston, *Women Workers*, p.6. Jeffrey Haydu, *Between Craft and Class: Skilled Workers and Factory Politics in the United States and Britain 1890–1922*, (Berkeley University of California Press 1890-1922, 1988) p.161.

the electronics industry. In this chapter I will broaden my scope beyond women working in the electronics industry, but the points raised relate directly to them, as it highlights their position in a fuller context. The closest 'skilled' trade union associated with the electronics industry was the AEU and they also facilitate a comparison across economic classes to include middle-class women engineers and how they had to organise themselves around the idea of being 'skilled'. I posit that women workers in the electronics industry were, if not in an entirely unique position, nevertheless a crucial case-study in the context of examining the transitions that took place regarding the organisation of and opposition to women workers during Britain's interwar years.

2.1 Political and Social Opposition to Working Women

Many conservative and traditional groups founded in the late nineteenth century that were set up and run by women to manage and present how the 'ideal' woman should live and, more importantly, raise her children, rose to prominence in the interwar years. These groups show how social and political opposition to women working in manual jobs hardened even further when it came to married women and mothers. These groups were not concerned with young single women taking up 'male' industrial jobs like some trades unions were but with 'protecting' the nation's mothers, a concern that cut across all classes. Helen McCarthy highlights how these concerns shaped employment trends, emphasising that 'paid work became the norm for young, single women: only 12 percent of unmarried eighteen to twenty four year were not in regular employment by 1931' whereas the picture was 'exactly reversed for married women, with less than one in ten returned as occupied in the 1931

census'.[272] The women working in electronics industry mostly fell into the first

group which goes some way to explain the lack of direct opposition the industry

faced for employing them.[273] Some of these conservative women's groups had

historic links with the anti-suffrage movement and, after their loss in 1918,

recalibrated their ambitions into projecting an ideal image of womanhood tied to

family and motherhood. Susan R. Grayzel has shown how this discourse around

'women's allegedly more natural and equally important task of reproduction'[274] was

prevalent before, during and after the war. Adrian Bingham argues further that

alongside the popular press, organisations such 'the Women's Institute and the

Mothers' Union who shied away from feminism […] played a significant role in

encouraging women to embrace their citizenship'.[275] However, the kind of female

citizenship that was encouraged by such conservative leaning groups was a

traditional one that rarely embraced the realities of the lives working-class women

had to live. Motived by her Christianity, Mary Sumner founded the Mothers' Union

in 1876 and set out the organisation's primary objective to reach out to the country's

mothers. Similarly, Catherine Booth and the Christian Mission aimed 'to raise the

standards of mothering in Britain by instructing women on their duties in home'.[276]

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[272] Helen McCarthy, *Double Lives: A History of Working Motherhood* (London: Bloomsbury Publishing, 2020) p.139.

[273] Glucksmann, *Women Assemble,* p.61.

[274] Grayzel, *Women and the First World War*, p.49.

[275] Adrian Bingham 'Enfranchisement, Feminism and the Modern Woman: Debates in the British Popular Press, 1918-1939' in *Aftermath of Suffrage Women, Gender, and Politics Britain, 1918-1945*, ed. by Julie V. Gottlieb and Richard Toye, (London: Palgrave Macmillan, 2013), pp.87-104 (p.94).

[276] Andrew Mark, *Women in God's Army: Gender and Equality in the Early Salvation Army* (Waterloo: Wilfrid Laurier University Press, 2003) p.116.

The third objective of the Mother's Union was 'to be united in prayer and to lead by example', which was 'its core purpose'.[277] Maggie Andrews highlights how even progressive and explicitly feminist groups that campaigned for more rights for women, such as the Women's Institute, 'did not challenge women's primarily domestic role'.[278]

The records of local Mothers' Union groups present a less evangelically motivated discourse but one that nevertheless projected an idealised version of women and motherhood in the interwar years. The meeting notes of the Stretford Parish Church Mothers' Union show a group mainly concerned with arranging daytime picnics and details around trips such as them 'having made arrangements with the York mothers for two saloon coaches to take us to Liverpool'.[279] Alongside a concern for leisure the groups notes also demonstrate a focus on religious activities such as inviting each member to 'join the bible reading fellowship'[280] for a subscription charge and the arrangement of lectures and seminars on various subjects such as how a housewife should properly manage the home while the husband worked. It is evident from these notes that the local Mothers' Union offered a place for mothers to socialise and form a genuine community. Much like the Women's Institute this group highlights how some women pushed back against the

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[277] Cordelia Moyse, *A History of the Mothers Union,* (Suffolk: Boydell and Brewer, 2009), p.43.

[278] Maggie Andrews, *The Acceptable Face of Feminism: The Women's Institute as a Social Movement* (London: Lawrence and Wishart, 1997), p.8.

[279] Chancery of Lancashire, Notebook 57, L89/43, MCL, p.19.

[280] Chancery of Lancashire, Notebook 57, L89/43, MCL.

reality of thousands of women, including some mothers, engaged in waged work and effectively organised themselves around projecting an ideal image of middle-class womanhood. They also show how the interwar years facilitated the necessity and opportunity for women to organise themselves in such a manner. Maggie Andrews argues that in groups such as these the 'perception of womanhood may have been primarily domestic, but it was not a passive domesticity'.[281] However, the realities of working-class life are absent from their committee meetings, and the frequent requests for donations and volunteering work show a disconnect between the group's perception of motherhood and economic realities. They did not oppose young working women or working-class mothers outright but did exclude them through omission as they did not fit within their preferred image of femininity and motherhood. As Helen McCarthy states, despite the economic realities 'the dominant ideal across all classes was that of the breadwinner family: a household headed by a male worker earning a wage large enough to keep his wife and children, typically through secure, skilled work'.[282] While women working in the electronics industry were accepted to some degree, it is clear that the dominant view was that it was a temporary job that should be given up upon marriage, despite the economic necessity of many working-class families relying on two incomes.

Nineteenth-century conservative and traditionalist assertions regarding gender and sex increasingly claimed credibility and support from the emerging scientific trends and growing schools of thought that gained popularity during the interwar years.

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[281] Andrews, *The Acceptable Face of Feminism*, p.9.

[282] Helen McCarthy, *Double Lives: A History of Working Motherhood* (London: Bloomsbury Publishing, 2020) p.3.

The most prevalent of these was the eugenics movement which expressed very particular views about the role of women and their position in British society. By the interwar years, a significant number of eugenicists had 'focused on the threat posed by the British urban poor'[283] and the significant role reproduction and working-class women played in the health of the nation. This concern had existed prior to the war but the country was now faced with the growing demand by employers in industries such as electronics to hire working-class women. The journal *Eugenics Review* exemplifies how many prominent writers in the field felt about women entering the workforce en masse. The main concern expressed within the pages of the journal during the interwar years is focused on mothers returning to work 'too soon' after giving birth and depriving the child. A report published in 1918 entitled 'Save the children' outlines the eugenicists' concerns over working women: 'the problem of child-life is undoubtedly the return to work of the mother too soon after childbirth. In many manufacturing centres- for instance, Dundee- the women return within a month of the child's birth' which the report argues means that the 'infant is deprived of its natural food and also that older children have to get food for themselves because their mothers' time off from the factory by no means coincides with the hours the children are free from school'.[284] From this we can see that concerns surrounding working-class mothers were widespread enough to be published in journals and given ample pages of discussion. Industries such as electronics were the targets of the eugenicists' concerns as they were associated with a mass of women who, in their eyes, were placing work above their own children and the nation's

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[283] Clare Hanson, *Eugenics, Literature, and Culture in Post-war Britain* (New York: Routledge, 2013).

[284] 'Save the Children', *The Eugenics Review*, 10 (1918), 1-176 (p.75).

future. Furthermore, unlike the Mothers' Union, eugenicists propose practical economic incentives to dissuade working-class mothers from employment following childbirth. Dr Leslie Mackenzie concludes in the *Eugenics Review* that 'in the interests of both mothers and children measures should be taken at once to improve the housing accommodation, to forbid women to return to work out of their homes during the months that they should be suckling their children, and to make adequate provision for the supply of nourishing food both to the expectant and the nursing mother'.[285] The examples above make it readily apparent that many religious and political schools of thought held negative perceptions of women working in industry, not primarily out of direct concern for the women themselves, but for their children and therefore the 'health' of the nation. Of course, this concern also led many eugenicists to different and less generous solutions such as an article in the *Eugenics Review* by the Liberal MP Harold Cox in 1922 which states 'it is impossible appreciably to raise the physical and intellectual standards of the mass of our population so long as the conditions of present life continue, and I further contend the only practicable method of greatly improving present conditions is to reduce the population'.[286] So, while some eugenicists did not concern themselves with working conditions or oppose women working in large numbers in the electronics industry, some argued that being working-class qualified them for sterilisation and disqualification from raising children.

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[285] 'Save the Children', *The Eugenics Review*, 10 (1918), p.75.

[286] Harold Cox, 'The Reduction of the Birth Rate as a Necessary Instrument for the Improvement of the Race', *The Eugenics Review,* 14 (1922), 1-214 (p. 84).

These views regarding working-class women were not just espoused by a small niche, as Lucy Bland and Lesley A. Hall point out: 'by the turn of the century, the appeal of eugenics in Britain had spiralled, largely because it tapped into British middle- and upper class anxieties of the period'.[287] The traditional focus on women as wives, consumers and mothers and the lack of acknowledgement of the new women-dominated industries, such as electronics, was not only espoused by the openly conservative elements of interwar British politics. The AEU represents one of the staunchest sources of interwar opposition to female industrial workers due to their official position that employing women always led directly to 'lower wages'[288] for their male members. There were in fact multiple political incentives for opposing the employment of women in the industrial sector following the end of the First World War. The demobilisation of women workers from certain industries was an attempt to ensure that the wartime experience remained exclusively linked to the imagery of fighting men and the erasure of women's contribution. Primarily, there was the pressure to re-integrate men back into their pre-war jobs in combination with pre-existing beliefs in established gender roles, specifically regarding married women. Opposition to married women in work took the form of outright condemnation of those who had entered waged war work, as Deborah Thom notes 'the policy of the Ministry of Labour also effectively excluded married women from manual work [as] no women could refuse domestic service work on the grounds she

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[287] Lucy Bland and Lesley A. Hall, 'The Rise and Appeal of British Eugenics', in *The Oxford Handbook of the History of Eugenics*, ed. by Alison Bashford and Philippa Levine (Oxford: Oxford University Press, 2010), pp.213-227, (p.213).

[288] 'AEU National Committee Shies at an Awkward Resolution' TU/ENG/6/F/, V10 Box, 1938. WCML.

had another trade as a war worker'.[289] Furthermore, wider resistance to women

working in industry often manifested itself either consciously or unconsciously in

the omission of women and their specific issues from the political discourse.[290] As

David Thackeray highlights: 'after the war, conservative literature rarely addressed

women as waged workers, focusing instead of their household duties and role as

consumers'.[291] Thackeray points out that the Conservative party's 1922 campaign

guidebook noted that 'the problems of a changeful time need the co-operation of the

women, which sees them from the kitchen and nursery window, with the man, who

looks through the office or workshop'[292] and that similar rhetoric was in continued

use throughout the entirety of the interwar years despite the expansion of the

franchise in 1918 and 1928. This form of soft opposition through omission reveals

that there was a widely held political position that changes brought about by the war

were to be considered a temporary upheaval of normality rather than a fundamental

change in how the country operated. Gail Braybon elaborates that the major post-

war positions established regarding women working in industry were: those who

wanted a complete reversal, those who demanded more radical change, and those

who accepted some change but wanted society to remain as it was, a position in

which 'the largest number of observers from all social classes fell into'.[293] Of

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[289] Thom, *Nice Girls and Rude Girls*, p.41.

[290] Braybon, *Women Workers in the First World War*, p.220.

[291] David Thackeray, 'From Prudent Housewife to Empire Shopper: Party Appeals to the Female Voter, 1918-1928', in *The Aftermath of Suffrage Women: Gender, and Politics in Britain, 1918-1945*, ed. by Julie V. Gottlieb and Richard Toye (Hampshire: Palgrave Macmillan, 2013), pp.37-55 (p.45).

[292] Thackeray, 'From Prudent Housewife to Empire Shopper', p.45.

[293] Braybon, *Women Workers in the First World War*, p.174.

course, it is to be expected that the Conservative Party would target traditional social beliefs regarding gender and middle-class women, who were less likely to be in an economic situation requiring them to work. Nevertheless, this does show that there was a political incentive to ignore the changed realities of interwar Britain, and a focus on how things should be regarding women in work rather than acknowledging the realities of the ambitions many middle-class women espoused and the economic realities of working-class women's lives. This applied to a significant number of women, as during the years 1916-1917 up to 511,000 women entered the workforce and in 1918 women made up 46.7% of the workforce.[294] Furthermore, when looking at a single company such as Metropolitan-Vickers the volume of women this applied to becomes even more apparent within the engineering and electronics manufacturing trades. John Dummelow points out that 'during the war, the number of workpeople increased from 5,200 to a peak figure of 8,000 in May 1917, but the old skilled workers nearly disappeared. Women came into the factory in large numbers, growing from 620 to 2,500—nearly a third of the employees'.[295]

The Labour Party and the trades unions held a range of complicated stances regarding women in industrial work that encompassed complete support to absolute opposition.[296] This opposition had existed prior to the interwar years and the new industries like electronics represented a shifting of employment opportunities rather

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[294] Thom, *Nice Girls and Rude* Girls, p.34.

[295] Dummelow, *Metropolitan-Vickers Electrical Co 1899-1949*, p.2.

[296] Marion Phillips, *Women and The Labour Party* (London: Headley Brothers, 1920). June Hannam, 'Women and Politics', *in Women's History: Britain, 1850-1945 An Introduction*, ed. by June Purvis (New York: Routledge, 1995), pp.185-209. Gerry Holloway, *Women and Work in Britain since 1840* (London: Routledge, 2005).

than a significant increase in the overall employment of women after the war. For instance, while engineering and aligned industries saw a steady increase of insured women employees from 36,400 in 1923 to 85,800 in 1938 traditional jobs held by women, such as textiles, saw a decrease from 79,080 in 1923 to 68,800 in 1938.[297] While they do, to a limited extent, highlight issues surrounding the plight of the new female workers, trade union literature and official Labour Party literature displays similar traits on the topic as their Conservative counterparts; that is, to either completely ignore certain jobs women were employed in or to present women as the traditional housebound consumer. A significant example of this can be seen in the pages of *Labour* and *Labour Woman* magazines. The electronics industry, despite the high number of female employees, receives little mention in the pages of these magazines, not even in relation to wages or working conditions. Working women were not completely absent from the pages of such literature, articles such as 'The girl whose serves the meals: the condition of the Waitress'[298] by Madeline J. Symons and published in 1922 directly tackle issues of women workers' wages and working conditions. However, the most consistent appeals and articles aimed at women readers engaged them as consumers and housekeepers. For example, every edition of *The Labour Woman* throughout the 1920s and 1930s features a column entitled 'Housewife' which deals with parenting issues such as 'many mothers complain that their young daughters will not wear thick enough clothes in the summer', or offering culinary advice such as 'when cooking fruit which is sour put

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[297] Glucksmann, *Women Assemble,* p.48.

[298] Madeline J. Symons, 'The Girl Whose serves the Meals: The Condition of the Waitress' *The Labour Woman* January 1922, p.6.

in a pinch of salt'.[299] From this, we can see that similar social pressures and expectations of women not staying in work after marriage and being mostly suited to housework emanated from publications such as this as well as the more conservative leaning ones. The lack of focus on new industries such as electronics and the women that made up its workforce can be linked to their lack of acceptance by certain trades unions, most starkly in the case of the AEU. Such literature attempts to provide an entirely united front for the labour movement and avoids any internal conflicts and contradictions. From these examples, it is clear women faced social and political resistance to their employment in industry in large part due to their potential and expected positions as wives and mothers. This means that the young, mostly single, working-class women who in large part made up the workforce of the interwar electronics industry did not receive the same level of opposition as married women or working mothers. Their position in the new industry was not lauded by social or political organisations but it was accepted in a limited fashion or completely ignored until the women workers in the industrial space transgressed into the realm of marriage or motherhood. The statistics regarding women who manufactured electronic and electrical goods demonstrate the social power of such expectations and opposition had upon women in the 'new' industries.

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[299] 'The Housewife', *The Labour Woman,* April ,1929, p.61.

Table 6 Age of operatives in electrical manufacture, 1931, by sex[300]
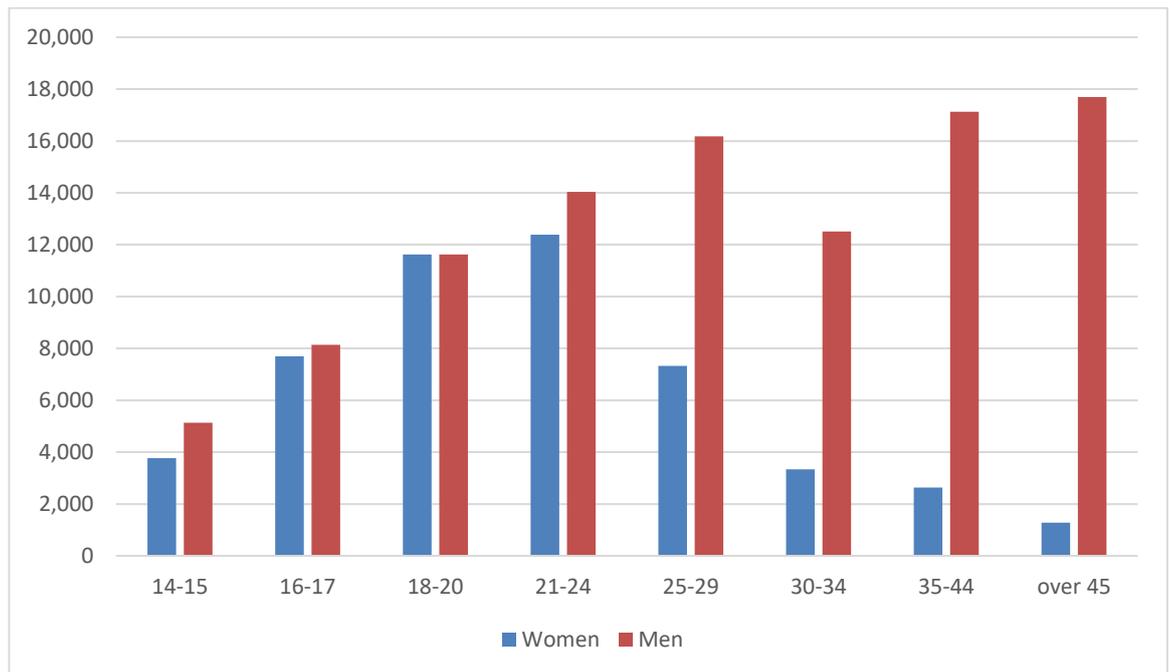
Table 6 shows that the number of women employed in the industry dramatically fell after the age of 24, unlike the men who remained employed much longer with the majority of employees being over 45. Despite the large number of female employees, with more 18-20 year old women employed in the industry than men of the same age, it is evident wider social pressures still pulled older girls and women away from the industry as they either got married or became mothers. This is despite the relative acceptance of their place in the electronics industry in comparison to other sectors. That said, the light manufacturing jobs offered by the emerging electronics industry significantly and permanently impacted employment patterns for young women. As Selina Todd observes, occupational studies from the interwar years show that working-class young women were 'slightly more likely to find work in a higher occupational grade than their brothers, and were much more likely to

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[300] Glucksmann, *Women Assemble,* p.61.

move two or more grades upwards from their fathers' as a result of 'post-war expansion in semiskilled work for young women in light manufacture'.[301] This claim is justified because the statistics from the same David Vincent study[302] show that the pre-1918 sample of women 'were more likely to experience downward progression from their fathers' last occupational grade'.[303] The young women in these roles, though, still faced opposition from powerful trades unions such as the AEU who had specific and lasting objections to working-class women in the engineering and electronics industries. In the rest of this chapter, I will examine the emergence of the WES as an organisational force of middle-class women following the end of the war, before focusing on the relationship that existed in the interwar years between women workers and the trades unions. I will then analyse how women working in electronics manufacturing fitted within this context and pushed back against it.

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[301] Selina Todd, 'Poverty and Aspiration: Young Women's Entry to Employment in Interwar England', *Twentieth Century British History*, 15 (June 2001), 119–142 (p.126).

[302] David Vincent, 'Mobility, Bureaucracy and Careers in Early Twentieth Century Britain' in *Building European Society: Occupational Change and Social Mobility in Europe, 1840-* 1940 (eds) Andrew Miles and David Vincent, (Manchester: Manchester University Press,1993), pp.234-235.

[303] Todd, 'Poverty and Aspiration'p.126.

2.2 Middle-class Women Workers and Organisation around 'Skill'

Writing in 1920, Barbara Drake highlighted the reasoning for the gendered hierarchy in trades unions by quoting a trade union correspondent who insisted that 'women will never organise women' but that 'working men can and have successfully organised women workers'.[304] Evidently, there was an implicit understanding by some in the trades unions that the new realities regarding female labour should be managed and organised by the supposedly more capable male representatives. This belief can be attributed to the large number of manufacturing workers that existed in the engineering trades as non-union members in the years immediately following the war. However, women who were in a position to after the war did organise themselves in various ways. Industrial action was not the only way the female workforce of the interwar years organised itself. For the middle-class women who were demanding access to careers and equality, organisational structures outside of traditional unions proved to be just as sustainable through and beyond the interwar years. Publications established by women for women, such *The Woman Engineer*, attempted to organise the female workforce by inculcating pride in their own work and by making a forceful argument for the skilled work being done by women in industry. Due to its focus on 'skilled' workers, this magazine was aimed at a readership of middle-class and qualified women within the engineering industry rather than the large mass of supposedly 'unskilled' women who worked in the electronics industry. As the official journal of the Women's Engineering Society, *The Woman Engineer* attempts to provide some counterbalance to the male

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[304] Drake, *Women in Trade Unions*, p.184.

dominated discourse around women as a purely unskilled workforce.[305] However, the journal also acknowledges the widespread negativity voiced by those opposed to women within the industry. In the September 1921 edition of *The Woman Engineer* there is a published discussion of the response to a paper read at the summer meeting of the Institute of Civil Engineers entitled 'The influence of the automatic and semi-automatic machine on the skill and resources of the mechanic and operator'.[306] The discussion is concerned with the impact upon women workers regarding the adoption of automatic machines. A Captain J.E Mortimer states that 'the skill displayed by women on automatic machines could not be seen to be better than that of men. They were undoubtedly more patient, and they were more satisfied with the conditions than the average man would be. That women were generally more skilful with their fingers was no doubt true but there was a difference between skill and a keen sense of touch […] the women scored generally in quickness rather than this'.[307] Captain J. E Mortimer acknowledges the capacity of the women to use the machines, even stating they were better than their male counter-parts in some ways, but from his perspective any skill displayed by the women workers on the automatic machines was due to innate gendered characteristics such as small hands and an ability to be patient with repetitious tasks, rather than any actual 'skill'. This

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[305] Carroll Pursell, 'Am I a Lady or an Engineer?', 78-97. Henrietta Heald, *Magnificent Women and their Revolutionary Machines* (London: Unbound, 2019). Roger Penn, *Skilled Workers in the Class Structure* (Cambridge: Cambridge University Press, 1984). Women's Engineering Society, 'History' < https://www.wes.org.uk/content/history> [Accessed March 2020]. E. Bruton and G. Gooday 'Towards a Longer History of British Women in Engineering', *British Society History of Science Newsletter Viewpoint* (September 2018) 12-13.

[306] 'Women's work on Automatics', *The Woman Engineer* 8 (September 1921), 93-112, (p.109).

[307] *The Woman Engineer* 8 (September 1921), 93-112, (p.109).

is an attempt to acknowledge that women workers in manufacturing could work with the technology but could not be considered as skilled as the men who worked with the same machinery. Alongside this, it is also an attempt to reinforce the perception that women workers were unambitious and had a disinterested attitude to their work. Others in this discussion take this negative gendered perception of women and automatic machines further and insist that women could not work successfully with such technology at all. A Mr F. E Robinson, for example, is reported to have insisted 'regarding the skill displayed by women, his experience was that women had been an absolute failure, and an expensive failure in supervising automatics. One had to nearly always put one woman to watch each automatic. She did not like the dirty work or the oil with which most automatics were smothered'.[308] Here again the use of gendered stereotypes underplays the capabilities of the women alongside their supposed unsuitability to work with the new and emerging automatic systems. This shows that while the workspace and the labour process were developing into gendered spaces, traditional attitudes still influenced the perception of women workers. This discussion, and the negative perceptions of female workers it contained, was likely included in the journal to demonstrate the kind of opposition that its female readers had to contend with in arguing for their skill and their positions within these interwar industries.

The Woman Engineer and the Women's Engineering Society reveal a concentrated effort by women to organise themselves around a defence of their work as 'skilled'. Spanning from the years 1919 to the current day, the interwar editions of the journal focus on this attempt to argue for the skilled work being done by

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[308] 'Women's work on Automatics' *The Woman Engineer* 8 (September 1921), 93-112, (p.109).

women. The images featured in the journal show how the middle-class contributors

of the magazine hoped to frame the contribution and skill of women visually.

Figure 8 Cover of the Woman Engineer March 1920[309]

OPERATOR ON "ALFRED HERBERT" PRECISION LATHE.
Loughborough Technical College (Illustration No. 1).

[309] 'Operator on an Albert Herbert Precision Lathe' *The Woman Engineer*, 2 (March 1920), 9-20, (p.9).

<u>Figure 9 Cover of the Woman Engineer June 1920</u>[310]
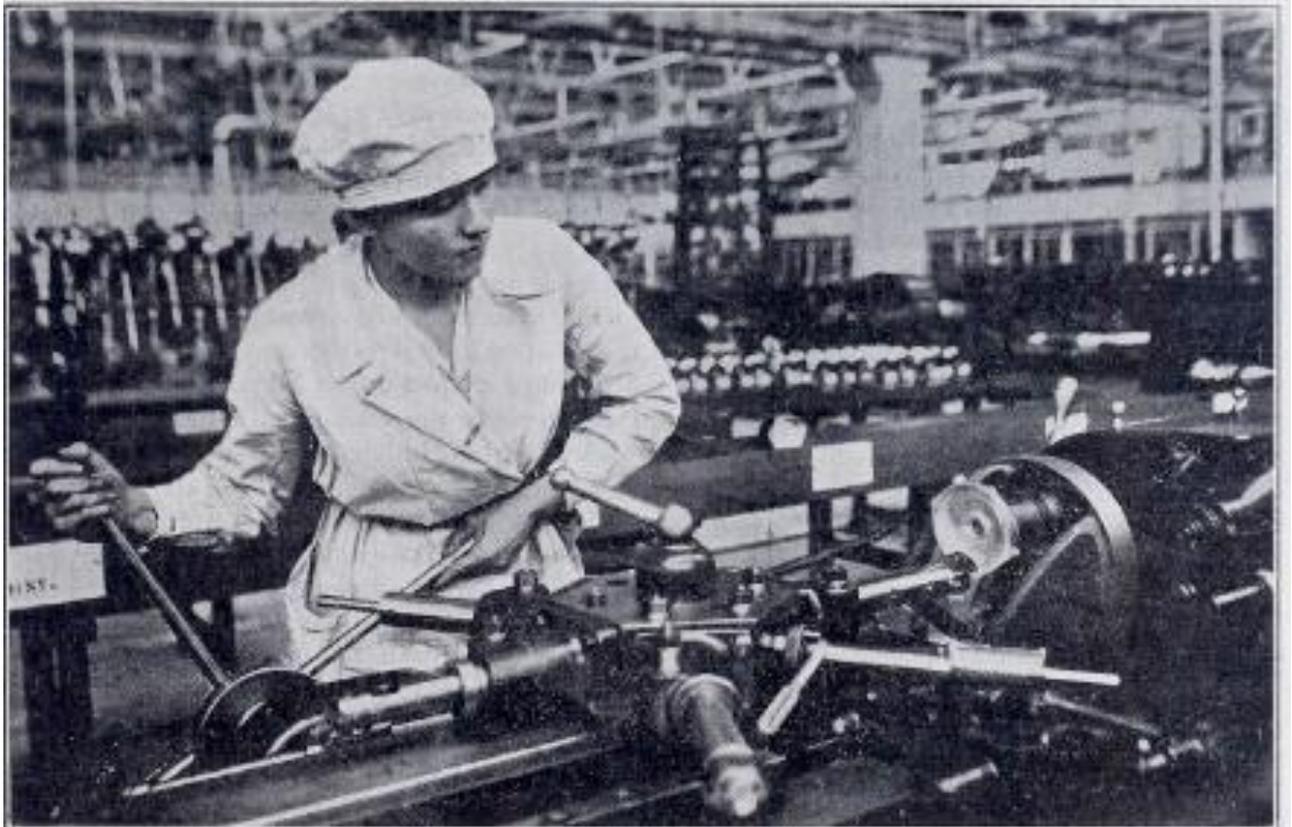
BORING THE BODY OF A MAGNETO ON A No. 4 HERBERT TURRET LATHE.

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[310] 'Boring the cover of a magenta on a no.4 Herbert Turret Lathe', *The Woman Engineer,* 3 (June 1920), 21-30, (p.21).

Figure 10 The Woman Engineer June 1920[311]

BRAZING THE FRAMEWORK OF COVER FOR A METER.

Many of the covers of *The Woman Engineer* feature a woman performing a

specific and individual task. Figures 8, 9 and 10 demonstrate a female engineer

operating a 'Albert Herbert Precision Lathe'[312], and 'Boring the Body of a Magneto

on a No4 Herbert Turret Lathe'[313] and finally 'Blazing the Framework of the Cover

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[311] 'Brazing the Framework of a cover for a meter', *The Woman Engineer,* 3 (June 1920), 21-30, (p.25).

[312] 'Operator on an Albert Herbert Precision Lathe' *The Woman Engineer*, 2 (March 1920), 9-20, (p.9).

[313] 'Boring the cover of a magenta on a no.4 Herbert Turret Lathe', *The Woman Engineer,* 3 (June 1920), 21-30, (p.21).

Meter'.[314] With these images, the journal is attempting to demonstrate the skill and capability of these women to do these kinds of jobs. This desire and need to focus on the individual skills of these women industrial workers can be attributed to two major concerns. Firstly, the readership of *The Woman Engineer* would have been primarily female and therefore the journal is employing an aspirational tone to encourage self-belief in the readers' skill and potentially encourage more women to take up the profession. Secondly, such images were a direct refutation of the widespread belief that women workers were not 'skilled' in the same way as men. The cover photographs were therefore used to argue strategically that women engineers were skilled, countering the discourse of trades unions (and specifically the AEU) who refused to accept women as skilled workers deserving of union membership and representation. The First World War had provided women with the possibility of careers within engineering which had previously been much less accessible. Organisations and publications such as this are a direct effort by educated middle-class women to maintain and progress the transformative potential of the First World War in relation to their employment opportunities.

However, while through its use of photographs *The Woman Engineer* highlights the skilled work women were capable of, it also echoes some of the gendered rhetoric used by companies and trade union periodicals in relation to 'unskilled' female labour. For example, an article by Mary Hicken in the June 1920 edition entitled 'The Experience of a Chargehand in a Machine Shop' states that 'I have been working with girls on Machines for nearly four years, both in training schools

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[314] 'Brazing the Framework of a Cover for a Meter' *The Woman Engineer,* 3 (June 1920), 21-30, (p. 25).

and factories and find them specifically suited to all kinds of repetitious work'.[315] Evidently, women who were eager to promote women as capable workers also deployed this gendered rhetoric to define specific jobs as suitable for women and to defend their newfound positions in the workforce. Mary Hicken makes a similar argument when she states 'they never seem to get tired of doing the same job day after day, however simple and monotonous the operation may be; in fact they usually strongly object to being given a new job'.[316] However, despite directly echoing many of the gendered views expressed by male employers and workers, Mary Hicken was acutely aware of how difficult the situation was for the women engineers around her and in a moment of self-reflection states that 'if any girl wishing to take up Engineering as responsible for others' work as well as her own' then 'a certain amount of tact is necessary. Especially when dealing with the men. I do not think anything annoys them more than the type of girl who thinks she knows as much in about six months as the man who has been at it all his life and thoroughly knows his job'.[317] This cautious language used by the women writing in *The Woman Engineer* can again be attributed to the contentious issue around women being accepted into the engineering industry at all and shows how women had to navigate this.

This is reflected specifically in the journal's discussion of the new industries, such as electronics manufacturing. For example, in the March 1921 edition, a Mrs Wilson

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[315] 'The Experience of a Chargehand in a Machine Shop' *The Woman Engineer* 3 (June 1920), 21-30, (p.25).

[316] 'The Experience of a Chargehand in a Machine Shop' *The Woman Engineer* 3 (June 1920), 21-30, (p.25).

[317] *The Woman Engineer,* 3 (June 1920), 21-30, (p.25).

writes about 'the entry of women into the newer industries'.[318] While many of these

jobs would later become defined as 'women's work' Mrs Wilson makes it clear that

in 1921 this was still a contentious issue. She explains that 'the entry of women into

the newer industries is full of difficulties. There has been opposition in every new

profession that has opened to women, and evidently the newer industries are going

to be just as hard a proposition'.[319] Mrs Wilson then, perhaps in an attempt to be

diplomatic, references her belief that 'after the difficulties of the trades unions,

almost the first obstacle that one is up against in this matter is the indifference of the

employer and how much of that indifference can be overcome is a question for such

societies as the W.E.S to discover'.[320] As shown previously a major reason for this

indifference and opposition was the fear that unskilled women workers (alongside

machines) would dilute the work resulting in lower pay for skilled male workers.

While Mrs Wilson avoids extensively critiquing the trade union movement, she does

dwell on the issues that defined their opposition to women engineers and trade union

membership. These issues mostly concern equal pay as well as the attitudes of

women workers, particularly young girls and the impact of marriage on their

working lives. For example, Mrs Wilson states 'the amount of wages to be paid to

women is one of the difficulties that trouble the employer'.[321] Despite raising these

issues regarding the trades unions, pay and the employers, Mrs Wilson strikes a

more conciliatory tone than the other campaigners for women's rights and other

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[318] 'The Entry of Women into the Newer Industries' *The Woman Engineer*,6, (March 1921), 53-72 (p.60).

[319] *The Woman Engineer*, 6, (March 1921), 53-72 (p.60).

[320] *The Woman Engineer*, 6, (March 1921), 53-72 (p.60).

[321] *The Woman Engineer*,6, (March 1921), 53-72 (p.60).

female trade union leaders would have done, a fact she is aware of and highlights. She states that 'the term equal pay is very misleading. It is very easy to measure pay but much more difficult to measure work. To talk about equal pay for equal work it is necessary to have people who from the very beginning have had equal training and we know that no women in England has had equal training with men inside the engineering trade […] payment by result to me is the way out, though I'm well aware that prominent women trade union leaders would oppose this bitterly'.[322] This highlights how there was not one unified approach in how to best argue for the inclusion of women engineers and electronics workers being welcomed into the industry and how much they should be paid. This article demonstrates that this was often due to issues of class, while some trades unions (the general ones that accepted women) had to defend low skilled workers who desperately needed equal pay, more middle-class institutions such as the WES and its journal were willing to take a narrower approach and demanded less from the industry in terms of pay in the hopes of greater inclusion and representation of skilled female workers. This meant that while the WES tried to undermine groups like the AEU and its position through their own methods of representing women as skilled, they were not as openly hostile, as these were organisations that women engineers were ultimately trying to join forces with. In their focus on 'skilled' engineering, the WES therefore often neglected the mass of unskilled women workers within the electronics industry. They were arguing specifically for a subset of trained, skilled and likely middle-class women, whose career ambitions were transformed due to the First World War, to receive wider representation and recognition.

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[322] *The Woman Engineer*,6, (March 1921), 53-72 (p.60).

The WES and *The Woman Engineer* are significant for lasting throughout the interwar years whilst similar organisations did not. For example, the Society of Women Welders was formed during the First World War to take advantage of the growing skill shortages. However, by the 1920s 'the Society was faced with unemployment for a number of its members' and complained of 'skilled workers forced to accept unskilled jobs. Welfare officers recommended that many of them should return to domestic service'.[323] The Society did not last beyond the 1920s. In comparison, the longevity of the WES can be attributed to it having influential figures such as Katharine Parsons maintaining its prominence and its narrower pre-occupation representing 'skilled' individuals rather than having to maintain many women workers as members. The next section will examine to what extent this was true for the organisation and industrial action undertaken by and for working-class women in the electronics industry.

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[323] Peter Gordon and David Doughan, *Dictionary of British Women's Organisations 1825-1960* (London: Woburn Press, 2001), p.236.

2.3 Trade Union Opposition to Women Workers

Working-class women in the electronics industry and more broadly did not have the financial or social capital to set up and sustain their own organisations and related publications like the WES, and therefore they had to rely on the trades unions and the Labour Party for representation and protection. It must be acknowledged that the Labour Party's official position on women's workers legal position following the end of the war was a more supportive one than that of the government. Starting with the Party itself, its own 'propaganda emphasised the complete equality of men and women in both its national and local councils'.[324] Furthermore, as Pamela M Graves points out 'the majority of Labour and Guild women seemed to agree with the party's official position. They soundly defeated every conference resolution opposing married women's right to work'.[325] Regarding the demobilisation of women, Labour's official position was outlined in a 1919 bill: 'work or maintenance at fair rates should be provided for all women displaced from their employment to make way for men returning from service with the forces or other national work' and that 'all women employed in trades formerly closed to them should only be continued to be employed at the trade union rates of wage'.[326] Furthermore, the bill demanded that 'trade unions should be urged to accept women members in all trades they are employed' and that 'the principle of equal pay for equal work should

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[324] Pamela M. Graves, *Labour Women: Women in British Working-Class Politics* (Cambridge: Cambridge University Press, 1994), p.24.

[325] Graves, *Labour Women*, p.128.

[326] 'The Employment of Married Women' *The Labour Woman,* March 1922, p.35.

be everywhere adopted'.[327] Had these positions been adopted following the end of the First World War then the potential impact on industries such as electronics and their willingness to employ women would have been significant if they had been required to pay them equally to men. This would have also encouraged less staff turnover within the industry and would have potentially strengthened the cultural and social opposition to mothers and married women working. Furthermore, we can see from developments in the interwar years that not all elements of the Labour movement agreed with the 'general policy of the Labour Party'[328] on women workers and equal pay.

The trade union movement perceived the influx of women into industry during the years of First World War as a major issue. Sheila Lewenhak insists that 'women workers did not become important to Britain's economy because of Women's Lib, or the earlier Women's Emancipation movement; nor because of two world wars' and that 'they were there before unions existed. They shared in labour history from its very beginnings'.[329] While it is true that women workers had played an important role within the workforce even before the working-class movements that developed during the nineteenth century, by the beginning of the interwar years the issue of women workers had never been as prominent within industry but specifically, and perhaps most bitterly, within the labour movement itself. This can be attributed to the willingness of companies to employ cheaper female labour alongside automatic

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[327] *The Labour Woman,* March 1922, p.35.

[328] *The Labour Woman,* March 1922, p.35.

[329] Lewenhak, *Women and Trade Unions*, p.1.

machines that facilitated the mass production of consumer goods while many trades

unions expected a complete return to the pre-war status quo. Of course, the complete

return was not a realistic demand as women's wartime work had altered the

perception of employers and reshaped many workplaces to facilitate them and

wartime experience had also led to developments in production methods. The

electronics industry openly showcased their female workforce and the

accommodations made for them. Employers introduced 'social clubs' and

'canteens'[330] to facilitate women workers employed in manufacturing, changes that

employers had little reason to reverse and the electronics industry simply continued

these trends. Despite the volume of women workers that were introduced into

various industries during the war and the use of female labour in the interwar years,

the workforce was still predominantly male as was most of the political and trade

union leadership, although by the 1920s this was beginning to change.[331]

   As Noreen Branson summarises, this willingness by some trades unions to

organise women at all can be attributed to the war and government pressures that

forced trades unions in certain industries to come to an agreement with the

Engineering Employers Federation permitting the employment of women on work

formerly done by men under the conditions that 'when the war ended substitute

females would be discharged'.[332] Many of those advocating that employees should

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[330] Gerry Holloway, *Women and Work in Britain Since 1840* (Abingdon: Taylor and Francis, 2005) p.143.

[331] Paula Bartley, *Labour Women in Power: Cabinet Ministers in the Twentieth Century* (London: Palgrave Macmillan, 2019), Graves, *Labour Women*. Andrew Thorpe, *A History of the British Labour Party* (London: Red Globe Press, 2015).

[332] Braybon, *Women Workers in the First World War*, pp.51-53.

pay the man's rate to any women employed in a women's role within the engineering industry either distrusted this deal from the outset or did once the end of the war was a reality. This can be seen when Katharine Parsons wrote resignedly in 1919 that, despite the great hopes that 'were entertained by women that a new profession was open to them, where they could earn good wages and where they would have some scope for their skill and intelligence', it was clear after the signing of the Armistice that 'all such pleasant hopes were destroyed, the training schools were closed to women, the trades unions reminded employers and the government to restore trades unions rules and within a few weeks the demobilisation of women dilutees was complete'.[333] It is apparent from this that campaigners in Parson's position saw the post-war situation of women industrial workers in the engineering sector as being something the employers and trades unions had agreed upon and organised since the outset which meant a complete reversal of their wartime position as part of the workforce, facilitated primarily by the trades unions. This perception is overall statistically true, as by the 'autumn of 1919, over three-quarters of a million less women were employed in industry than at the time of the armistice'.[334]

However, what Parsons could not have known in 1919 was that working-class women would become the defining aspect of the workforce in the consumer industries that grew out of the war such as electronics and the manufacture of wireless technology. This presented the trades unions with a new issue as employers began to promote the capabilities of women workers in relation to certain kinds of work and industries despite the desire of trades unions to return to the pre-war

[333] Parsons, *Women's Work in Engineering and Shipbuilding during the War*, p.8.

[334] Drake, *Women in Trade Unions*, p.107.

'bread winner' model. Employers in the electronics industry began to actively promote their use of female labour as beneficial and economically sensible despite wider societal conceptions of gender roles. Despite this development, in the first half of the interwar years the number of women trade union members dropped significantly, as other industries acquiesced to the demands of the trades unions. This happened alongside a general drop in trade union membership, as Sarah Boston notes: 'trade union membership declined steadily from a record high in 1920 of more than 8 million members affiliated to the TUC (a figure not reached again until 1946) to slightly more than 4 million in 1933 at the height of the slump'.[335] Whilst this can be attributed to the economic situation in the interwar period following the financial crash, it is also related to the failure or lack of effort on the part of many trades unions to effectively organise the new women workers alongside the employers' preference to keep them unorganised.

Some trades unions continued to oppose both women's entry into the industry and their position as trade union members. The AEU is the most explicit example of this policy in relation to women workers as it persisted throughout the entirety of the interwar years. Women working in electronics and in engineering therefore experienced more persistent and open opposition from their most suitable skilled trade union than other working women. For example, the general trades unions began to accept women before, during and after the war and other skilled unions such as the Lancashire and Miners Union accepted women members as early as November 1918, despite the type of work being widely perceived as more unsuitable

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[335] Boston, *Women* Workers, p.6.

to women than the electronics industry.[336] For instance, a press cutting from 1938 reports that the 'AEU National Committee Shies at an Awkward Resolution'.[337] The article summarises the AEU as having 'always opposed the employment of women in engineering and does not admit women to its membership' while acknowledging that 'there are, however, many women in the industry, mostly doing less skilled work; some are in other trades unions, such as the transport and general workers union and many are non-union'. [338] From this, it can be ascertained that trade specific unions were aware of the number of women doing work within the industry that fell under their auspices, however they were willing to leave these women unorganised or relying upon the general trades unions. Furthermore, the AEU attempted to regulate the industry itself regarding the employment of women workers as light engineering and electronics companies continued to employ a growing number of women. For instance, another newspaper article reports on the National Committee of the AEU voting on whether to limit the number of women employed in engineering. A union member named Mr J. Smith is reported to have proposed 'that having in mind the inroads that have been made in the engineering industry, this committee believes the time is long overdue when determined efforts should be made to limit the capacity in which females should be employed'.[339] While this rhetoric represents the prevalent ambition within the AEU to regulate the

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[336] Angela V. John, *By the Sweat of Their Brow: Women Workers at Victorian Coal Mines* (London: Routledge,1980), p.227.

[337] 'AEU National Committee Shies at an Awkward Resolution' TU/ENG/6/F/, V10 Box, 1938. WCML.

[338] TU/ENG/6/F/, V10 Box, 1938, WCML.

[339] 'A.E.U National Committee Shies at an Awkward Resolution' TU/ENG/6/F/, V10 Box, 1938, WCML.

number of women entering the engineering trade, skilled or unskilled, the actual policy of the AEU was even less tolerant towards women. As a press report explained, 'the committee defeated this motion. It did so apparently not because it has become any less opposed to the employment of women but because by negotiating to limit the capacities in which they were employed it would be admitting, by implication, their right to be in the industry at all'.[340] Furthermore, as Richard Croucher notes 'it was common […] for AEU convenors to represent women for a penny a week subscription' which ' had the advantage of keeping women out of the general unions. At the same time, it meant that the women themselves remained the passive recipients of help, without their own stewards and the rights of union membership'.[341] Therefore, the AEU not only denied women electronic workers membership of their own union but also attempted to exclude them from the general unions. From reports of the interwar mass observation survey it is evident that while the AEU was the most prominent union, unskilled workers were not encouraged to join a union. A report from 1941 on Metropolitan-Vickers from an unskilled perspective states that 'there is no compulsion to join a union in the shops. Except for a few trainees the whole body of skilled men are in the union, this is reckoned to be about 60% of total employees. The union is the AEU, it is in no trade union sense an active body' and that 'no positive assistance was given to the apprentices in their recent strike, beyond the refusal to accept women as unskilled labour as substitution. There is not a union atmosphere about the place'[342].

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[340] TU/ENG/6/F/, V10 Box, 1938, WCML.

[341] Croucher, *Engineers at War 1939- 1945*, p.269.

[342] Bill Naughton 'Report on Manchester Industrial Atmosphere' *File Report 839* (Mass Observation: Manchester, 1941), p. 9.

It is clear from such reports that trade specific unions were opposed or unsure of how to deal with female workers employed in factories and manufacturing; on the other hand the general trades unions were clearly more concerned with how to effectively organise the large number of non-unionised female workers that existed in the interwar period. These included the National Union of General and Municipal Workers and the Electrical Trades Union which began to admit women in 1916.[343] The different opinions from within the trade union movement reflected a wider industry debate around female labour and its classification as unskilled or skilled alongside the developing permanence of women workers within industries like electronics. The most common justification given for a trade union opposing the admission of women was 'to prevent women from doing men's jobs for less pay' which was 'typical for most union's refusal to negotiate equal minimum rates'[344]. For the AEU, the issue of wages and women was directly linked to the concept of skilled and unskilled work which had specific class implications and had also excluded unskilled men for many years.

In the early interwar years many trades unions decided it was more crucial to protect the jobs and wages for their male members. This was due to the lingering perception that women working in electronics and similar industries were a temporary legacy of the upheaval brought about by the war, rather than a permanent presence in the workforce. The significance of not being allowed membership of the

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[343] Deirdre Beddoe, *Discovering Women's History: A Practical Guide to the Sources of Women's History 1800-1945* (London: Rivers Oram Press,1993), p.115.

[344] Boston, *Women Workers and the Trade Union Movement*, p.164.

AEU for women electronic workers, especially those classed as 'unskilled', can be assessed by the changes the AEU managed to achieve for its male membership during the interwar years. Firstly, after the war in 1920 the Amalgamated Society of Engineers merged with other engineering unions to form the Amalgamated Engineering Union, which alongside the Transport and General Workers Union, the National Union of General and Municipal Workers and the Miners Federation were 'the largest unions of the interwar period'.[345] Therefore, just from the implication of the size of potential collective action, the AEU was a beneficial and potentially protective union for its members. One benefit of being a member was ensuring the employer kept a holiday fund for workers. For example, one slip from Vickers Armstrong Limited shows that the AEU managed to ensure that 'the amount due to you from the holiday fund account made up to the 11th of July 1939 is £10, 11 shillings'.[346] Furthermore, while of course the AEU continually demanded better wages for its members, one of the key concessions it won from employers was the acceptance of a shorter working week: 'after nearly a decade of fluctuating fortunes the 44-hour week [was] established for all AEU members before the onset of the depression.'[347] This was also achieved by some Commonwealth branches such as the one in Australia. In terms of securing higher wages and more benefits the AEU also had some successes. For example, in 1926 the AEU managed to get 'all previous rules rescinded' for members who worked on the Grimsby port. The new rules included promises such as 'when working on the mud in the basin or outside

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[345] Edward Boyle, *Modern Britain Third Edition: A Social History 1750-2010* (London: Bloomsbury, 2012), p.196.

[346] 'Holiday fund slip '1/T19/1, MCL.

[347] T. Sheridan, 'The Amalgamated Engineering Union' *Labour History,* 17, (1969)*,* 52-56, (p.54).

fish dock entrance during the day-tide, double time and for each night-tide additional overtime rates to be paid' as well as 'overtime worked either before or after the normal working hours shall be paid of time and half expect in the case of work done between midnight and the commencement of the following day shift by a workman who continues working until midnight, in which case it shall be paid and double-time'.[348] The AEU did manage to secure new rules around wages and over-time during the interwar years and at the very least managed to argue the case for such causes even when they were defeated, an argument many women were exempt from or had to take up on their own in smaller numbers. This also meant women were also excluded from assisting in the effort to secure these benefits to male members in the engineering and electronics industries. This demonstrates that while working-class women in the electronics industry did have the general trades unions open to them, membership of the powerful and dedicated skilled union would have provided them with many gains.

2.4 Trade Unions and Organising Women in the New Interwar Industries

I have shown that in the face of both political and social opposition women found ways to organise themselves. However, this differed between middle-class and working-class women. Working-class women were not able to establish and fund their own publications but were reliant on the existing general trades unions and their own spontaneous industrial action. Despite the open opposition of the AEU, individuals within institutions and campaigners who were primarily concerned with

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[348] 'Amalgamated Engineering Union Grimsey Port Rules' 7/53, MCL.

women workers were insistent that the established male trades unions should and would open up completely to the membership of women. This can be partly attributed to the growing number of women involved in general trade union activities and the public political sphere. For instance, throughout the interwar years 'close to a million women joined a labour or socialist political organisation. At least seventy-five per cent of them went into the Labour Party to become co-founders and builders of Labour's national network of constituency parties' and 'twenty percent joined the Women's Co-operative Guild and the rest of the Independent Labour Party (ILP) and the Communist Party'.[349] This facilitated women leaders and organisers rising to prominence in the trade union movement such as Florence Saward who gained prominence in the war and in the interwar years when she 'chaired meetings, gave speeches, and offered advice to male union members in local branches, as well as talking directly to women workers'.[350] The growing number of women directly and publicly involved in politics was a significant change from pre-war Britain.

This did raise, to some extent, the efforts in recruiting women. As Alison Fell emphasises 'unionisation remained significantly higher amongst women workers throughout the interwar period than it had been pre-war'.[351] The February 1926 edition of the *Labour Woman* declared 'for the sake of women, for the sake of low paid men for the solidary and the security of the working-class the number of

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[349] Graves, *Labour Women*, p.41.

[350] Fell, *Women as* Veterans, p.183.

[351] Fell, *Women as Veterans,* p.178-179.

women trade unionists must be increased'.[352] While the AEU remained steadfast in their opposition to female membership throughout the interwar years the wider trade union movement evolved its position as it became evident women industrial workers in certain industries remained in large numbers despite the efforts by some to return to the pre-war situation. As Sarah Boston states once the reality of this had begun to be accepted 'trade unionists, men and women alike, were agreed that an increased recruitment of women workers was necessary as a first step toward arresting the undercutting and general lowering of wages which women's cheap labour had caused'.[353] This point is shown to be accurate when looking at the various general trade union publications of the 1920s and 1930s and the Trade Union Congress (TUC) annual reports. One such trade union publication is *Labour* magazine which spanned across the 1920s and 1930s. The magazine was published by both the Labour party and the TUC so whilst it does not represent the issues of any specific trade union and their representation of women, it does include many articles discussing the topic, and particularly the growing realisation that women were going to have to be more effectively organised as they continued to establish themselves in the new industries. Whilst most of the articles and images within the issues of this magazine concern themselves with the strength of the Labour Party in the 1920s, and later with the popular front against fascism in the 1930s, there are recurring internal debates about the trade union movement and role of women workers in manufacturing.

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[352] 'Women Wage Earners! Join Your union! Now is the Time!' *The Labour Woman*, 1 February 1926, p.14.

[353] Boston, *Women Workers and the Trade Union Movement*, p.157.

For example, the February 1935 edition of the magazine contains an article written by Ann Loughlin entitled 'Wake Up You Women Workers!'[354] She argues that 'it is quite easy to show that the wages and conditions of women and girls in industry today are infinitely better than they were a quarter of a century ago' but that in the eyes of many young women 'the Trade Union Movement never gets the credit it deserves in the popular mind that its record deserves, and for this, among the other reasons it is more difficult to attract new recruits'.[355] The article, despite its overall ambition to implore more women to take up trade union activity, places the lack of trade union representation of women as a responsibility of the women themselves. If the employment of women continued to grow 'she must assert herself and insist that her services must be paid for at their proper value'.[356] Noticeably Loughlin does not mention what this 'proper' value is in relation to male workers. Despite acknowledging the displacement of men by women within the new industries she does not mention the fact that trades unions like the AEU actively opposed female membership. In the case of women within electronics, they received little to no direct attention from the trades unions and had to take industrial action on their own. Articles such as this are the trade union equivalent to the electronic companies' magazines, in terms of promoting organisational talking points which are clearly attempting to form their own narrative when it comes to women and the trade union movement. The working-class women's indifference is argued by Loughlin to be an ungrateful position taken from ignorance rather than the trade union movement's

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[354] 'Wake Up You Women Workers!' *Labour* (Feb 1935), p.127.

[355] *Labour* (Feb 1935), p.127.

[356] *Labour* (Feb 1935), p.127.

failure to appeal to women or to organise them effectively within certain industries. In contrast, it was acknowledged by some in the trade union leadership that new efforts must be taken to appeal to women workers. The records of annual TUC congresses emphasise this concern, as do the appointments of women as union organisers whose role was to appeal directly to women workers.

The annual reports of the Trade Union Congress are often less definitive in their declarations as they include debates and discussions about how to get more women involved in the trade union movement. For example, from the reports of the 1932 annual congress it is argued that two major problems existed regarding the trade union movement effectively appealing to more women. These are described to be 'general apathy, or fear of victimisation owing to the intense industrial depression' and 'the apathy of the local officials of the trade unions concerned'.[357] These discussions of disparate viewpoints and fuller analysis provide a more self-reflective insight into the trade union movement's attitudes towards women workers than a magazine such as *Labour*. Furthermore, they provide specific examples of the failed efforts on the trade unions' behalf to court more female members: 'several trade union council secretaries mention that endeavours have been made to urge trade unionists who have daughters engaged in industry to see that they join the appropriate trade union, but so far without any appreciable result'.[358] This kind of discussion is reflective of many TUC reports that attempt to detail more effective

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[357] 'Organisation of Women' *Report of the Proceedings of the 64th Annual Trades Unions Congress* (September 1932) p.104.

[358] 'Organisation of Women' *Report of the Proceedings of the 64th Annual Trades Unions Congress* (September 1932) p.104.

and widespread efforts to appeal to women and share propaganda and information. The dissemination of information was a key issue and was discussed regularly at meetings resulting in plans to create more material aimed specifically at women.

  The propaganda discussed in the TUC annual reports often took the form of simple leaflets and posters aimed at women reliant on general trades unions such as those working in electronics. For instance, one commonly seen poster from 1938 was titled 'Common Sense for Women Workers'. This leaflet attempts to summarise the benefits of trade union membership for women as well as the contemporary challenges faced by female employees. For instance, it attacks 'speeding up which is such a detestable feature of many industrial processes, greatly increases this strain' especially 'where piece work is the rule, and the worker is oppressed by the necessity of performing operations with machine like regularity for hours on end'.[359] It is clear that those writing leaflets such as this understood the type of work many women would have undertaken in industries like electronics when it refers to expected regularity and piece work, and that 'much of the routine work done today is characterised by deadly monotony of effort which puts a heavy strain on the nerves'.[360] The manufacture of electronics was extremely monotonous, a reason given for hiring women for the job in the first place. While making no direct mention of a specific industry and appealing to the broadest possible constituency of women union members, the leaflet's description of 'women's work' demonstrates the extent to which the kind of work women were doing in the production of

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[359] 'Common Sense for Women Workers: Things They Ought to Know' 60.1/292/60/4, 1938, MRCW, p.2.

[360] 60.1/292/60/4, 1938, MRCW, p.2.

electronic goods had come to define the term. It also highlights the TUC's

knowledge that the industry had been left unorganised throughout the interwar years.

Although the leaflet seemingly recognises the troubled position of women and the

hardships specific to them it does not demonstrate in any meaningful way how the

trades unions had successfully managed to counteract this or planned to in the

future. As Sarah Boston states: 'the recruitment campaigns they launched lacked any

specific appeal made to women, except to be recruited. They were received with

apathy by trade unionists'.[361] While clearly a genuine effort to appeal to female

workers employed in light manufacturing, in order convince them of the benefits of

trade union membership, material such as this also served a dual purpose of

demonstrating to the unions that did not admit women (such as the AEU) why

women within those industries deserved and needed some representation. Tellingly,

the leaflet's subtitle is 'Things They Ought to Know'[362], which implies that the

audience for the pamphlet may not just be the women themselves, but male workers

who did not consider the plight of women workers as a major priority. The final

point of the leaflet emphasises the negative potential consequences of such an

attitude: 'the trade union influence must be directly appropriate to the strength of the

Movement in membership and activity'.[363] This frames the acceptance of women as

positive for the wider trade union movement. Women workers, including those in

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[361] Boston, *Women Workers and the Trade Union* Movement, p.21.

[362] Common Sense for Women Workers: Things they ought to Know' 60.1/292/60/4, 1938, MRCW, p.1.

[363] Common Sense for Women Workers: Things they ought to Know' 60.1/292/60/4, 1938, MRCW, p.3.

the electronics industry, had also demonstrated their ability to win industrial disputes through their own organisation and activity.

Table 7 A Comparison of Female Trade Union Membership[364]
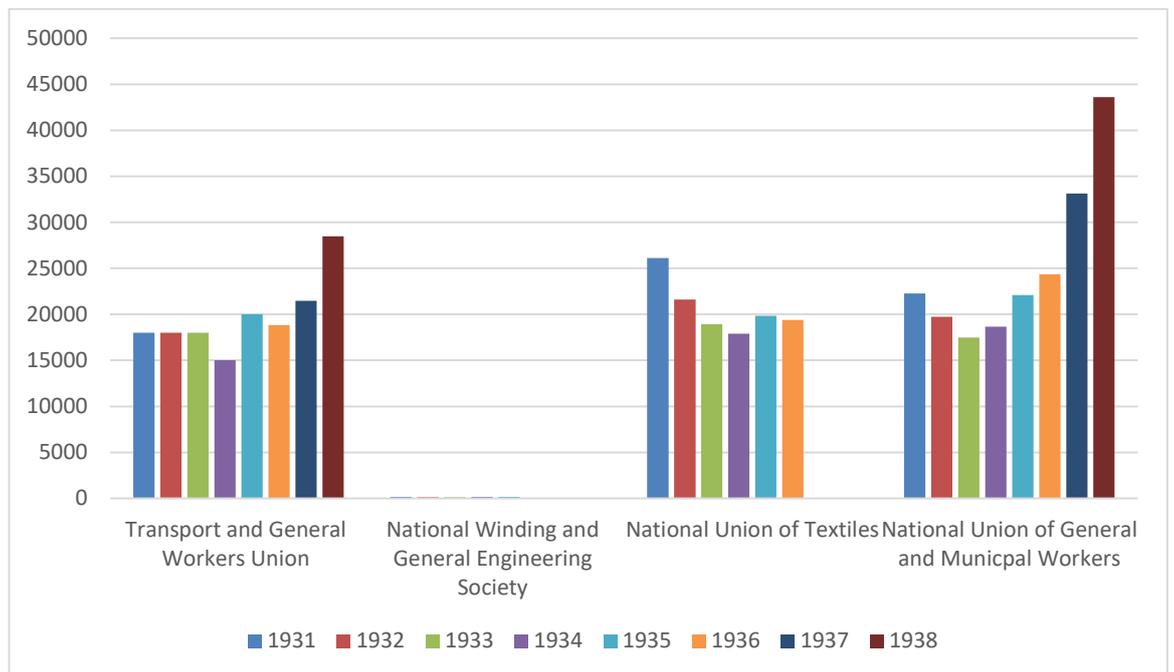
Table 7 is a comparison of women trade union membership between four trades unions that operated throughout the 1930s. The graph shows that while trade specific groups like the National Winding and General Engineering Society had a low number of women members (consistently under 200) the general trades unions had a growing number. Alison Fell highlights that this was continuing the trend that

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[364] 'Survey of Women's Membership 1931-1938, *National Women's Advisory Committee 4/1 12,* January 1939, 292/60/4 60 (1) MRCW.

had begun during the war: 'union membership rose steeply during the war, from 237,00 in 1914 to 1,342,000 in 1920'.[365] Furthermore, the graph shows unions that had traditionally high female membership such as the National Union of Textile Workers lost female members while the general trades unions managed to increase membership. This can be attributed to the growth of industries such as light engineering and electronics which attracted women in increasing numbers from other sectors — often older industries such as textiles. As Lynden Briscoe states these statistics highlight the 'long term decline of the British textiles industry', noting that 'the change of importance of the textile industry to the national economy as a whole is reflected in its contribution to national income'.[366] Alongside this, the textile industry experienced the inverse of the electronics manufacturing industry in regards to women workers in the factory: 'Statutes passed in 1920 and 1936 forbid the employment of women on the night shift. The result has been an increased employment of men on what used to be women's jobs'.[367] While many 'unskilled' women were members of the general trades unions, organisations were still needed to specifically represent women's interests in the new industries. Yet many women who viewed themselves as 'skilled' workers were denied membership by powerful unions like AEU, who also made efforts to block women entering the general unions.

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[365] Fell, *Women as Veterans*, p.178.

[366] Lynden Briscoe, *The Textile and Clothing Industries of the United Kingdom* (Manchester: Manchester University Press, 1971), p.1.

[367] *The Textile and Clothing Industries of the United Kingdom,* p.176.

Table 8 Female Membership of the National Union of General and Municipal

Workers[368]
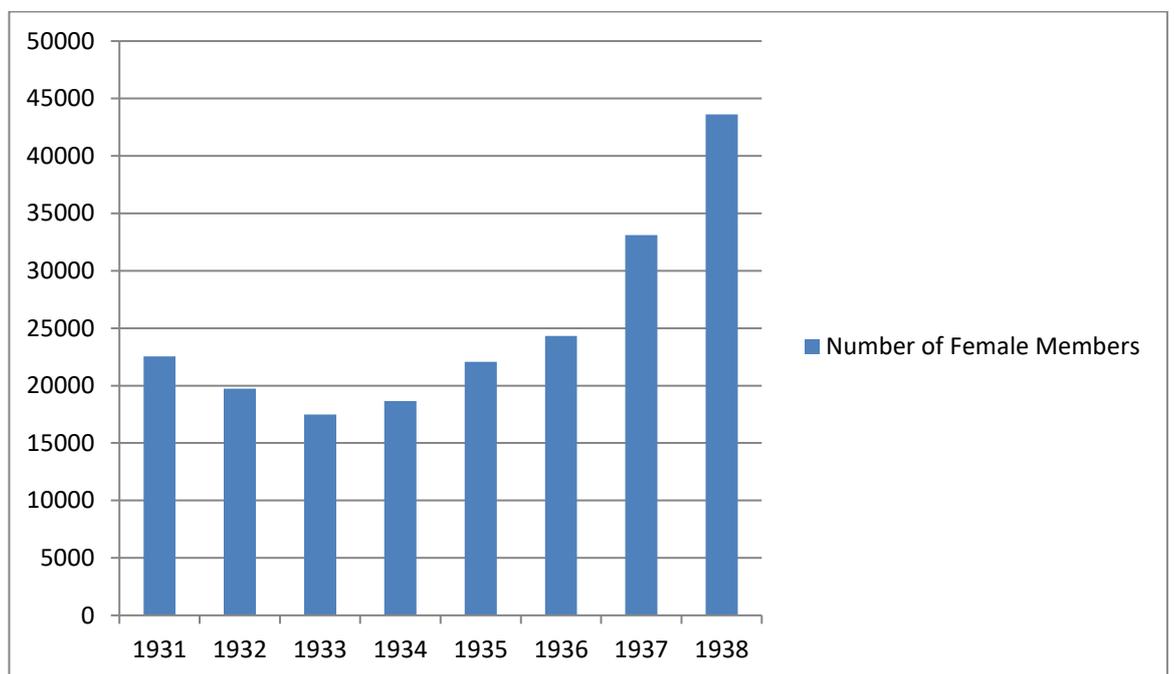
Table 8 shows an initial decline in trade union membership of women during the

early years of the 1930s. The increasing number of women working in industry

alongside the falling membership highlights why propaganda to appeal to women,

such as the TUC leaflets discussed previously, were increasingly distributed. Table 8

also shows that membership increased by the middle of the decade; however, this

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[368] 'Trades Union Congress Survey of Women Membership' 60.1/292/60/4, 1931-1938,
       MRCW.

cannot be attributed to an increase in campaigning methods alone. Alongside the increased use of recruitment propaganda, the labour movement and trades unions attempted to appeal to a sense of inclusiveness and protectiveness of a community of manufacturing workers that was simultaneously promoted by the interwar companies and their publications. By the middle of the 1930s there was a more direct effort on the part of the wider labour movement to be more proactive in promoting the role of women by emphasising them as a key part the labour movement, and one the movement was dedicated to benefitting. This can be seen in outlets such as *Labour*[369] produced by the National Council of Labour. For example, this image is taken from a September 1937 article titled 'Workers at Play':[370]

Figure 11 'Workers at Play'[371]

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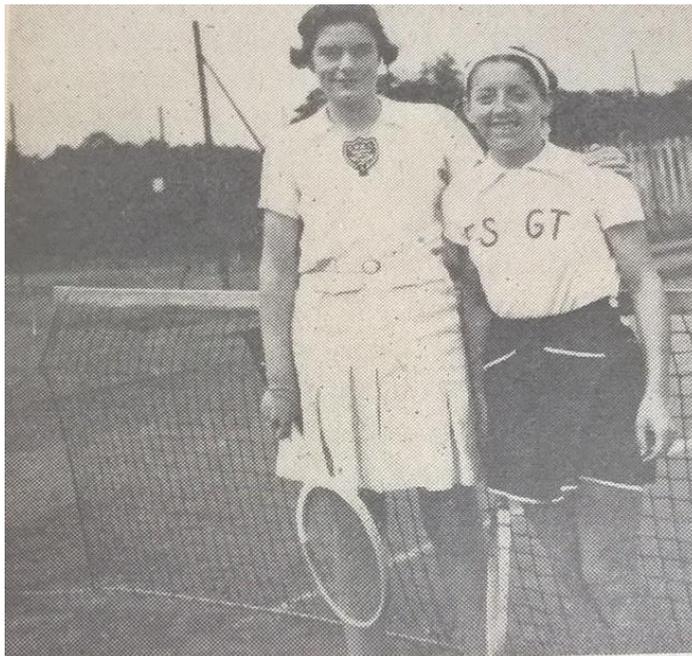
[369] 'Workers at Play' *Labour A Magazine for All Workers*, September 1937, MSS.292/4/4/5, MRCW p.1.

[370] 'Workers at Play' *Labour A Magazine for All Workers*, September 1937, MSS.292/4/4/5, MRCW p.23.

[371] 'Workers at Play' *Labour A Magazine for All Workers*, September 1937, MSS.292/4/4/5, MRCW p.1.

Figure 11 is of Joan Holman and Mollie Gurtner the winner and semi-finalist of the women's singles, at the lawn tennis championships at the Third International Workers Olympiad in Antwerp. The article's primary purpose is to report on how Great Britain's team performed at these events, however, the reporting of events such as this serve another purpose: to foster a communal and leisure-based connection between the working-class readership and these publications. This points to another form of social benefit that both male and female leaders attempted to organise women manufacturing workers round: a sense of community within the labour movement. While women workers within the male dominated industries and the new industries had often been left to rely on their own unofficial organisation there is a clear effort in the later editions of *Labour* to emphasise the importance of the female workforce. This was partly because of the rise in female union membership, but also as an acknowledgement that there were thousands of women workers working in light manufacturing. Such an important part of the country's workforce had become impossible to ignore, particularly as they were sometimes organising and going out on strike independently or accepting lower rates of pay.

Despite the growing number of women in interwar industries and the common problems they faced, such as lower wages and long hours of monotonous work, the statistical evidence shows that during the early to middle years of the 1930s the trades unions continued to have a difficult time organising them. For example, notes from a 1936 meeting document of the National Women's Advisory Council at the

Trades Union General Council are entitled 'Difficulties in organising women'[372].

The notes summarise that during the 1920s and 1930s: 'in many industries less

employment is being provided for men and more for women. This does not mean

that women are finding employment at the expense of men' but that 'it does show,

however, that new and expanding industries are providing more employment for

women than for men'.[373] A key barrier to recruiting women and union members is

the perceived temporary nature of women's involvement in these new industries,

particularly in relation to factory work involving long hours: 'the difficulties in

organising women are intensified on account of the fact we have to make a fresh

appeal to new batches of women every six years'.[374] The social pressure that pushed

women out of work at an early age evidently also impacted the trade unions

enthusiasm and ability to organise them as effectively as they eventually wished to.

The notes also mention the distribution of material such as the leaflet mentioned

above: 'a special 4-page propaganda leaflet for women engaged in industry is now

in circulation'.[375] Again, the particular problems associated with female labour are

given as a reason for the trades unions failure to properly organise such workers,

alongside their definition as 'unskilled'.

Furthermore, the union's meeting notes record an effort to match how companies

were attempting to relate to their female employees through magazines and

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[372] 'Trade Union Congress General Council Difficulties in Organising Women' 60.1/292/60/4, 1936, MRCW.

[373] 60.1/292/60/4, 1936, MRCW.

[374] 60.1/292/60/4, 1936, MRCW.

[375] 60.1/292/60/4, 1937, MRCW.

newsletters, which attempted to keep them informed of developments in the

organisation as well as foster a sense of community within it. In another example

dating from 1937, notes from the National Women's Advisory Council highlight the

launching of a monthly newsletter: 'through the distribution of these Monthly News

Letters to Secretaries of local Trades Council and local Woman's Organising

Committees, opportunities are given to our membership on the amount of work

being done by the General Council on all questions affecting women…our

newsletters inform readers what the TUC is doing with regards to young workers,

health insurance, the New Factories Act 1937, Education 1936'.[376] While the

distribution of such information among members and potential members of the

trades unions served a similar purpose to company magazines such as that produced

by Metropolitan-Vickers, in keeping everyone informed and involved in large

developments within the organisation, the company magazines focus much more on

the recreation the company provides outside of the workplace, in comparison to

trade unions' output where leisure activities get few mentions. Meeting notes also

demonstrate that the TUC was inclined to present a more idealistic picture of the

treatment and acceptance of women than was really the case throughout the interwar

years — especially the powerful craft unions. For example, a January 1938 letter

from the TUC to all the affiliated trades unions states 'we are fortunately past the

stage when the male trade unionist, grumbling loudly about the invasion of women,

asked why he should trouble himself about their wages and conditions'.[377] This

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[376] 'Trade Union Congress General Council Organising of Women' 60.1/292/60/4, 1937, MRCW.

[377] 'Trade Union Congress General Council Letter' 60.1/292/60/4, 1937, MRCW, p.2.

ignores the fact the AEU refused to admit women, and were openly stating their

opposition to female membership to the press throughout the interwar years.

2.5 Self-organisation and Industrial Action in the Electronics Industry

The case of the AEU is an extreme and relatively unusual example of the opposition

faced by female industrial workers. Alice Kessler-Harris argues that more generally

during this period 'trade unions not only participated in the debate but accepted

women for the first time as a permanent factor in the labour force' and that by the

mid-1930s most trade unionists 'had stopped asking whether to organise women and

started wondering which women to organise'[378]. Nevertheless, the resistance of the

AEU, a large and powerful union, to accepting women workers as members,

alongside the ineffective recruitment efforts of the general trades unions, meant that

thousands of women were left without any representation. Industries that had been

previously dominated by men such as engineering were defended but the low-skilled

female workers employed within the electronics industry were either ignored or left

to general workers' unions, or to the National Federation of Women Workers, a

specialist union for women. The AEU maintained its opposition until 1943. One

reason for this was the desire for these unions to maintain what they had already

managed to achieve in the face of companies looking to cut wages and implement

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[378] Alice Kessler-Harris, *Gendering Labour History* (Champaign: Illinois University Press, 2007), p.53.

new 'scientific' workplace rules such as rationalisation. Alongside this were
conservative gender views regarding the suitability of certain jobs for women that
many trade union members and organisers would have held, and an ongoing
advocacy for a male 'breadwinner' model.

For the women in the industries affected by this attitude it often meant they had
to create and rely on organisations created specifically to represent women workers
or, as in the case of electronics manufacturing, for the most part remain officially
'unorganised'. Figures 12 and 13 demonstrate however, that women did take
industrial action during the interwar period, without relying on the experience of
male trade union leadership.

Figure 12 Women transport workers on strike (photograph 1)[379]

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[379] Daily Herald Archive, 1983-5236/19745, NSMM.

Figure 13 Women transport workers on strike (photograph 2)[380]

Figures 12 and 13 are from the *Daily Herald* newspaper, which began as a 'daily

strike bulletin'[381] and remained affiliated with the labour and trade union movement

throughout the interwar years. These images are from the strikes organised by

women transport workers in 1918 following a demand for equal pay to men and a

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[380] Daily Herald Archive, 1983-5236/19746, NSMM.

[381] George Lansbury, *The Miracle of Fleet Street: The Story of the Daily Herald*
(Nottingham: Spokesman Books, 2009) p.1.

war bonus.[382] At one point 20,000 women were on strike across the country and while they achieved a bonus, they did not get the equal pay they desired.[383] These images show that women managed to self-organise to some degree and effectively win some of their demands. Many of these activities resulted in women's trades unions uniting into new larger organisation to strengthen their position. The photograph below demonstrates the scale these organisations managed to reach in these years.

Figure 14 Women's Cooperative Guild Jubilee Congress 1933[384]

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[382] Ian J. Cawood, *Britain in the Twentieth Century* (Oxon: Routledge,2004), p.64.

[383] Daily Herald Archive, 1983-5236/19745 and 1983-5236/19746, NSMM.

[384] Daily Herald Archive, 1983-5236/19755, NSMM.

Figure 14 shows the Jubilee Congress meeting of the Women's Cooperative Guild

held in 1933. The image contains banners from various trades unions and groups

dedicated to the further organisation of women workers. Yet despite their numbers,

70,000 at this event, they still experienced opposition from a small number of trade

specific unions.[385] The Women's Cooperative Guild did not just organise women

workers around trade unionism but directed them towards political activism such as

opposition to the arms trade. The Guild emphasised how women who were

organising other women were not just doing so in the tradition of trade unionism or

for industrial action but applied it to other international and domestic political

campaigns too. Alongside this, the Guild organised women to campaign for rights

outside the workplace and was 'the first British women's group to openly endorse

legalised abortion, although in limited circumstances'.[386] Other groups established

by women attempted to organise 'unskilled' women workers around more

ideological political motivations such as the Communist Party of Great Britain's

Women's Network formed in 1920 which 'encouraged the involvement of women in

the Communist Party and advises on women's issues'.[387]

Interviews reveal that in comparison to other industries such as transport, within

the electronics industry many working-class women were experiencing a lack of

formal organisation and did not join either the general trades unions or any of the

women-led groups. This did not necessarily mean they did not resort to strike action,

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[385] Daily Herald Archive, 1983-5236/19755, NSMM.

[386] Linda Naranjo-Huebl, Rachel MacNair, Rachel M. MacNair, *Prolife Feminism: Yesterday and Today* (Sulzburger and Graham Inc, 1995), p.147.

[387] Peter Gordon and David Doughan, *Dictionary of British Women's Organisations 1825-1960* (London: Woburn Press, 2001), p.38.

although it was usually unofficial and spontaneous rather than planned with the backing of the trade union leadership. For example, Winifred Cotterill recalls that she was 'never within a trade union'[388] but was often asked to go on strike by other women to avoid being called a blackleg. Mrs Johnson, recalling her time working at the General Electric Company in the 1930s, states that that no trade union was ever mentioned or brought to her attention. Despite presenting an overall positive picture about her experience she describes a strict workplace place where 'they didn't pay anyone for nothing at the GEC'.[389] Mrs Johnson became a charge hand and recalls that, unlike her male equivalents, women like her overseeing other women would 'turn a blind eye'[390] to indiscretions such as eating on the job. While there was seemingly no formal organisation of the women workers in manufacturing, then, Mrs Johnson's evidence show that they attempted to make work easier for each other in this way when they could. Mrs Johnson explains that while they were not a member of any trade union, she and the girls she worked alongside did strike on their own (no exact date given) over an attempt to introduce more automation into the works. She elaborates that 'they took away our bonuses due to the new machines'.[391] Mrs Johnson's section of girls argued that they did not benefit them as much as they were claimed to do so and in response they went on strike and successfully 'won the day'.[392] Valerie G. Hall asserts that in the interwar years 'so

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[388] Mrs Winifred Cotterill notes, MSS.266/6/2, MRCW. p.3.

[389] Mrs E.E Johnson notes, MSS.266/6/1, MRCW, p.4.

[390] Mrs E.E. Johnson recording, MSS.266/6/1, MRCW.

[391] Mrs E.E. Johnson recording, MSS.266/6/1, MRCW.

[392] Mrs E.E Johnson recording, MSS.266/6/1, MRCW.

involved did some women become in politics that their political role superseded their domestic role. The contrasting picture which we had begun to see in the pre-war period-with most women limited to the private sphere and all-consuming domesticity, and a minority enthusiastically and aggressively striking out into the public sphere in the formerly male preserve of politics-now became much more apparent'.[393] The evidence about female strike action might suggest that this was the case amongst workers in the electronics industry. However, while this does apply to women leaders such as those shown in the photograph of the Women's Cooperate Guild and those in the strikes that garnered the attentions of the press, the government, and public, it does not account for women workers in manufacturing such as Mrs Johnson who while not consciously becoming political, enacted their own strikes spontaneously, focused on specific grievances, and which often lasted less than a day. Activity such as this would have been unlikely to have been recorded or even noticed by the wider industry or press. As these women had no specific trade union available to them, their industrial disputes would not have had the propaganda and awareness-raising power of trade union backed action.

Furthermore, while unsanctioned strike activity by women in electronics manufacturing with specific organisation to reply upon would have garnered the general sympathies of the wider trade union movement, the framing and depiction of such instances by trade union material and the politically aligned press tended not to be an entirely positive or sensitive portrayal, as in Figure 15.

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[393] Hall, *Women at Work, 1860-*1939, p.51.

Figure 15 Women Striking at Mullard's Radio Valve Factory[394]

Figure 15 is of a group of striking women and is dated August 1934. It shows 'hundreds of girls on strike at a radio valve factory'.[395] The press cutting from the *Daily Herald* states, 'girls on strike pelted mounted and foot police with bananas at Mullard's Radio Valve Factory and another works at Hackridge near Mitcham' and that 'a thousand girls and a number of boys struck several days ago'.[396] Such a large scale strike would have received much more notice than the seemingly small affair

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[394] Daily Herald Archive, 1983-5236/19744, NSMM.

[395] Daily Herald Archive, 1983-5236/19744, NSMM.

[396] Daily Herald Archive, 1983-5236/19744, NSMM.

mentioned by Mrs Johnson. However, much like that incident no official trade union involvement is referred to. Furthermore, no specific demands are mentioned, and the overall ambitions of the strike activity is given little attention despite the *Daily Herald* paper being affiliated with the trade union movement. It also appears that no local newspapers reported on the strike. In 1921 the editor of the newspaper Hamilton Fyfe declared in response to the question 'how do you propose to deal with special industrial and political questions in which women are more interested in than men? Will you have anything like a special weekly feature for women?' No, certainly not'.[397] As a newspaper it clearly had sympathies for all those involved in industrial action. However, this response show that women's industrial concerns were not perceived as unique or worthy of individual focus by some leading figures in the labour movement.

The framing of this strike activity using photographs further emphasises this and demonstrates how women were represented by the trade union movement in industries that in large part had previously avoided the organisation of women. For example, rather than emphasising the seriousness of the strike and the reasons for it the *Daily Herald* focused on the fact fruit was thrown and the image shows people buying this fruit and laughing. The fact that children are included in the image and made prominent presents the strike visually as a fun and inclusive event that was an enjoyable day out rather than a stressful and disruptive day of industrial unrest and a loss of wages for those choosing to strike. The framing of this photograph could to some degree be seen as publication friendly to the labour movement utilising a

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[397] 'The Daily Herald: its Message to Women' *Daily Herald,* 1 October 1922, p.151.

similar method as the electronic companies did in their magazine publications, that is, it aimed to convince people that being part of this event was a fun and social thing to do. It also serves to demonstrate how female strikers were undermined in comparison to male industrial activity and their own organisations were often viewed with suspicion. Framing the women's strike as a mostly frivolous event reinforced the government and employers' perception that groups such as the National Federation of Women Workers (NFWW) and the trades unions were encouraging industrial action without a just cause. As Cathy Hunt highlights the NFWW 'was twice stung into refuting claims that the federation was encouraging strikes among women-workers'.[398] Noticeably, the *Woman Engineer* does not highlight unofficial strike activity such as this. Despite facing the same kind of opposition, it is clear that the organised middle-class women had differing concerns within the industry than the unorganised working-class women.

From these examples, it is evident that despite the growing ambitions of the general unions to organise women workers, the resistance of the AEU helped foster apathy from some women in the electronics industry regarding trades unions. Despite this, smaller and sporadic incidents of industrial action were taken by women in the electronics industry than reflects what was happening in other industries during this time. However, it was rarely large or sustained enough to garner much media or public attention. In comparison to these small scale and spontaneous strikes, the WES and its members were able to maintain a more substantial and long-lasting organisational force. This can be attributed their ability

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[398] Cathy Hunt, *The National Federation of Women Workers, 1906-1921* (Basingstoke: Palgrave Macmillan, 2014)*,* p.93.

to mass produce literature, particularly the *Woman Engineer*, as well as the higher social status of important members such as Katharine Parsons. The First World War was transformative for many women's ambitions and opportunities within engineering, but middle-class women had to organise in the interwar years in the face of opposition to these developments. However, the mass of women working in electronic engineering had already managed to secure their position within the industry yet were forced to organise suddenly when the material conditions of that position became unbearable, and were often left without the direct assistance of any other groups or union.

2.6 The AEU Opposition to Acceptance

By the late 1930s most trades unions had opened their doors to women members, but the AEU was the longest to resist this change. When the AEU did finally perform an about-face of their position, it is apparent that this was a change that was resisted until the last possible moment. This can be readily seen in the notes from gatherings such as the Special Central Conference on the question of women taking up war work that was held in 1939. The notes record an exchange between Mr I. C. Green representing the employers and Mr W. Hannington representing the AEU. At the meeting 'there was some informal talk about women doing work on small drilling machines and the Union's representatives raised no objections to this' and that 'there was also an understanding that women would be put on the inspection of certain small components'.[399] Despite this seemingly agreeable attitude on behalf of AEU, however, the notes also state: 'the point that it is desired to emphasise,

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[399] 'Special Conference Women' CP/IND/HAND/07/02, PHM, p.2.

however, is that the question of rates of wages for women doing work formerly performed by men never arose at any time during the discussion' and that in 1939 'war conditions had not yet developed the conception of mass displacement or the supplementing of skilled men by female labour'.[400] Of course, as I have demonstrated this was not the case within the electronics industry which had maintained a high proportion of women employees and therefore was in better position for war than general engineering. Despite this, the AEU made no efforts to defend the wages of these women. This highlights the fact as late as 1939 the AEU, while acutely aware of the impact war could potentially have upon the wider engineering industry, still refused to accept paying women a skilled wage or a wage equivalent to men. Noticeably absent from this meeting is a representative for the women manufacturing workers or any female trade union representative. This demonstrates that the kind of collusion between employers and trades unions to manage women workers that Katharine Parsons argued took place at the end of the First World War continued well into the Second World War.[401]

In 1943, however, the AEU finally accepted women as members. One reason for this dramatic change was the mounting pressure to accept women following the acceptance of female members by other unions. As previous discussions have shown, the AEU's refusal to consider any women as skilled in the same way as male workers in engineering was a key factor in the union's refusal to admit women into their ranks, which reflected wider issues regarding the position of women in

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[400] CP/IND/HAND/07/02, PHM p.2.

[401] Lady Parsons, *Women's work in Engineering and Shipbuilding During the War*.

industry. The AEU's stance shows how the defence of skilled male workers cut across class and its influence over the perception of 'women's work' that existed throughout the interwar years. As far as the union was concerned the AEU represented 'skilled' workers, and all work done by women was inherently perceived as 'unskilled'. The absence of protection and union representation of women within these industries was a cause of anger for many onlookers. For example, an anonymous poem found at the Manchester Working Class Library (probably dating from the 1930s and found in a sleeve with other material related to Metropolitan–Vickers in the interwar years) illustrates this dissatisfaction. The poem takes as its subject workplace issues within the large electronics and electrical engineering companies such as 'Westinghouse, to Metro. Vickers, From Metro Vic's, to AEI'[402] and highlights a desire for unions to take more action regarding the women employed within these companies. The poem focuses on the plight of the unorganised worker and on the power that employers held over them, opining: 'will I no longer be needed? Must I join the employed? Can I hope that I'll be lucky and not pushed out the gate?'[403] The poem is credited to an 'onlooker' implying it is written not by an employee from but by an outside observer applying pressure for more trade union organisation within them.

Another example of objections to the lack of protection or representation of women workers in these industries can be seen in a document entitled 'Statement on Women' from a trade union conference in 1939 or 1940, which states that 'women

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[402] 'Take Over' *Onlooker*, Sling/Vickers Box 1, WCML.

[403] 'Take Over' *Onlooker*, Sling/Vickers Box 1, WCML.

have not yet received equivalent wage increases as recently won by the males'.[404]
This document also states that it was still necessary to 'campaign within AEU for its
ranks to be open to females' and that 'maximum assistance and education in trade
unionism to be given to females to enable them to become a force in workshops,
side by side with the males'.[405] Evidently, by the onset of the Second World War
some trades unions activists argued that women had not been effectively
incorporated into the appropriate trades unions. This document states that during the
interwar years the trade union movement had failed 'to take the necessary steps to
defeat the objective of the employers and to draw into the organised class movement
all female labour in the industry' and that throughout the 1920s and 1930s many
women in the engineering industry were 'receiving inadequate rates of pay and
practically wholly unorganised, used by the employers as cheap labour'. [406] By the
late 1930s the perception of other unions and the wider labour movement was that
the AEU's stance had become untenable, and they openly applied pressure in
congress and conferences to bring about change. It was not just the Second World
War itself, then, that transformed the AEU position.

When the AEU finally gave way and admitted women members during the Second
World War, it represented a significant change and important conclusion to the
contentious interwar wrangling over women's proper place within the engineering
industries. Richard Croucher attributes the AEU's change in policy to the increasing

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[404] 'Statement on Women' *Amalgamated Engineering Union / Amalgamated Union of Engineering and Foundry Workers / Amalgamated Electrical and Engineering Union: Women members,* SLING/ENG/13, WCML, p.1.

[405] 'Statement on Women' SLING/ENG/13, WCML, p.1.

[406] 'Statement on Women' SLING/ENG/13, WCML, p.1.

pressure as a result of the successful recruitment of the general unions: 'it would have been impossible for the AEU to retain any significant measure of control within engineering in the long run had it not taken this decision'[407]. However, while I have shown this to be true, it was not just increasing pressure that forced this change but material changes in circumstances. As Sarah Boston argues, whereas 'in World War 1 [the AEU] had evaded the issue by coming to an agreement with the National Federation of Women Workers that the federation would organise those women entering engineering during the war'[408] in the Second World War the NFWW no longer existed. As a result, the members feared that 'as in World War 1, the wartime situation would be used to break down skilled jobs, create more women's jobs and generally erode the status and wages of the skilled men. They looked upon the organisation of women and the application of equal pay for equal works as a means of arresting this trend'.[409] Angus Calder summarises that it was therefore 'the force of inexorable circumstances which compelled the AEU to give way.' For Calder, the eventual admission of women from January 1943 was 'an admission of the fact in this age of mass production techniques and differentials, the only way to preserve the position of skilled man was to organise his semi-skilled sisters (and brothers) before they ousted him'.[410] In turn, the fact that it took the AEU such a long time to reach this realisation in comparison to other unions can be seen as an attempt to maintain their position as an exclusively 'skilled' union.

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[407] Croucher, *Engineers at War 1939- 1945*, p.274.

[408] Boston, *Women Workers and the Trade Union* Movement, p.212.

[409] *Women Workers and the Trade Union Movement,* p.212.

[410] Angus Calder, *The People's War: Britain 1939-1945* (London: Pimlico, 1969), p.403.

Calder's proposition is borne out by the evidence I have uncovered of women in the electronics industry. It is apparent that by the end of the interwar years women workers in manufacturing had effectively carried out industrial action independently, and in the case of 'skilled' middle-class women formed their own large organisations and leagues, and consistently argued for their rights through their own publications. Therefore, from the AEU's perspective it was beneficial to have some level of control and influence over these workers.

Following their admission into the AEU, it was not long before the benefits of joining a union became apparent as new industrial victories were won for women workers in the engineering industry in post Second World War Britain. In 1945 together with the Association of Engineering and Shipbuilding Draughtsmen, the Association of Scientific Workers and the Clerical and Administrative Workers Union, a successful negotiation resulted in a new rate of pay for women within the Metropolitan-Vickers company: 'the new rates of pay mean weekly rates of pay 1/- for those ages 19, 2/- for those aged 20 and 2/6 for those aged 21 and over'.[411] Furthermore, as early as 1943, at the annual AEU conference, delegates demanded equal pay and emphasised the skilled nature of the work done by women in the engineering trade. During this conference 'the union side asked how, as women needed special training, the firm could justify paying them the same rate of wages as they paid to women sweeping the floor?'.[412] This issue was specifically related to the Rolls Royce Factory in Glasgow where women in the valve department were

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[411] 'To All M.V. Female Staff Employees' C.M.T/45, MCL.

[412] 'Special Conference Women' CP/IND/HAND/07/02, PHM, p.7.

paid 29/ while men from the same department were paid: 50/.[413] This confrontation ended with 'a new agreement which named, and accounted for every individual machine' and that 'the work done on it not the sex of the operator would determine the pay'.[414] The AEU was still fighting to maintain their definition of skilled work during these years, but crucially it was now willing to accept women workers into that definition. This effectively highlights just how neglected and overlooked many women who worked within engineering and electronics had been in the interwar years, due to the opposition of the AEU. It was therefore an extremely significant development when that opposition ended.

In conclusion, in this chapter I have shown that during the interwar years the establishment of a large block of working-class women within the electronics industry, alongside the ambitions of middle-class female engineers, created opposition from those who either argued for a return to a pre-war norms or who focused on their narrow interests in the face of these changes to the workforce. The dominance across the political spectrum of socially conservative understandings of women's roles saw the increased prominence of groups such as the Mothers' Union which projected their version of an idealised domestic role for women whilst groups like the eugenicists debated exactly how damaging such a large number of waged women workers was for the 'health of the nation'. Alongside this, the labour and trade union movements had to come to terms with how to practically deal with women workers, and their position often took the form of opposition or wilful

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[413] 'Special Conference Women' CP/IND/HAND/07/02, PHM p.9.

[414] Angus Calder, *The People's War: Britain 1939-1945* (London: Pimlico), p.403.

ignorance. The electronics industry and the women within it were denied a trade specific union due to the refusal of the AEU to accept them. As a result, these women were forced to rely upon organising themselves in various ways. Firstly, some women workers helped form and maintain their own organisations such as the Women's Cooperative Guild. Secondly, women electronics workers who received little attention from the established trades unions organised themselves and carried out spontaneous forms of industrial action which often proved effective.

Finally, middle-class women engineers organised themselves around the defence of their work as 'skilled' in the face of direct opposition from the AEU. The case of the AEU represents a prolonged evolution of the attitudes of male-dominated trades unions towards all female workers throughout the interwar years. Their insistence and reliance on the difference between 'skilled' male work and 'unskilled' female work reflects the wider gendered nature of labour relations, and the dominance of the male breadwinner model, during this period. Their continued resistance can be attributed to this. On the other hand, their eventual admission of female members during the Second World War was caused by multiple factors including direct pressure from other unions who had begun to target women members, as well as the change in circumstances between the First and Second World Wars. Not all women workers in engineering and electronics were in the same position. The women behind *The Woman Engineer* had their own specific class interests to promote whilst the women employed in the mass production of electronics goods had to rely on themselves when it came to defending their pay and working conditions. Despite these differences between women workers in the engineering industries, however, they were lumped together as 'women' by trades unions and other social and political commentators. Overall, opposition to women working in the electronics

industry differed to that in other industries because, whilst some of the social pressures were the same, the direct opposition from the AEU was unique due its directness and longevity. The self-organisation by women that took place within the electronics industry was therefore also unique. Their strikes were spontaneous and received little media attention, even from sympathetic outlets. Taking this wider context into account, the next chapter examines how employers visually represented the women they employed to manufacture electronics.

Chapter 3: The Roles and Representations of Women Workers in Manufacturing Interwar Electronics

As I demonstrated in previous the chapter women working in industry, especially under the umbrella term of engineering, were opposed by multiple groups and for multiple reasons. Most explicitly so were the embedded social expectations regarding gender, and most vehemently by men already working within the industry, over issues regarding skill and undermining wages. This placed the electronics manufacturing companies that favoured cheaper female labour, both the established engineering firms and new firms that emerged in the interwar years, in a position of having to convince people internally and externally of the benefits of women working with electronics. This chapter shows how they justified their employment of women by representing their female workforce in a specific manner that demonstrated their capability, pliability and overall benefit to the company and industry as a whole. This chapter focuses on the important roles women held in the manufacturing workforce in the interwar electronics industry and on how the electronics companies represented them visually by linking perceived notions of gender to the suitability of manufacturing wireless technology such as the thermionic valve. To examine the representation of women as manufacturing workers in the electronics industry in this period it is essential to also focus on the major changes that took place regarding the adoption of mass production techniques and how women workers became visually linked directly to this production process following the First World War. Much has been written on the First World War and the Second World War and how industries during wartime shaped and were shaped by female employment due to the presumed transformative nature of the war effort. In comparison, the interwar period has received significantly less attention. This

chapter will both be informed by and build on work by historians such as Miriam Glucksmann, focusing on how the electronics industry represented the roles women held within the production process of wireless technology.

As I summarised in my literature review, much of the early historical work regarding women's entry into the workforce during wartime and following it, presented the moment as a progressive achievement for women. This can be seen in work of historians such as Arthur Marwick who argues the First World War was a transformative moment for women workers as 'throughout Europe new social reforms were enacted and new rights for labour enshrined'.[415] However, this chapter will demonstrate that this is not entirely true, following the work done by historians such as Gail Braybon who presents women as being 'seen […] as pawns in the battle between capital and labour'.[416] The positive perception of the impact of the war on working women's lives can be attributed to some extent to the way in which companies themselves later presented and created a progressive narrative around their initial employment of women in company documents both public and private. For instance, the Manchester based company Ferranti's company journal details the developments within the company as well as reflections on the company's early years of operation. This account noticeably highlights the role and impact the initial influx of women had on the company and its workforce. The 1952-1954 edition of the *Ferranti Journal* dedicates a small section of a page to a discussion of the 'the

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[415] Arthur Marwick, *Total War and Social Change* (Basingstoke: The Macmillan Press, 1988), p.1.

[416] Braybon, *Women Workers and the First World War*, p.96.

first women employed by Ferranti'.[417] The journal claims that 'Miss O.K. Forbes

who recently retired from the firm was responsible, in collaboration with Mr G.Z.

De Ferranti, for engaging the first girls to start work at Hollinwood Factory, in

1915'.[418] Such articles present the adoption of female labour as a progressive and

forward-thinking approach by the company, making little reference to war-time

necessities or the economic incentives of the 1920s and 1930s of relying on cheaper

female labour. Such articles in official company material are sometimes

accompanied by positive recollections of women who worked there. This edition of

the *Ferranti Journal* features responses to the initial article and provides

recollections from a female employee who was employed at the firm during the First

World War. Edith J. Wheeler describes her work environment as 'quite comfy' and

states that she 'worked at a lathe about the size of a sewing machine, I was certainly

quite proud of this'.[419] This response from one of the first women employed at the

firm demonstrates that some workers at least maintained an avid interest in the

progress of the company as they read about the industry and the progress it was

making. As I will explain later in this chapter, these companies used publications to

foster a sense of community and loyalty to a workforce that, as I demonstrated in the

last chapter, was largely not represented by the trades unions. It is also significant

testimony from one of the few examples of recorded reflections from the company's

interwar female employees. However, it is important to note that in writing to the

company journal, this response may have been written to be primarily a positive

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[417] Ferranti Journal, 1952-1954, 3/3/9357, MSI, p.121.

[418] Ferranti Journal, 1952-1954, 3/3/9357, MSI, p.121.

[419] Ferranti Journal, 1952-1954, 3/3/9357, MSI, p.122.

account of her time employed by the company to increase the likelihood of being featured.

As Susan R. Grayzel emphasises, positive depictions of the initial influx of women workers during the war often took the form of 'listing and praising the variety of war work that women performed'.[420] In reality, many of the changes were not long-lasting. By the end of the war '[women's] overall economic and social status showed few, if any notable transformations'.[421] However, as I argue in this chapter, it was in the interwar years that women's relationship to specific kinds of work was truly transformed and solidified through rhetoric and corporate imagery, which 'gendered' certain jobs in the new industries such as electronics as 'women's work'. This period also saw the British state, large companies and the trade union movement attempt to deal with the aftermath of the large-scale employment of women workers that had taken place during the First World War, as well the introduction of mass production techniques that were utilised in the production of popular consumer products such as wireless sets and the thermionic valves required to operate them. The key research questions that this chapter considers are, firstly, how these female workers, who were widely employed in interwar electronics and engineering companies to manufacture the products, were viewed and represented as a workforce by their employers and the popular media and, secondly, how these women viewed themselves in relation to their work, the industry and their developing role within these companies. To achieve this, I draw on the perspective of both the women manufacturing workers themselves and the perspectives and approaches taken by their employers. I use a variety of sources including

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[420] Grayzel, *Women and the First World War*, p.5.

[421] Grayzel, *Women and the First World War*, p.5.

recollections and interviews with female workers from the period, and

representations of the company's workforces found in magazines and journals.

These sources highlight how these companies treated their female employees,

viewed, and represented their female employees and how the women themselves

viewed 'progress' in working conditions in the period, such as in the introduction of

fire safety rules, canteens and the new technology utilised in mass production

techniques.

   In the previous chapter I touched upon the fact that prior to the First World War,

theoretical debates and discussions throughout nineteenth century Britain around the

'natural' roles and accepted gender norms regarding men and women in society had

developed into a clear ideology and organising principle with regards to home life,

work, and the 'natural' biological and social capabilities of each sex. As Robert B.

Shoemaker states, by the middle of the nineteenth century 'existing beliefs about

gender differences crystallised into an ideology of separate spheres predicated on

explicit distinctions between women's domestic responsibilities and the masculine

public world outside the home'.[422] Women were defined by their supposed natural

inclination towards childrearing and home care. This viewpoint was disseminated

not just by the masses as accepted common knowledge, but often by the scientific

community and those in positions of power and influence. For instance, a letter from

Queen Victoria from 1870 states that 'God created men and women different - then

let them remain each in their own position'.[423] Clearly this view held enormous

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[422] Robert B. Shoemaker *Gender in English Society 1650-1850: The Emergence of Separate Spheres?* (New York: Routledge, 1998), p. 209.

[423] 'Gender Ideology & Separate Spheres in the 19th Century'*, V&A,* http://www.vam.ac.uk/content/articles/g/gender-ideology-and-separate-spheres-19th-century/ [Accessed 20th July 2018].

sway over how nineteenth century British citizens viewed both sexes and their

gendered roles in relation to the home and working life. In large part this can be

attributed to the apparent support of scientific and academic evidence regarding

gender roles. For example, as Angela Sani argues in relation to the writing of

Charles Darwin: 'Even he, the father of biology of evolutionary biology was so

affected by a culture of sexism that he believed women to be the intellectually

inferior sex'.[424] This context not only shaped the opposition to women workers in

the electronics industry that I analysed the previous chapter, but also how the

various electronics companies represented the traits of their female workforce and

women's abilities to hold such roles within the industry. However, while this

prevalent viewpoint placed women as passive, incurious, naturally predisposed to an

uneventful home life, and ill-suited to practical or intensive work, in reality this was

not a sustainable way of living for the majority, and particularly for working-class

families. For middle-class women, the desire to break free of these gender norms

can be seen, for example, in the desire and goal of obtaining greater women's rights

evident in the growth of the women's movement and in the ambition of some

women to seek education and training, individual opportunities, recognition and

self-fulfilment as embodied by the WES. However, for the country's working-class

families it was an economic necessity that the women family members, both wives

and daughters, worked to some degree to assist with the overall family income. This

was particularly the case with young and/or single women, but in certain industries

and regions, married women also worked. Therefore, despite the strict gender roles

that were politically and culturally reinforced throughout nineteenth-century British

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[424] Angela Saini, *Inferior: How Science Got Women Wrong and the New Research That's Rewriting the Story* (Boston: Beacon Press, 2018) p.95.

society, thousands of women engaged in waged work before the outbreak of the

First World War. This type of work had a continuation in the industrial labour

undertaken by women in the electronics industry.

For example, many young girls and women in the nineteenth century worked in

factories and textile mills, which expanded in number due the industrial revolution.

As Carol E. Morgan states: 'while women needed an income, manufacturers needed

labour that was cheap and plentiful'.[425] This challenged, on one level, the concept of

the two separate, gendered spheres that dominated nineteenth-century society, but

the women's rights movement had not yet achieved its largest number of supporters

or its most crucial social and political victories and it was still expected that 'all

women (ideally) reflected the labour of their husbands rather than manifesting or

profiting from their own waged work'.[426] It took a transformative event and the

emergence of new industries to reconfigure the pre-existing gender system in regard

to labour and the suitability of certain types of work for women. The First World

War saw one and a half million women enter the workforce to replace the men who

were mobilised for military service, while thousands more moved from one sector,

such as domestic service, to a role in industry, particularly as munitions production

workers, who between 1916 and 1917 became 'nearly half of the workforce'.[427]

During these years the aeronautics industry also relied upon female labour.[428] While

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[425] Carol E. Morgan, *Women Workers and Gender Identities, 1835-1913: The Cotton and Metal Industries in England* (London: Routledge, 2001) p.65.

[426] Mary Poovey, *Making a Social Body: British Cultural Formation, 1830-1864* (Chicago: Chicago University Press), p.125.

[427] Thom, *Nice Girls and Rude Girls: Women Workers in World War I*, p.34.

[428] John Howard Morrow, *The Great War in the Air Military Aviation from 1909 to 1921*, (Tuscaloosa: The University of Alabama Press, 1993), p.251.

much of this work was given to women on the assumption that it was a temporary necessity of wartime, for some women it was transformative in regard to their own perceptions of their professional identities. For example, following the end of the war, Katharine Parsons highlighted the case of a gun repair firm during the war where 'two girls dealt with guns varying from the 13 inch naval gun, weighing 50 tons, to the 6-pound Tank Gun' and argued that girls could 'design repairs to guns and mechanism and calculate the factor of safety of damaged gun by logarithm and slide rule'.[429] Parsons also highlighted the skilled nature of women's work in metallurgy, optics and munitions. She attributed the successful nature of women adapting to skilled mechanical work to the intensive training facilitated by the urgency of the war. It is evident that Parsons is arguing here that women had earned the right to work in the same jobs as men due to what she perceives as the demonstrably positive effects of their entry into the workforce in relation to both the levels of production and their skilled engineering work. Parsons is also critical of the trades unions and the Labour Party's efforts in regard to women's employment in the 1920s. Ultimately, her appeal within this pamphlet is against the 'strange perversion of women's sphere to make them work at producing the implements of war and destruction and to deny them the privilege of fashioning the munitions of peace'.[430]

While Parsons' grievances were warranted regarding the dismissal of many female employees during the initial post war years, she is clearly mostly concerned with what was viewed as 'skilled' work. However, a closer examination of the

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[429] Parsons, *Women's Work in Engineering and Shipbuilding During the War*, p.5.

[430] Parsons, *Women's Work in Engineering and Shipbuilding During the War*, p.9.

interwar electronics industry shows that women in large numbers did in fact fashion many of the munitions of peace, although it was considered unskilled work, was opposed by many in the labour movement and received little serious attention in general. The First World War demonstrated the potential of female employment to women who saw their wartime work as an example of the highly-skilled work women could effectively accomplish in areas of industry such as engineering. But more specifically and more exploitable was the potential seen by the emerging interwar industries and companies of utilising cheaper female labour for mass production. As Ruth Milkman highlights contemporaries assumed that 'employers would replace male workers with cheaper female labour in order to reduce wage costs'.[431] This link between female employment and mass production industries such as electronics would truly emerge when other wartime work carried out by women was brought to an end. The increasing use of female labour can be seen clearly by the multitude of debates, articles, campaigns and visual representations found in electronics companies publications regarding female employment and the supposedly 'unskilled' work that the mass production of wireless technology and consumer electronics relied upon.

3.1 Automation and Representations of Women Workers in the Interwar Electronics Industry

A 1922 edition of the *Metropolitan-Vickers Gazette* (MVG) states in relation to the company's employment of women that: 'many of the prevailing ideas as to women's incapacity from the physical point of view are not borne out when the history of

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[431] Ruth Milkman, *Gender at Work: The Dynamics of Job Segregation by Sex During World War II* (Chicago: University Press Illinois, 1986), p. 27.

women's work in industry is considered'.[432] Echoing Parsons' arguments, the *MVG*

argues that attempting to accommodate the perceived needs of women in the

workplace led to a substantial contribution to 'the study of industrial fatigue and all

of the factors which make for the efficient employment of human beings in

factories'.[433] While the *MVG* states the capabilities and benefits of female

employment it also makes it clear by 1922 that the same tensions and issues that

Barbara Drake had considered on the advent of the armistice, such as the 'dilution of

skilled work' impacting 'the question of wages,'[434] were still prevalent. For instance,

the *MVG* points out that 'a point of equilibrium has not been reached' and

emphasises it probably would not be reached until 'some understanding has been

reached on the question of the relation between male and female wages for the same

class of work'.[435] Wages and the classification of work as either unskilled or skilled

to a large degree centred on the employment of women and the dilution of skilled

work that taken place during wartime. For instance, in 1923 the economist George

Douglas Howard described the wartime process of dilution 'as the introduction of

less skilled workers to undertake the whole, or a part of the work previously done by

workers of greater skill or experience, often by the simplification of machinery'.[436]

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[432] E.E Wilson, 'The Employment of Women in Munitions Factories', *The Metropolitan-Vickers Gazette,* July 1922, YA1998.16, MSI p.12.

[433] Wilson, *The Metropolitan-Vickers Gazette,* July 1922, YA1998.16, MSI, p.13.

[434] Barbara Drake, *Women in the Engineering Trades* (Westminster: Labour Research Department, 1917), p. 29.

[435] Wilson, *The Metropolitan-Vickers Gazette,* July 1922, YA1998.16, MSI, p.13.

[436] Gertjan De Groot, *Women Workers and Technological Change in Europe In the Nineteenth and Twentieth Centuries* (London: Francis and Taylor, 1997), p. 200.

This process became even more 'synonymous with the introduction of women'[437] in the interwar years alongside the introduction of new automated production processes in the new industries. A 1920 edition of the *Manchester Guardian* outlined the situation: 'some of the developments of the period have afforded particular scope for utilisation of female labour' with an example given regarding 'the manufacture of cigarettes and of the electric lamp and thermionic valves in which a large expansion of production has occurred'.[438] This technology facilitated the perceived dilution of skilled work done by men in favour of cheap female labour aided by automation. This raised questions about how much women should be paid, what unskilled work consisted of, and the potential threat to skilled male jobs which created tensions between trades unions and the use of female labour as I have discussed previously.

Metropolitan-Vickers conducted various reports analysing the state of the industry during this period which demonstrate the impact on wages. One report from August 1923 titled 'International Rates of Wages in the Engineering Industry'[439] compares international wages from within the industry to establish 'the position of Britain' and what 'advantages and disadvantages the British manufacturer may have'[440]. Table 9 is the report's comparison of the purchasing power of unskilled workers across five countries.

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[437] Gertjan De Groot, *Women Workers and Technological Change in Europe In the Nineteenth and Twentieth Century*, (London: Francis and Taylor, 1997) p. 200.

[438] 'Women in Industry' *Manchester Guardian,* September 20, 1928, p.12.

[439] 'International Rates of Wages in the Engineering Industry' *Metropolitan-Vickers Research Department Report,* August 1923, 2003.50/7/2/71, MSI, p.1.

[440] 'International Rates of Wages in the Engineering Industry', MSI, p.1.

Table 9 International Rates of Wages in the Engineering Industry 1922 (In Pence per Hour)[441]
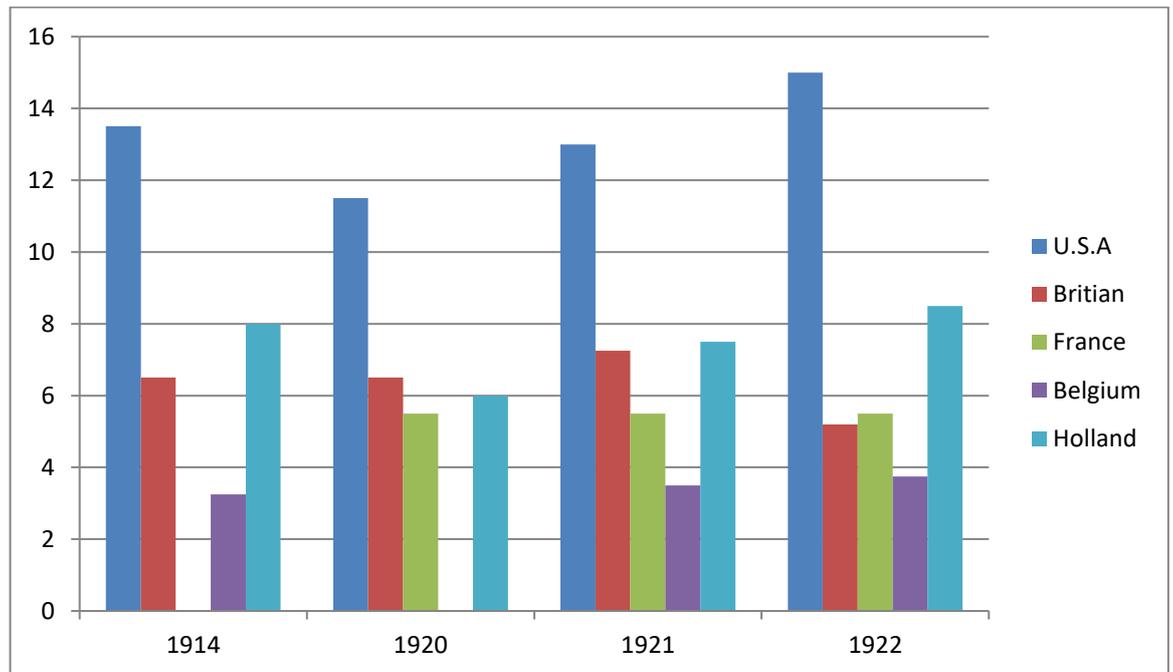
From Table 9 is it clear that by 1922 British unskilled workers were receiving lower wages than during the First World War. The report concludes that overall in the early interwar period there was an international levelling of wages, when also comparing skilled labour against unskilled. The report states that 'skilled and unskilled tend to coincide with the skilled lapsing to semi-skilled through mass production methods'.[442] Noticeably there is no direct international comparison between the countries' female workforces or their wages and type of work, however much of this new 'unskilled' mass production labour in the electrical engineering

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[441] 'International Rates of Wages in the Engineering Industry', MSI, p.1.

[442] 'International Rates of Wages in the Engineering Industry', MSI, p.4.

and electronics industry was being done by women, which was therefore often viewed as women 'diluting' the skilled (male) workforce.

Visual imagery connecting female labour and new industrial technologies linked to 'dilution' was prominently featured and disseminated by official industry publications. Official and corporate promotional material from the interwar period directly and visually link this supposedly unskilled mass production technology to female labour. This shaped (and was shaped by) gendered perceptions of both the technology and the women who worked with it. These visual representations attempt to portray the simplicity and ease of use that automation that allowed anyone, without official training, to use it.

Figure 16 Pumping Machines at Cossor Valve Works[443]

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[443] Cossor, *Cossor Courier*, (April 1937), p.14.

Figure 17 Automatic escalators at Cossor Valve Works 1937[444]

For example, Figures 16 and 17 are taken from the February and March editions of

the *Cossor Courier*, the company magazine of the London based electronics

company A.C. Cossor. These images show how the use of automation was utilised

in the production of thermionic valves. The text in relation to the second image

states that 'these escalators are entirely automatic in operation. They flash the

filaments-fire the getters-and, due to the considerable length of their track, age the

valves'. [445] Similarly, the text accompanying the first image describes it as 'one of

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[444] Cossor, *Cossor Courier* (April 1937), p.14.

[445] Cossor, *Cossor Courier* (April 1937), p.14.

the large circular pumping machines in the Cossor Valve works'.[446] Images like this
are attempting to demonstrate the company's new production methods to its
magazine's readers and employees, but they also serve to gender this type of work
as every image of a mass production task is presented as being done by a woman
worker. In describing the production processes these magazines define such work as
most suitable for women. It is directly stated, for example, that 'we recognise no
operator as being a fully qualified tester until she has had at least three years'
experience'.[447] By using the pronoun 'she' rather than 'he' it is clear that by 1937 it
was expected that a woman would be working on these kinds of production jobs
rather than a man. As Mike Savage argues: 'where employers extract absolute
surplus value they are acutely conscious of labour costs and hence attempt to
employ cheap labour whenever possible and this makes female labour especially
attractive to them'.[448] This desire for cheap labour necessarily brought with it the
gendering of certain positions as 'women's work' as can be seen in Figures 16 and
17. Furthermore, while these images and the associated text assume a female worker
they do not emphasise any level of skill, training or competence, rather, they
emphasise the opposite. While the visual cover photographs from *The Woman
Engineer* I analysed in my previous chapter emphasised the individual skill of each
women depicted, these photographs from the company magazines deemphasise the
women themselves and focus on how the manufacturing process is increasingly
simple and easy to use. In this comparison the intent behind each depiction is made

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[446] Cossor, *Cossor Courier* (February 1937), p.16

[447] Cossor, *Cossor Courier* (April 1937), p.17.

[448] Mike Savage, 'Trade Unionism, Sex Segregation, and the State: Women's Employment
in 'New Industries' in Interwar Britain' *Social History,* 13, (1998), 209-230 (p.218).

abundantly clear. Employers represented the manufacturing process as simple, easy

and repetitive and therefore most suitable to 'unskilled' and cheap female labour.

These magazines can be seen as a direct attempt to explain and justify the increasing

presence of women manufacturing workers in the industry.

It is evident from these 1930s examples that the initial gendering of industrial jobs

that took place in the years immediately following the First World War continued in

a much more overt manner during interwar years due to the use of new technologies.

This had a greater impact in solidifying the perception of certain industrial jobs as

'women's work' than the temporary munitions production in wartime Britain.

During the war, before certain jobs had been accepted as 'women's work', many

male employees feared the introduction of women to the industrial workforce. The

Ferranti company journal provides this perspective of the male employees who

witnessed the widespread hiring of women workers. J. N. Bardaley, who worked in

the Ferranti radio department, describes how during the First World War 'we had a

large number of young girls, and could have put on a beauty show equal to any on

the stage'.[449] He describes the worries that developed during the war from the

perspective of the male workforce, stating that 'we began to think that our future

was to be the heavy drudges while the girls had the light work'.[450] While this

highlights the common fear held by many male employees that they could be

replaced by less expensive female labour, it also demonstrates a concern that in the

gendering of the workplace men would be left to contend with all the demanding

work while women would benefit from perceived 'lighter' kinds of work that they

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[449] Ferranti Journal, 1952-1954, 3/3/9357, MSI, p.80.

[450] Ferranti Journal, 1952-1954, 3/3/9357, MSI, p.81.

were deemed to be more suitable for. During the interwar years this rhetoric was equally utilised by women in order to defend their new position within the workforce. For example, Mrs Winifred Cotterill, who was born in 1905 and was employed at the General Electrical Company (GEC) in Coventry from 1921-1929, mentions in an interview recorded in 1984 that she believes a man could not do her job or other form of light work due to the fact a man's hands 'would be too clumsy'.[451] This echoes a refrain often used by the employers themselves, and has here been internalised by the female employee. This shows that in the 1920s some female employees took pride in what were presented as their intrinsic and gendered traits that made them more suitable for jobs such as the manufacture of consumer electronics. In short, gender differences were deployed in the interwar period to define and defend certain roles and positions within industries such as electronics and electrical engineering by both employers and employees when it was beneficial to do so. However, this had not been the case for the initial influx of female employees during the war and only became so as women became directly linked to certain jobs in industries such as electronics manufacturing throughout the interwar years.

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[451] Mrs Winifred Cotterill recording, MSS.266/6/2, MRCW.

3.2 Changing Representations of Women and Work

<u>Figure 18 A 'Lady' switchboard operator at Salford Corporation Electricity Station 1916</u>[452]
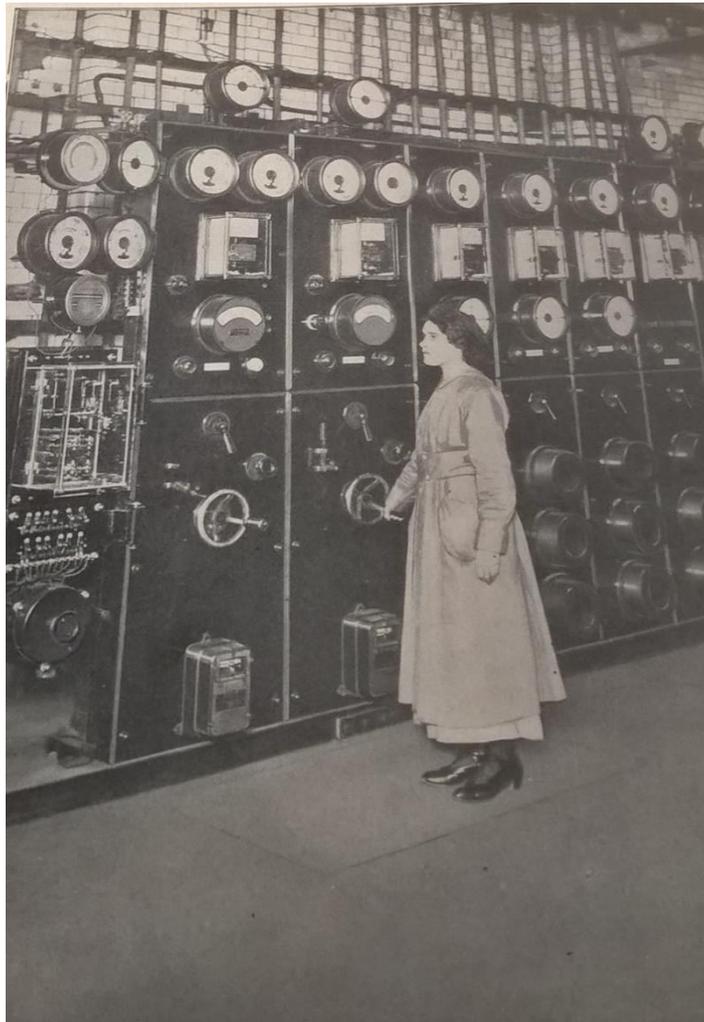
The shift in understandings of what constituted 'women's work' within industrial settings is evident from the fact that imagery taken from wartime company magazines and promotional material centralizes the woman worker whilst

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[452] 'Lady Switch Board Attendant' *The British Westinghouse Gazette*, YA2012.27, October 1916, MSI p.2.

highlighting her femininity and the temporary nature of her position. Figure 18 is taken from the December 1916 edition of the *British Westinghouse Gazette* and depicts a female employee operating the switch board at the 'Salford Corporation Electricity Station'.[453] The image and the accompanying text is clearly attempting to highlight the novel femininity of its subject. For example, the text associated with the image describes the worker as 'a Lady switchboard attendant'[454]. The image was taken in 1916 during the first influx of women into such industries. As Susan R. Grazyel explains: 'as male waged labourers were lost to the armed services, women filled their ranks, finding employment on a scale neither seen before the war nor sustained afterwards … while the war caused some women to shift jobs, it enabled others to join the paid workforce for the first time'.[455] Photographs such as this within the company magazines serve to introduce readers, who would have been other employees, to the new 'lady' workers who had begun to take up positions during wartime. Furthermore, the qualifier of 'lady' switchboard attendant reveals the expected temporary presence of these new female workers. By emphasising 'Lady' the image implies that the position will eventually be taken up by a 'normal' (i.e. male) switchboard attendant once the war had come to an end. As Grayzel emphasises 'despite the positive impressions of women's waged wartime work, as circulated in the media, such work was always assumed to be temporary'.[456] Furthermore, Angela Woollacott emphasises how wartime imagery often 'casts

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[453] 'Lady Switch Board Attendant' *The British Westinghouse Gazette*, YA2012.27, October 1916, MSI p.2.

[454] 'Lady Switch Board Attendant' *The British Westinghouse Gazette*, YA2012.27, October 1916, MSI p.2.

[455] Grayzel, *Women and the First World War*, p.27.

[456] Grayzel, *Women and the First World War*, p.27.

women's production of shells as feminine and domestic'.[457] While this was the case during the war, the contrasting representations of the 'lady' employee in this image and many later images of female workers in the industry demonstrate that in the interwar period less emphasis was placed on their individual femininity or presenting them as a temporary (if heroic) curiosity. Rather, in the interwar period women became assimilated into workforces which transformed how they were portrayed by their employers.

In additions to photographs, cartoons and magazine illustrations found in company magazines also exaggerated the femininity of the war-time female worker and emphasised how out of place they appeared to be in the workplace. Comparing images from the end of the First World War, the early interwar period and the beginning of the Second World War makes it evident how depictions (and perceptions) of women workers evolved in this period.

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[457] Angela Woolacoot, *On Her Their Lives Depend: Munitions Workers in the Great War* (Berkeley University of California Press), p112.

Figure 19 'Carry On' magazine illustration 1916[458]

Figure 19 dates from the First World War and is entitled 'Carry on'. It presents the

female industrial worker as temporary, feminine and being used to 'carry on' a

man's role. This is evidenced by the fact she is wearing high heel shoes whilst also

'posing' coquettishly for the viewer. In doing so the image is implying that she is

defined by her femininity and that this has not been lost as a result of her temporary

wartime work.

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[458] 'Carry On' *The British Westinghouse Gazette*, YA2012.27, October 1916, MSI p.2.

Figure 20 Woman Welder at British Westinghouse 1919[459]

In contrast, Figure 20 is an image of a women 'welding a joint'[460] which is found

in the June 1919 edition of the *British Westinghouse Gazette* and places the women

and her work as central to the image. The text associated with the image makes no

reference to the gender of the employee and is purely a technical overview of the

depicted job. The article reviews aspects of the process, explaining for example that

'Butt, spot and line welding are all done with alternating current and the low voltage

and high current required for the welding operation is provided by means of a

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[459] 'Metal Electrode Welding; Welding a Joint' *The British Westinghouse Gazette*, YA2012.27, MSI, June 1919, p.274.

[460] 'Metal Electrode Welding; Welding a Joint' *The British Westinghouse Gazette*, YA2012.27, MSI, June 1919, p.274.

suitable transformer'.[461] This depiction of a single female employee does not overly emphasise the worker's femininity. This stands in stark comparison to the earlier representations, particularly during the First World War, which are clearly more gendered in their presentation of the company's female workers. This shift by the late 1930s and early 1940s can be attributed to the accepted and desirable permanency of the semi and unskilled female workforce that had come to define industries such as those mass-producing electronics.

Figure 21 Herbert Capstan Lathe Advertisement 1940[462]

Figure 21 shows an advertisement from the April 1940 edition of the *Metropolitan-Vickers Gazette* which shows a woman working on a Herbert Capstan Lathe. This demonstrates how advertising such industrial products had to both visually show women taking part in such work and dissuade any potential doubts

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[461] 'Metal Electrode Welding; Welding a Joint' *The British Westinghouse Gazette*, YA2012.27, MSI, June 1919, p.274.

[462] 'Alfred Herbert LTD Coventry' *Metropolitan-Vickers Gazette*, April 1940, p.viii.

regarding female manufacturing workers being capable of utilising and operating such tools. In comparison to the depictions of feminine 'workers' in the First World War, this kind of company material emphasises the woman as an effective worker rather than an out of place curiosity. In addition, it suggests that the technology has been specifically made with a female workforce in mind therefore implying its permanency as well as the influence of ongoing gendered understandings of women's capabilities as workers. For example, the advert describes how the tools are 'extremely easy to handle' and that 'when correctly tooled and set up for repetitive work they are particularly adapted for use by women and young operators'.[463] Here the advert is acknowledging the employer's desire for female workers (and for their lower wage costs) while also describing how the workplace has been altered to facilitate them. It is also directly linking the suitability of women to repetitive work, a desirable skill in relation to mass production. This is an argument that was directed at those sceptical internally and across the industry. Linking women's suitability to repetitive work and emphasising physical attributes such as their nimble fingers is present in multiple companies' output during this period up until the beginning of the Second World War. Femininity was de-emphasized when it clashed with the industrial imagery but gendered characteristics were emphasized when it helped represent the women workers as preferable to their male counterparts. It was therefore during the interwar years that the visual relationship between the mass production of consumer goods and women manufacturing workers was formed, disseminated and negotiated.

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[463] 'Alfred Herbert LTD Coventry' *Metropolitan-Vickers Gazette*, April 1940, p.viii.

In this section I will explore these issues further, focusing on how three companies represented their female workforce as a group. The magazines and club newsletters published by the companies that produced electronic goods and valves in Britain's interwar years, such as Cossor, Westinghouse and Metropolitan-Vickers, contain numerous photographs depicting female employees at work, both in adverts for the company's products and, in the case of the club newsletters, as positive representations of the company's treatment of and relationship with its employees. These gazettes and newsletters were read primarily by those employed and connected to the company in some manner and so many of the photographs taken of the female workforce (staged or otherwise) attempt to highlight the capabilities of their manufacturing workers and their treatment by the company but also to reassure readers that they were effective as workers and were correctly supervised by the appropriate male figures. The three images below taken from the *British Westinghouse Gazette* demonstrate this dynamic, which was clearly present in much of the industry's representation of its female workforce during the interwar years.

Figure 22 Brismsdown Cosmos Vaccuum Lamp Shop 1919[464]

Figure 22 was published in the September 1919 edition of *British Westinghouse Gazette* and depicts the Brimsdown Cosmos works and the 'foot making section of the Vacuum Lamp shop'.[465] The article accompanying the photograph does not mention the gender of the workforce present in the image and is primarily focused on the effectiveness of the works. However, the image is clearly staged in order that everyone is looking at the camera or at least everyone has been made aware that a photograph was being taken. This highlights the women workers despite the associated text making no mention of them specifically. Furthermore, while the gender of the pictured workers is not highlighted in the text, the image is placed alongside references to the fact the factory provides a new 'workers canteen' and

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[464] 'Foot making section of the Vacuum Lamp shop' *The British Westinghouse Gazette*, YA2012.27, September 1919, MSI, p.39.

[465] 'Foot making section of the Vacuum Lamp shop' *The British Westinghouse Gazette*, YA2012.27, September 1919, MSI, p.39.

allows their employees the proper amount of 'rest'.[466] This both demonstrates the attempt in these internally produced company magazines to demonstrate the positive treatment of their employees and the progress being made in this aspect of the factory life. By foregrounding the women by choosing an image of them looking towards the viewer, alongside the text offering reassurances about the welfare and facilities for its employees, the magazine emphasises the company's paternalistic outlook, which was typical of attitudes to the growing number of female industrial workers employed in interwar years. As Celia Briar states, due to the amount of work demanded from workers, during the war years 'restrictions on women's hours of employment were considerably relaxed, and the emphasis of State employment policy moved towards women's welfare in the workplace'.[467] A focus on women's welfare continued to be emphasised by companies in the interwar years and company magazines such as the *British Westinghouse Gazette* utilised photographs of its female workforce to assuage these concerns. Furthermore, while such visual representations attempted to connect and express the positive progress associated with the industry's female workforce, other photographs served to de-emphasise the femininity of the workforce while also reassuring readers that the work force was properly supervised, and that women workers in manufacturing were capable of working effectively. In the Metropolitan-Vickers company magazines these dual purposes of images of women workers can often be found together. For example, from the same 1919 article as the above Figure 22 the image below attempts to present a less staged representation of the workplace.

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[466] 'The Manufacture of the Cosmos Electric Lamp' *The British Westinghouse Gazette*, YA2012.27, September 1919, MSI, p.38.

[467] Celia Briar, *Working for* Women, p.40.

Figure 23 Cosmos Lamp Work 1919[468]

Figure 23 is of the 'pump room at the Cosmos Lamp Work'.[469] While Figure 22

clearly focuses on the female employees and has them looking directly at the

camera, this image appears before the previous images and features a man observing

the women's work. Despite giving the impression of the photograph catching the

manufacturing workers in the middle of their normal working day, clearly the

inclusion of the male overseer has been intentional in order to present to the readers

an authority figure checking on the work the female employees are producing. This

is designed to give an impression of an efficiently ordered (and gendered) hierarchy

in place on the factory floor.

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[468] 'Pump room at the Cosmos Lamp Work' *The British Westingthouse Gazette,* YA2012.27
September 1919, MSI, p.38.

[469] 'Pump room at the Cosmos Lamp Work' *The British Westingthouse Gazette,* YA2012.27
September 1919, MSI, p.38.

Figure 24 Cosmos Flash Lamp Department 1919[470]

Figure 24 is of the 'Flash Lamp Department at the Cosmos Lamp Work'.[471] This photograph has evidently been set up to include, in the centre of the image, the male overseer of the female employees, who is standing while the women are all seated. This positioning mirrors the relationship of authority he has over the female workers. He is the only person looking directly at the camera (the women are all from an angle) further emphasising his authority within the photograph. This can be attributed to the fact the purpose of the image is not to highlight the female employees but the workplace and the building itself. The photograph is therefore being utilised to reassure the readers of the company *Gazette* that the female

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[470] 'Flash Lamp Department at the Cosmos Lamp Work' *The British Westinghouse Gazette*, YA2012.27, September 1919, MSI, p.36.

[471] 'Flash Lamp Department at the Cosmos Lamp Work' *The British Westinghouse Gazette*, YA2012.27, September 1919, MSI, p.36.

workforce present in the image is under capable management and the facility is

capable of meeting expectations. The presence of a single male observer or manager

inspecting a group of female manufacturing workers is common throughout the

photographs contained in these company magazines, particularly when the intention

of the text associated with the image is not to specifically highlight the female

workers or their contribution but to underline the company's effective work space

and production methods.

Figure 25 Metropolitan-Vickers Armature Coil Forming and Field Coil Winding Departments 1921[472]

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[472] 'Metropolitan-Vickers Armature Coil Forming and Field Coil Winding Departments' *Metropolitan-Vickers Gazette*, YA2012.27, November 1921, MSI, p.258.

Figure 26 Armatures in course winding at Metropolitan-Vickers 1921[473]

Figures 25 and 26 provide clear visual evidence in relation to Miriam

Glucksmann's argument that 'a rigid gender-based division of labour was

established in electrical engineering with the adoption of methods of mass

production' and that women 'were concentrated in semi-skilled manual works'.[474]

This is also shown to be the case in recollections of the manufacturing workers who

experienced this division. For example Edith J. Wheeler, writing to the *Ferranti*

Journal as one of the company's first female employees, states that 'as a girl of 17 I

was one of (as near as I can recall) about 30 girls employed at Ferranti's building in

'Charthouse Square'.[475] Edith Wheeler recalls a strict division of male and female

employees, as in the work place 'we were kept in strict seclusion as far as possible

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[473] 'Armatures in Course Winding' *Metropolitan-Vickers Gazette*, YA2012.27, November 1921, MSI, p.259.

[474] Glucksmann, *Women* Assemble, p.63.

[475] Ferranti Journal, 1952-1954, 3/3/9357, MSI, p.122.

from the men, Lunch time had to be spent in our room' and that that there was 'no going out until the end of the day'.[476] Beyond this, Edith Wheeler recalls that even when she did encounter the male employees there was little communication between them and the female employees. She states regarding one man that the 'poor fellow was minus one arm-he might have been minus a tongue too for all he talked. A nod was the most we could get from him'.[477] From this is clear that the early female employees at Ferranti took pride in their work despite the evident gender divisions and they seemingly had little interaction with male workers which was directly enforced by the management within the company. As I have noted, linking women with the new industrial technology can be attributed to the desire for a cheaper and less unionised workforce. However, this was often justified by a gendered rhetoric around the suitability of women to the kind of repetitive work found in mass production industries such as electronics and electrical engineering.

This is demonstrated in the *MVG* by the statement that 'it is generally realised that, temperamentally, women are more highly sensitive than men and temperament is likely to play a considerable part' in the 'degree of efficiency with which a worker may perform her regular duties'.[478] A similar gender discourse is evidenced in the company magazines' descriptions of why women were best suited to the electronics industry, such as the *MVG's* argument that 'much of the work requires deftness and speed, and, being comparatively light, involves little physical strain'.[479] Rhetoric

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[476] Ferranti Journal, 1952-1954, 3/3/9357, MSI, p.122.

[477] Ferranti Journal, 1952-1954, 3/3/9357, MSI, p.122.

[478] Wilson, *The Metropolitan-Vickers Gazette,* July 1922, YA1998.16, MSI*,* p.15.

[479] Wilson, *The Metropolitan-Vickers Gazette,* July 1922, YA1998.16, MSI*,* p.14.

about being mentally suitable for repetitious work and having 'nimble' hands was particularly common when linking women's physical and feminine traits with the work involved in mass production. For instance, when describing Edith Wheeler in the Ferranti journal it is said that she possessed 'nimble fingers which made her particularly adept at handling small parts'.[480] This is equally reflective, perhaps, of the lack of importance, attention or consideration given to women's voices as individuals in the workplace during this period in comparison to their male counterparts. Edith Wheeler projects an apologetic tone throughout her recollections in the company journal and directly links herself to the kind of technology companies such as Ferranti came to produce in the interwar years. For example, she states 'Sorry if I've been a nuisance but like the wireless, you could easily switch me off'.[481] It is clear in the journal's description of Edith Wheeler and her letter that there was a gendering of the kind of work she undertook, and of the kind of skills and personal qualities she possessed, as one of the company's first female employees.

However, not all the recollections by female employees fit so readily with the stereotypes about women, work and technology as presented in the company magazines. Other recollections by the women employed in electrical engineering and electronics companies during the interwar period are more directly critical of their working situation and contrast the emerging concerns around welfare emphasised in the company magazines and gazettes with the harshness of the expectations of mass production techniques and its supervision policies. In her

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[480] Ferranti Journal, 1952-1954, 3/3/9357, MSI, p.124.

[481] Ferranti Journal, 1952-1954, 3/3/9357, MSI, p.123.

recollections Mrs Winifred Cotterill states her job when hired at the age of 16 was 'in the machine shop on small presses' and that she had 'eight years of really hard work'.[482] While the recollections found in the company magazines are potentially softened recollections due to loyalty and being published in the company owned magazines, these recollections are still potentially more accurate about the interwar working environments than the articles and photographs produced by employers, although they are necessarily reliant on an individual's memory. For example, Winifred Cotterill states 'I had to start dead on 7:30 am, no tea breaks but if no one was looking you could snatch a bite of something to eat while you were working'.[483] Cotterill also recalls that the expectations and the supervision of the female employees she worked alongside were very unforgiving and sometimes harsh. She states 'nine times out of ten often the foreman would be waiting at the end of the section with his watch in his hand and his eyes on the big clock on the wall and black looks' as well as on certain jobs when the 'the rate fixer would stand behind with a stopwatch and swear you could do more than that. Talk about being brought to tears!'[484] The photographs reproduced above demonstrate how this would have worked in practice with one male supervisor closely observing many female production workers. Personal recollections also demonstrate that these women and young girls had little representation in the trades unions and describe harsh working rules despite the employer's concerns over welfare and working conditions presented commonly in the company magazines and journals. The recollections of a

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[482] Mrs Winifred Cotterill notes, MSS.266/6/2, MRCW, p.1.

[483] Mrs Winifred Cotterill notes, MSS.266/6/2, MRCW. p.1.

[484] Mrs Winifred Cotterill notes, MSS.266/6/2, MRCW. p.2.

Mrs E.E Johnson employed at G.E.C between 1928 and 1937 are indicative of the conditions at the time. Mrs Johnson, after leaving her job as a weaver at seventeen worked 'on the selectors on the winding shop and machine shop' as well on the 'adjusters'.[485] This trajectory of women moving from textile work to the electronics industry was a common one, and relates to similar gendered expectations about the skills required in both industries: as Teri L. Caraway highlights it was also reported by commentators on the textile industry that 'women's hands are more nimble'.[486]

Figure 27 Filament Mounting a Valve at the Tungsten Lamp Manufacturing Plant 1923[487]

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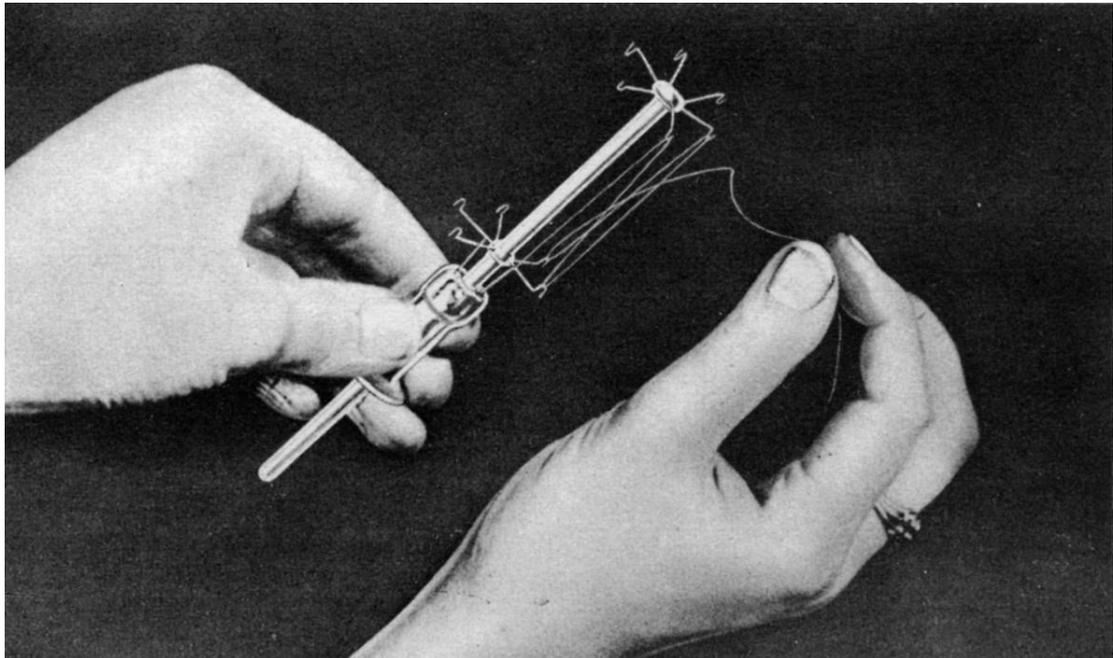
[485] Mrs E.E Johnson notes, MSS.266/6/1, MRCW, p.1.

[486] Teri L. Caraway, *Assembly Women: The Feminization of Global Manufacturing* (Ithaca: Cornell university Press, 2007), p.114.

[487] General Electric Company, *The Story of the Lamp* (Coventry: General Electric Company, 1923).

Figures 22 to 26 all share a similar characteristic of depicting women manufacturing workers in large groups. This stands in direct contrast to how groups such as the WES depicted single women and also in comparison to how the employers initially represented women working in industry during the war. The WES and wartime company depictions highlight single women for two different reasons: firstly to emphasise skill and secondly to embody femininity in a masculine workplace. It is apparent that interwar electronics companies de-emphasised women workers' individuality and uniqueness to portray gendered characteristics more suited for the roles the women were employed in, such as a 'natural' suitability for repetitive work and lack of career ambition. Figure 27, published by GEC in 1923, shows one of the major examples of a way in which individuals were focused on by highlighting the supposedly inherently nimble fingers of a woman worker here mounting a valve at the Tungsten lap manufacturing plant. While the female labour force are represented as a uniform and disciplined group this is not to suggest they were not also explicitly gendered in company representations to connect them to the work being done. Figure 27 implies that these innate gendered characteristics applied to the female workforce as a whole which made them suitable to the role of manufacturing electronic products. Photographs and rhetoric about women's natural inclination for simple repetitive work show that electronics companies evolved in how they represented women in the industrial workplace. In the war years their femininity had been exaggerated to highlight their difference from the factory floor, whereas in the interwar period they were gendered in a manner which tied them explicitly to the role of light manufacturing technology such as valves, thereby positioning the job as a 'woman's job'. These representations attempted to justify the industries' reliance on cheaper labour as these women were not represented as skilled or trained, but as inherently suited to the job. Equally, this also constructed a

narrative that directly argued against the opposition from other employers and trades unions within the electronics industry that I focused on the previous chapter.

In her recording Mrs Johnson describes how women often had the unrealistic expectation placed upon them of performing two jobs after marriage, keeping the house as well as carrying out waged work. She suggests that this was the reason why most girls left G.E.C once they were married. This description of women's paid work and unpaid labour has been described by sociologists such as Arlie Hoschild as 'the second shift'.[488] Mrs Johnson also mentions that the women who worked on wireless were employed seasonally. Unlike Winifred Cotterill, Mrs Johnson describes her time at the company as 'quite pleasant'.[489] This could be attributed to the later date of her employment implying better working conditions. However, she also reiterates similar memories to Mrs Cotterill such as 'nobody had a tea break before the war'.[490]

Despite the thousands of women employed in electronics like Mrs Johnson, outside of the new industries long standing gendered expectations regarding a woman's role at home continued to influence the social perception of women within and outside of the workplace. This can be seen clearly in a 1932 edition of the *Leeds Mercury* which reports on the widely held opinion that 'married women workers were not strictly an insurable proposition at all'. [491] This is further exemplified by

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[488] Arlie Hoschild, *The Second Shift: Working Families and the Revolution at Home* (New York: The Penguin Group, 1989), p.10.

[489] Mrs E.E Johnson notes, MSS.266/6/1, MRCW p.2.

[490] Mrs E.E Johnson notes, MSS.266/6/1, MRCW p.2.

[491] 'Married Women Workers, *Leeds Mercury,* 8 March 1932, p. 6.

the 'gradual dismissal'[492] of many married women from jobs such as teaching and other industries during the initial post war years. Here the value of the female worker is tied to her gender and the perceived complications involved in hiring women as potential wives and mothers. However, in specific examples of jobs within the new industries such as electrical engineering and the production of electronics the female workforce was reported on in a positive manner in the press. For instance, a 1922 edition of the *Sheffield Daily Telegraph* reports on a woman employed by the Mullard Radio Valve Company with the 'inborn gifts of mechanics' who was involved with 'wire cutting and electrode support making. Channelling and grid lacing'.[493] Clearly, this article is attempting to demonstrate the capabilities of the female workforce, but it also reinforces the *Metropolitan-Vickers Gazette* claim of the electronic industry as specifically suitable for women. This is explicitly highlighted and contrasted in the *Sheffield Daily Telegraph* article on the women employees involved in the creation of radio valves, where there is a brief comment on women employed in the education sector: 'it was decided at a meeting of the Burton Education Committee, yesterday, to ask all married women teachers to hand in their resignations, it being pointed out that there were men out of employment'.[494] This demonstrates a noticeable contrast between women employed in different industries as early as the 1920s, with the new industries rapidly being seen as an acceptable use of female labour in contrast to the 'skilled' work of female teachers, who were asked to step down in favour of men.

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[492] Carrie Brown, *Rosie's Mom: Forgotten Women Workers of the First World War* (Lebanon: UPNE, 2002), p.182.

[493] 'Women Engineers' *Sheffield Daily Telegraph*, 1 July 1922, p.10.

[494] 'Women Engineers' *Sheffield Daily Telegraph*, 1 July 1922, p.10.

The consumer electronics industry was not exclusive in its continued use of female labour, manufacturing in the aeronautics industry expanded and remained open to women in the interwar years. Julie Wosk claims that the freedom offered by aeroplanes through flight were closely 'linked to issues of female identity'[495] for female pilots and those working in aeronautics However, outside of wartime there is not evidence of employers in the aeronautics industry attempting to visually link the manufacture or use of their technology to women workers in a similar manner to that I have shown from the consumer electronics industry. Wosk does provide numerous examples from the US and France of how women in general were in fact visually separated from the technology in the interwar years. Wosk argues images of women and planes reflected 'social ambivalence about female fliers, cultural images of women and airplanes were often equivocal about women's place in the new order of aviation.[496] They celebrated the uniqueness, courage and apparent oddity of female aviators in photographs and press reports while popular posters and imagery kept women as grounded onlookers, framing the use of the technology as a purely masculine endeavour.

Imagery represented that individuals could overcome cultural limitations regarding the use of the technology but the entire gender could not. In Britain the press popularised prominent female figures linked to flight such as Lady Heath as being fashionable and clean as much as they focused on her skills as a pilot.[497]. Brian Foss

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[495] Wosk, *Women and the* Machine , p.158.

[496] Wosk, *Women and the* Machine , p.158.

[497] Wosk, *Women and the* Machine , p.163.

demonstrates that visual depictions of women working within the manufacturing of aeronautics emerged predominantly during wartime, particularly during the Second World War, which represented women workers as a 'gender defined group performing with resolve within a foreign context where maleness was taken as the norm'.[498] This contrasts with the consumer electronics industry where internal representations of women's supposedly innate suitability emerged during the interwar years alongside the growth of consumerism in Britain. This difference between the consumer electronics industry and aeronautics can be attributed to the nature of their products: consumer electronics tied women to their product visually as they had more economic incentive to do so, while the non-consumer focused aeronautics industry had little to gain from publicly and visually challenging traditional gender expectations regarding technology outside of wartime patriotic narratives about women helping the country's cause.

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[498] Brian Foss, *War Paint Art, War, State and Identity in Britain, 1939-1945* (New Haven: Yale University Press, 2007), p.108.

Figure 28 Shah of Iran's visit to British Westinghouse 1919[499]

Other photographs utilized by the company highlight the strict gender division

even more explicitly while linking national progress and profit to the use of cheap

female labour. For example, Figure 28 is taken from the December 1919 edition of

the *Westinghouse Clubs News* magazine. The article the image is taken from is

entitled 'Visit of the Shah of Persia'.[500] The photograph captures 'a flashlight

photograph of the Shah taken in G aisle upon the occasions of his visit to the works

in November'.[501] Footage of the Shah's visit to the UK in 1919 can be found on the

British Pathé website which features him witnessing a 'military parade at Aldershot;

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[499] 'Visit of the Shah of Persia' *The British Westinghouse Clubs News*, YA1998.16
December 1919, p.3.

[500] 'Visit of the Shah of Persia' *The British Westinghouse Clubs News*, YA1998.16
December 1919, p.3.

[501] 'Visit of the Shah of Persia' The British Westinghouse Clubs News, YA1998.16
December 1919, p.3.

just after World War One'.[502] From this it is clear the British government was attempting to demonstrate the advances made militarily and in industry to a prominent foreign visitor. Evidently, during the Shah's trip to Manchester he took a guided tour of the Westinghouse Manchester Works. As in the case of previous images I have analysed, a group of female manufacturing workers are being inspected and observed by a male figure of authority, although, in this instance the group includes the Shah and his entourage, those visiting with him, those providing the tour of the factory and some men from the press. The article states that 'the Works were in a particularly tidy state, and it is pleasing to record that more than one of the several press men present remarked very favourably upon the cleanliness of the Works generally'.[503] Undoubtedly, the article exists to emphasise the positive impressions the Manchester Works left on the Shah and to elicit a sense of pride from those linked to the company who would have been reading this newsletter. While the Shah visited many areas in his 1919 trip to the United Kingdom the article states 'we understand as a matter of fact, that it was the Shah's own wish that he should visit Manchester whilst in the country'.[504] While the photograph displays a similar dynamic of a group of female workers being observed by male authority figures it is the only image of the Shah's factory tour included and noticeably has him viewing the group of female employees while they work and emphasises the quietness and cleanliness of the work space. This echoes the extent to which these

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[502] The Shah Of Persia At Aldershot 1919, *British Pathé* https://www.britishpathe.com/video/the-shah-of-persia-at-aldershot/query/Marching [Accessed January 27th 2018].

[503] 'Visit of the Shah of Persia' The British Westinghouse Clubs News, YA1998.16 December 1919, p.3.

[504] 'Visit of the Shah of Persia' The British Westinghouse Clubs News, YA1998.16 December 1919, p.3.

workers were acutely aware of the gendered expectations placed upon them as female employees. For instance, Edith Wheeler states that in regard to the building's lift that 'we girls had to avoid touching any part of it'[505] to avoid having to work in clothes that were too dirty. Again, cleanliness is directly associated here with a female workspace.

This photograph also constructs a cultural message for the readers of the magazine by highlighting the female workers being observed by a foreign leader whose country had a less progressive attitude towards female work, alongside a more general demonstration of the wealth and capabilities of the company. As Nikki R. Keddie states 'Iran had seen far less modernization than the Ottoman Empire or Egypt. It had stronger groups opposed to modernisation […] regarding women as on other matters, Iran was behind the Ottoman Empire in reform'.[506] Further, 'though neutral in World War 1, Iran became a battlefield for foreign forces and emerged from the war devastated'.[507] The photograph can be seen to use the women manufacturing workers as a nationalist tool of pride alongside a projection of wealth and superiority to a foreign leader while also relaying the Shah's positive impression to the readers of the magazine. Women workers employed in the manufacturing of wireless technology played a key role within these companies in embodying visually both the self-proclaimed progressiveness of such companies but also the industry's growing concerns over better working conditions, welfare, leisure and the (paternalistic) care given to its female employees. In the next chapter I

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[505] Ferranti Journal, 1952-1954, 3/3/9357, MSI, p.122.

[506] Nikki R. Keddie, *Women in the Middle East: Past and Present* (Princeton: Princeton University Press, 2007), p.84.

[507] Keddie, *Women in the Middle East*, p.84.

elaborate on this point further and show how the electronics companies utilised the imagery of women to represent modernity and progress at public exhibitions.

3.3 Women Workers and Factory Conditions

As I have argued, company magazines also highlight the fact that during the interwar period concern over women's safety in the workplace played a significant part in shaping perceptions of wider factory working conditions. For example, the March 1919 edition of the *British Westinghouse Gazette* contains an article written by the prominent electrical engineer Arthur Percy Morris Fleming entitled 'The Human Factor in Industry'.[508] In this article Fleming details the changes brought about by the war and also how the end of the war represented for the electrical industry an opportunity to break with a past that had experienced in his view a 'paralysing handicap arising from an unduly high regard for tradition'.[509] Furthermore, Fleming argues 'it will be impossible to revert to our pre-war industrial attitude and post war industrial policy must be characterised by the boldness, freedom and breadth of outlook'.[510] Fleming places the growing number of women employees as one of the central issues of the post First World War industry. Fleming states that 'considerable attention is being directed to plans for reconstruction, and careful surveys are being made' in consideration of the 'increase in production, the elimination of wasteful competition, tariffs, supply of raw

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[508] Arthur Percy Morris Fleming, 'The Human Factor in industry' *The British Westinghouse Gazette,* March 1919, p.230.

[509] Fleming, *The British Westinghouse Gazette*, March 1919, p.230.

[510] Fleming, *The British Westinghouse Gazette*, March 1919, p.230.

materials, demobilisation of military and naval forces, change in the character of manufacture from war to peace conditions, women in industry, wages'.[511] He argues that all these elements required a focus on the 'the human element in industry'.[512] Fleming's article defines this as the industry needing to give increased attention on the treatment of employees as well as their physical and mental wellbeing in relation to the workplace. When comparing this article to others in the *British Westinghouse Gazette* and other companies' analysis of the interwar situation it is acutely evident that this developing consideration for the 'human element' in industry was heavily influenced by the growing number of female employees in the interwar period.

For instance, the *Metropolitan-Vickers Gazette* contains a lengthy article across its April and November 1920 issues written by H. Mensworth entitled 'Some Phases of Work Management' which attempts to provide advice on the most productive method of managing a workforce. Much like Fleming, Mensworth ascribes great importance to the idea that 'the human aspect is predominant'.[513] Mensworth tackles each of these post war issues within his reports, many of which detail the specific role and impact the influx of women had upon them. This can be seen clearly in how Mensworth links women to the development of workplace safety and better conditions. Mensworth states that these issues were central to the initial interwar years 'particularly where women and young persons are employed and where it is necessary to see the Factory Acts are complied with'.[514] Articles such as this

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[511] Fleming, *The British Westinghouse Gazette*, March 1919, p.230.

[512] Fleming, *The British Westinghouse Gazette*, March 1919, p.231.

[513] H. Mensworth, 'Some Phases of Work Management' *The Metropolitan-Vickers Gazette,* April 1920, p.196.

[514] H. Mensworth, *The British Westinghouse Gazette*, November 1920, p. 192.

demonstrate how the extra considerations that were brought about by the increasing

number of female workers in factories facilitated a wider discussion of the

conditions in the workplace more broadly and the proper treatment of employees.

Mensworth directly acknowledges this development and states 'in connection with

the employment of women on a large scale, the terms 'welfare' has been introduced'

in relation to the 'working conditions, particularly for women, such as adequate

heating, lighting ventilation, rest periods, provisions for first aid, canteen

accommodation etc'.[515] This was not a development unique to the electronics

industry as other sectors that had a large female workforce, such as carpet

manufacturers, followed this trend.[516] Canteens were held up in many of the

company magazines as representing the modern workplace although as the images

of the Cossor canteen shows, the gender divisions that existed while working were

largely maintained in the canteens.

Figure 29 Men in the Cossor Canteen 1936[517]

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[515] H. Mensworth, *The British Westinghouse Gazette*, November 1920, p.192.

[516] Long, *The Rise and Fall of the Healthy Factory*, p.66.

[517] Cossor, *Cossor Courier*, April 1936, p.24.

<u>Figure 30 Women in the Cossor Canteen 1936</u>[518]

Despite the emphasis on such amenities, in the recollections of Winifred Cotterill, she echoes a similar issue to that recorded in the Metropolitan-Vickers Work Committee Meetings over employees having an aversion to fully utilising the work canteen. Cotterill states that she never used the canteen but just 'brought in her own sandwiches'[519] demonstrating some level of distrust by the growing reach of these companies' relationship with its employees. Despite the overall positive acknowledgment of the role women had played in influencing such consideration in the interwar years, gender perceptions are at play in articles focusing on the management of the workplace like that of H. Mensworth. Mensworth makes it

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[518] Cossor, *Cossor Courier*, April 1936, p.24.

[519] Mrs Winifred Cotterill recording, MSS.266/6/2, MRCW.

abundantly clear that in the electronic industry he perceives that women should, as much as possible, be supervised by other women because 'so far as discipline is concerned, they are very much better taken care of by a member of their own sex' because they understand 'their idiosyncrasies and weaknesses better than would a foreman'. [520] Noticeably, Mensworth describes the potential unique weakness of the female workers for manufacturing and production but makes no reference to their strengths, although he clearly accepts their new role in defining the outlook and shape of the new industries. These kinds of representations of women further show the employers positioning their adoption of cheaper female labour as an industry positive that benefited the conditions of both men and women within the industry. Vicky Long argues in the interwar years that 'investigations into the physiological abilities and need of young workers and women within industry were largely displaced by studies of the psychological consequences of monotonous and repetitive work'[521] but that this focus on the psychological plight of the individual ironically represented individuals within a pre-defined mould, such as gender, rather than fostering individual talents and desires. Therefore, these workers were expected to adapt to their work as a group rather than as individuals.[522] As I have shown, multiple employers in the electronics industry fit this example and represented women as part of a specific workforce that was linked with improved conditions and amenities and as I elaborate on in the next section, concepts of modernity.

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[520] H. Mensworth, 'Some Phases of Work Management' The British Westinghouse Gazette, November 1920, p.191.

[521] Long, *The Rise and Fall of the Healthy Factory*, p.152-153.

[522] Long, *The Rise and Fall of the Healthy Factory*, p.152-153.

3.4 Women Workers and 'Modernity'

Another aspect of the representation of women as progress for industry conditions and the country's image is that women workers in the electronics industry and manufacturing were linked with the concept of modernity and the 'modern woman'. Concerns over welfare extended to the growing interest in the workers' leisure time and in the paternalistic care of the female workforce. Companies such as Metropolitan-Vickers appealed to a sense of community and the benefits of a close relationship between employer and employees. This can be seen in their Club News magazines which publicize the company's various events and activities such as theatre productions, dances, the rambling club and sporting activities. These magazines often included photographs of women enjoying these opportunities. For example, each edition of the *Westinghouse Club News* and the *Metropolitan-Vickers Club News* contains updates on the companies 'Girls Club' which held various social events for the female employees of the companies including going to the theatre, fancy dress events and playing various sports. A collection of photographs from the Girls Club can be seen below.

Figure 31 British Westinghouse H Screw Ladies Football Team 1917[523]

Figure 32 Miss Crowther winner of the 1923 Girls Club Fancy Dress Carnival

2nd Prize[524]

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[523] 'British Westinghouse H Screw Ladies Football Team 1917' *The British Westinghouse Gazette*, YA2012.27, August 1917, MSI, p.5.

[524] 'Miss Crowther' *Metropolitan- Vickers Club News*, YA1998.16, April 1923, MSI, p.16.

Figure 33 Rambling section of the Metropolitan Girls Club 1926[525]

Figure 34 A theatrical performance by the Metropolitan-Vickers Girls Club

March 1929[526]

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[525] 'Rambling Section' *Metropolitan- Vickers Club News*, YA1998.16, August 1926, MSI,
    p.8.

[526] 'Neptune and Thetis are in the Background Here' *Metropolitan- Vickers Club News*,
    YA1998.16, March 1929, MSI, p.1.

These photographs can be viewed as a reflection of wider social concern during the interwar period in relation to the working-class and its relationship to the arts and to leisure time, in conjunction with the companies' attempts to project publicly a considerate and caring image regarding its female employees. During the interwar period 'captains of industry moved in a highly complex ethical and cultural world where religion and humanistic ideas played […] a complicated role' but the main motivation for such concerns was 'to improve the health and physical condition of their workforce, and so to increase labour productivity'.[527] As Fiona Skillen highlights, 'the interwar years in Britain (1919–1939) witnessed a boom in sporting participation amongst women'.[528] While this raised its own issues around proper gender roles and suitable clothing for women, clearly companies with female employees attempted to cater to this desire in interwar Britain, both to promote a healthy workforce and to create a sense of belonging. This mirrors the labour movement's and trade union attempts to create a similar sense of community and loyalty from women workers that I pointed to in the previous chapter.[529]

For many factory workers the sporting and leisure opportunities provided by companies such as Cossor, Metropolitan-Vickers and Ferranti were the only enjoyable aspect of being employed in these industries. For example, Winifred

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[527] Stephen G. Jones, *Sport, Politics and the Working Class: Organised Labour and Sport in Interwar Britain* (Manchester: Manchester university Press, 1988), p.62.

[528] Fiona Skillet 'It's Possible to Play the Game Marvellously and at the Same Time Look Pretty and be Perfectly Fit: Sport, Women and Fashion in Interwar Britain' *Costume,* 46 (2012),165-179, p.165.

[529] 'Workers at Play' *Labour A Magazine for All Workers*, September 1937, MSS.292/4/4/5, MRCW p.23.

Cotterill did not enjoy her time at the company and its work environment as she states, 'these days the conditions would not be tolerated' and that 'I would rather go scrabbling than return to GEC and I've had to do so at times. Of course, conditions are better now so perhaps if I was young again, I would change my mind, who knows?'.[530] These observations display a sharp contrast to the recollections and images published in official company magazines which often acknowledge the hard work but present a friendly and accommodating work environment despite the hardships. Despite her strong dislike of the company it is evident that the social aspects fostered in the company did provide Cotterill with the only enjoyment and fulfilment she experienced at work: 'the only thing that gave me pleasure at G.E.C was the social side. I was the only works member of the rather elite hockey team of which I later became captain until leaving to get married' and 'I formed a lady's cricket club, again captain until marrying. You can imagine how like a freed bird I felt after a hard day and then going onto a lovely airy sports field'.[531] Given that Cotterill equates GEC with a cage it is apparent why such companies were eager to foster and promote the social aspects of being employed by them. As can been seen in Cotterill's case, it was one of the few positive experiences for some lower level female employees, and the official company material made sure to utilise their female workforce as symbols of this positive experience to be had within their company.

These representations of women enjoying sports and clubs provided by the company further tie the image of women factory workers to a better workplace and

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[530] Mrs Winifred Cotterill notes, MSS.266/6/2, MRCW, p.3.

[531] Mrs Winifred Cotterill notes, MSS.266/6/2, MRCW, p.3.

to wider societal trends around modernity and gender. Alongside early depictions of the 'feminine' war worker, interwar depictions of groups of women linking them to industrial technology, and as fulfilled and protected workers, women were also presented as sexual objects in company magazines, particularly in illustrations, which often sits in sharp contrast to how they were being presented as a workforce. In relation to the Metropolitan-Vickers company this can most clearly be seen in the imagery of its *Club News Magazine*.

Figure 35 Metropolitan-Vickers Club News November 1924[532]

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[532] 'Cover' *Metropolitan- Vickers Club News*, YA1998.16, November, 1924, MSI.

Figure 36 Metropolitan-Vickers Club News December 1924[533]
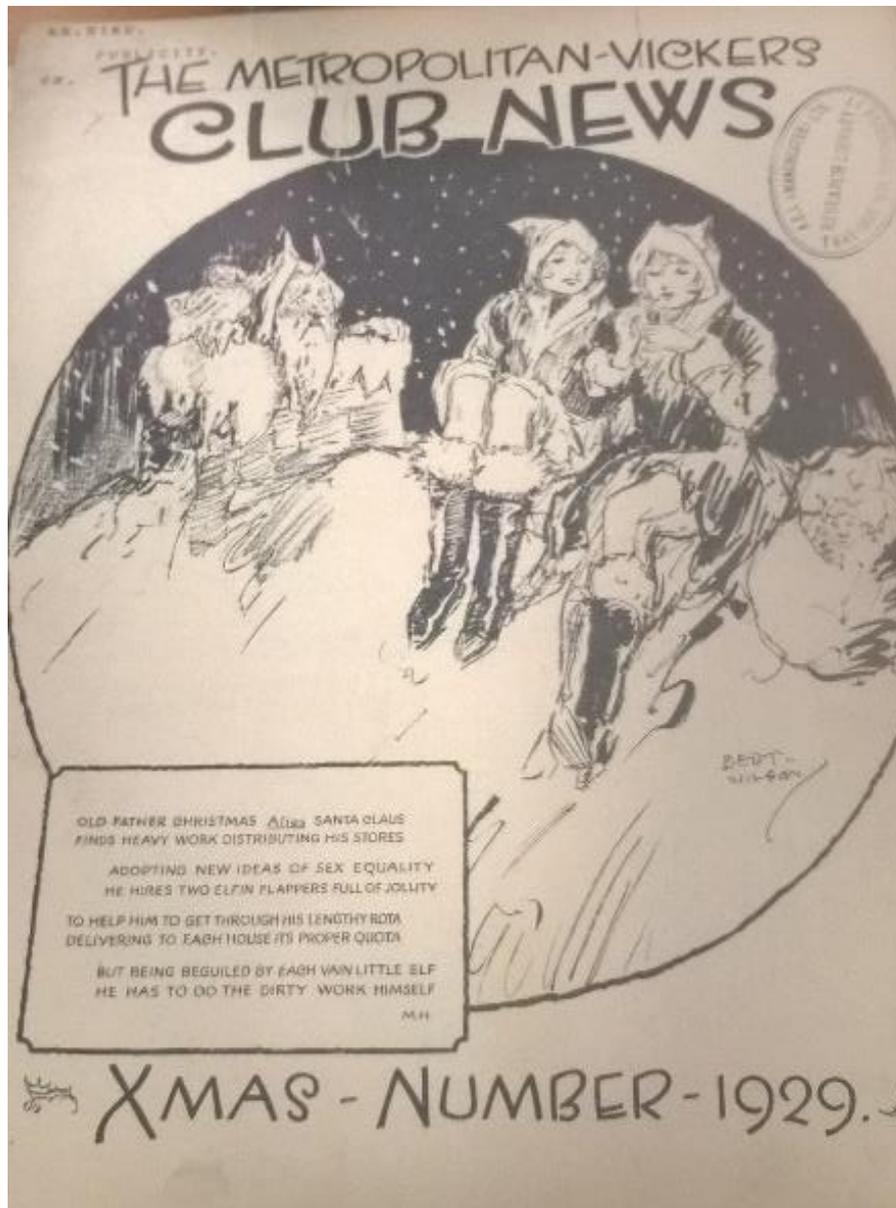
Figure 37 Metropolitan-Vickers Club News November 1927[534]

As well as containing information regarding clubs and activities specifically for the company's female workforce these *Club News Magazines* also often present women in a much more sexualised manner. This representation can be attributed to the desire to appropriate the look of the 'modern woman' in regards to the perception of the company. Liz Conor argues that the image of the 'modern woman'

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[534] 'Cover' *Metropolitan- Vickers Club News*, YA1998.16, November 1927, MSI.

during this period relates to the fact that 'in the early twentieth century, women's visibility extended from their incursions into public space, particularly that of the metropolis' and that 'some types of Modern Women which emerged at this time- the Screen Star, Beauty Contestant, and Flappers-were manifestly, though not solely, constructed around their visibility'.[535] It is unclear if the company is trying to present this imagined and more visible form of femininity as representative of some aspect of its female workforce. However, these images do show that imagery of femininity and women played a prominent role in these companies by representing the company's modernity regarding female employment and the welfare and leisure opportunities being provided for their employees. However, while these depictions of women attempted to signify modernity and the images of facilities such as canteens constructed hoped to present a 'modern factory space', in reality in the workspace and on the factory floor enduring and conservative expectations regarding sex and gender remained prevalent. As is evident from the photographs of the gender divided canteens in the Cossor factory these 'modern spaces' still held older concepts of gender within them.

Furthermore, despite the glamorous portrayal of women in the magazines such as the *Metropolitan-Vickers Club News* it clear that the working-class female employees knew which expectations they ought to conform to. For example, Edith Wheeler recalls that because the girls worked on the top floor when there were any incidents involving fires and the need to evacuate, the firemen would set up 'a huge sort of canvas bag on to the window sill' and required 'brave volunteers to slide

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[535] Conor, *The Spectacular Modern Woman*, p.7.

down to the pavement'.[536] Edith states that other than her, no other female

employees ever dared take a part in this. Edith states: 'I think most of the girls

would have preferred being roasted to showing their legs'.[537] Figures 35, 36 and 37

serve to link the company, the wireless technology it was making and its women

employees to the wider social constructs and perceptions surround modernity and

gender in the interwar years embodied by the image of the flapper. These

representations are more related to creating a modern image and internal branding

for the company than arguing in favour of their female workforce. However, this

kind of representation of women was not entirely divorced for those employed

across the electronics industry. As I analyse in my next chapter, the electronics

industry employed and heavily relied upon women as public demonstrators at its

annual exhibition Radiolympia.

In conclusion, in the interwar years in Britain female workers were represented as

being directly linked to modernity and progress regarding technology, industrial

safety and as positive representations of the new industry's relationship with its

employees. The interwar period saw women workers who manufactured consumer

electronics go from being represented as temporary necessities to becoming the

public face of new industries in part thanks the numerous photographs and images

produced by companies such as British Westinghouse, Cossor and Ferranti and

Metropolitan-Vickers. Imagery of female workers in the First World War was

explicitly gendered and emphasised the curiosity of women doing certain jobs while

in the 1920s and 1930s popular imagery along with economic incentives meant that

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[536] Ferranti Journal, 1952-1954, 3/3/9357, MSI, p.123.

[537] Ferranti Journal, 1952-1954, 3/3/9357, MSI, p.123.

certain jobs were perceived and presented as explicitly suitable for women and were usually promoted as a large group workforce rather than as individual curiosities. This facilitated the gendering of electronic production jobs and defined the industry by its use of female labour. This development had a much larger and longer lasting impact than the use of female labour during the First World War, which can be seen by the eventual admittance of women to all trades unions by the start of the Second World War despite the ever present tensions over female labour, automation and the dilution of skilled male work. The women themselves recall strict divisions between female and male employees, harsh conditions, high expectations in relation to production output and a lack of union representation which contrasts greatly with the employer's uses of women workers as representatives of a paternalistic concern with welfare, leisure and as the representatives of modernity and 'progress' within official company material. Despite the stark contradictions present in their visual representation, working women effectively became visually and economically linked with the production methods used in these new interwar industries and as a result the technology and the jobs that deployed it became gendered as 'women's work'. In the following chapter I examine another major role women held in the electronics industry, exploring how they were represented alongside wireless technology at public exhibitions.

Chapter 4: The Roles and Representations of the Wireless and Women at the Interwar Radiolympia Exhibition

In the previous chapter I analysed the creation of an interwar female workforce within the electronics industry and explored how these women were represented in gendered ways within company literature. In the final chapter I will examine how middle-class women shaped the consumption of wireless technology and brought the technology into the domestic realm. In this chapter, however, I focus on the roles women held in the commercial space between the two endpoints of production and consumption. This chapter explores in particular the employment of women in the interwar electronics industry beyond the factory floor and the manufacturing of the technology. This latter category of women within the interwar electronics manufacturing industry has received little attention. When historians have considered female factory workers it has usually been part of a wider look into the 'new' interwar British industries rather than a specific look at the various roles women occupied within the electronics industry, such as in the work of Miriam Glucksmann.[538] On the other hand, the evolution of women as consumers of wireless technology and their impact on the technology has been detailed by historians such as Maggie Andrews.[539] In the context of the electronics industry and wireless technology it is the role of women in the area between these two points in the manufacturing and consumption process that received the least attention by historians; it is this gap in the historiography that I will fill in with this chapter. I focus on the interwar Radiolympia exhibition as the best example of this neglected

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[538] Glucksmann, *Women Assemble.*

[539] Maggie Andrews, *Domesticating the Airwaves.*

area. I argue that the women who were positioned within this in-between space by the electronics companies at the exhibitions and the media were represented as embodying specific gendered expectations that differed significantly from those relating to working-class factory women or middle-class consumers.

A modern exhibition required a construct of a modern woman to promote a modern technology. Nicole Kalms argues that the use of promotional models by large technology companies reinforced patriarchal gender norms around sexuality and that it is no coincidence that most promotional models are women that are 'encouraged to dress provocatively as these uniforms are the titillation that tempts the viewer to a possible sexualized encounter: an opportunistic one-one-one female, yet faked, interaction that aims to lure both men and women into some form of commercial transaction'.[540] This critique does apply directly to how women were used on the electronics booths at Radiolympia and how the media framed them in their photographs of the exhibition. However, I argue that at the Radiolympia public exhibition three distinct (and often contradictory) constructions of femininity were promoted and represented by the management of the major interwar electronics companies. Myra Macdonald argues that during the interwar years three constructions of feminine identity dominated in advertising discourse: 'the capable household manager; the guilt-ridden mother: and the self-indulgent 'flapper'.' These were not self-contained categories of actual women, but manufactured versions of feminine responsibilities or aspirations that had particular resonance for women of

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[540] Nicole Kalms, *Hypersexual City: The Provocation of Soft-Core Urbanism* (London: Routledge, 2017), p.140.

the period'.[541] At the Radiolympia Exhibition the companies that organised it constructed their own representations of 'modern' feminism in relation to wireless technology. I define the first of these as the 'modern woman', who was depicted as embodying the fun and spectacle of the event as well as its future-facing tone. Secondly and most prominently, women were employed at the exhibition as one of the first examples of women demonstrators to market a new technology through their appearance alongside the aspiration of being seen as an early adopter of it. Finally, the event itself became increasingly defined by the influx of middle-class housewife attendees, and this gendered understanding of who the customers were shaped the way the technology was presented and marketed. These three representations and constructions of femininity were distinct but overlapping and at the Radiolympia exhibition all three were the public facing representations of women's position in regard to the electronics industry and the gendering of wireless technology in the interwar years. Marshall Berman asserts that for individuals operating within the construct of modernity, it is to experience personal and social life 'as a maelstrom, to find one's world and one self in perpetual disintegration and renewal, trouble and anguish, ambiguity and contradiction: to be part of a universe in which all that is solid melts air'.[542] This modern ambiguity and contradiction in how women were represented by the British interwar electronics industry and the companies present was displayed openly at the Radiolympia exhibition.

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[541] Myra Macdonald 'From Mrs Happyman to Kissing Chaps Goodbye: Advertising Reconstructs Femininity' in *Critical Readings* in *Media and Gender*, ed. by Cynthia Carter and Linda Steiner (Maidenhead: Open University Press, 2004), pp. 41-67 (p.45).

[542] Marshall Berman, *All That Is Solid Melts into Air: The Experience of Modernity* (New York: Penguin Group, 1982), p.15.

4.1 Radiolympia and the Celebration of the Interwar Electronics Industry

Figure 38 General View of Radiolympia [543]

Radiolympia, known commonly as the 'Radio show', was the largest, most prominent, and regularly held wireless exhibition of its type. It was first held in 1926 at the Olympia Exhibitions Centre in Hammersmith, London. Radiolympia became the centrepiece attraction for demonstrating wireless technology and provided an opportunity for public attendees to have direct contact with new developments in wireless technology and valve design. By the later 1930s it had become the centre

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[543] 'General View of Radiolympia' 8 August 1933, The Daily Herald Archive Collection, Wireless, NSMM.

stage for showing off the wonders of television to captive audiences.[544] The majority

of the audience outside of wholesalers was primarily middle-class for two reasons.

A middle-class audience could afford to at least entertain the possibility of

purchasing the latest products and be willing to pay the entrance fee of 1 shilling and

6 pence.[545] The working-classes did, however, undoubtedly have exposure to the

event and its sights. Some attended just for the spectacle rather than as prospective

purchasers, or more commonly working men and women listened to the broadcasts

from the event or read about it in the newspapers. Radiolympia was held annually

until its final show in 1947. The intention of the exhibition organisers, the Radio

Manufacturers Association, as stated in press reports and advertisements, was

ultimately to demonstrate and advertise new developments in technology but it also

had a clear secondary function; a national celebration of a growing and highly

profitable domestic industry that was fulfilling a primarily domestic demand and

consumer base that grew year on year throughout the interwar period.[546] The lavish

and celebratory tone of the exhibition can be seen in Figure 38 and in the surviving

video footage from the interwar years archived by the BFI.[547] Figure 38 is a

photograph of the 1933 Radiolympia that captures the scale of the event including

the size of the hall, the large stage where plays and dances were held and broadcast

from, and the viewing balconies. Figure 38 shows that the style of Radiolympia was

influenced by the aesthetics of 1930s expressionist films such as *Metropolis* and the

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[544] 'See What's Happened Since You Bought Your Set' *The Times* 24 August 1938, p.14.

[545] 'Radiolympia' *Daily Mail* 16 August 1934, p.6.

[546] 'Meet the Best Sets and Radiolympia' *The Times* 19 August 1932, p.7.

[547] 'Trade Show at Radiolympia' *BFI Player* <Watch Trade Show at Radiolympia online - BFI Player> [Accessed 12 February 2021].

designs of futurism which 'advocated a cult of progress'.[548] Public exhibitions of science and technology, even those held by private companies and industries, had operated as a form of soft power for the British state in a major way since the nineteenth century. As I mentioned during the introduction of this thesis the biggest and clearest example of this the Great Empire Exhibition of 1924-25 as well the Great Exhibition of 1851 as the which served to create and promote 'national glory, local pride, and commercial well-being'.[549] The author John Tallis described the event as one where 'all social distinctions were for the moment merged in the general feeling of pride and admiration at the wondrous result of science and labour exhibited in the Palace glass'.[550] Therefore, while these exhibitions of industry were on one level an internal celebration of domestic success they also served as a projection of power and progress to the empire and the rest of the word. Radiolympia, despite not being organised by the state, held extra significance in this regard due to the context of the interwar years where projections of power and progress demonstrated a public triumph over the losses incurred during the war and the economic upheaval of the depression years while still maintaining industrial and scientific leadership on the international stage.

The emergence of such an exhibition dedicated entirely to the promotion and use of one particular technology shows the growth in both public demand and public interest in the technology and the desire to witness the latest developments face to

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[548] Selena Daly, *Italian Futurism and the First World War*, (Toronto: Toronto University Press, 2016), p.125.

[549] Jeffrey A. Auebrach, *The Great Exhibition of 1851: A Nation on Display*, (New Haven: Yale University Press, 1999), p.75.

[550] Auebrach, *The Great Exhibition of* 1851, p.128.

face. This is directly evidenced in the British media's enthusiasm for the annual exhibition and the spectacle that it brought with it, including the consistent increase in attendees each year since the event was first held. In 1932 the *Daily Mail*'s Harold Watkins gushed about that year's Radiolympia by saying 'so many and so varied are the exhibits at Radiolympia this year that anyone might be forgiven for wondering where to start his tour of the stands'.[551] Attendance figures and money made through trade at Radiolympia were regularly reported on the by press and are a good indicator of the interest in the electronics industry and appeal of the event. It was reported the 1934 Radiolympia 'was an undoubted success. The attendance during the nine days totalled 240,148, compared with 209,000 last year. The amount of trade done this year is approximately £29,500,000, compared with £22,563,000 a year ago' and that 'the success of the show will mean increased employment in the industry probably extending to thousands of workers'.[552] It is clear from this that Radiolympia was an important trade event that was perceived by the media as a symbol of the health and growth of a British industry. Radiolympia both furthered the growth of the British electronics industry but also reflected this growth back to the country in a public display of success. Therefore, the presentation of the Radiolympia exhibition was the primary way those outside the industry came into contact with it and the representations of the women working within it. Photographic and video evidence as well as press reports show that on the show floor and amongst the stall of each company women demonstrators were employed. At events such as the Radiolympia exhibition women workers as demonstrators were relied upon

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[551] 'Marvels of Radiolympia' *Daily Mail* 19 September 1932, p.12.

[552] 'Increased Radio Business' *The Times* 27 August 1934, p.7.

much like they were in the manufacturing process and became linked publicly to the technology albeit in a different way. This representation was seen by the thousands who did not attend as the press eagerly reported on the event, published photographs of the exhibition and the event itself was broadcast on the wireless.

4.2 Radiolympia and the Spectacle of the Modern Woman

The celebratory tone surrounding the annual event brought with it a sense of spectacle and pageantry that can be seen in the size of the event and its broadcast of shows, dances, and plays. Women were placed front and centre of this spectacle and represented as embodying the youthful and fun-loving aspects of the technology. Undoubtedly representations of the modern and independent young women found at Radiolympia were influenced by popular imagery of the flapper. However, while the flapper represented a potentially androgynous and unknown future, the models and demonstrators at Radiolympia always reflected a modern woman that retained her traditional femininity and therefore contextualised them and wireless technology as embodying a safe kind of progress and future.

Figure 39 Radiolympia girls with a cathode television tube[553]

Figure 39 is a photograph taken by the *Daily Herald* newspaper at the 1936

Radiolympia exhibition and is described as showing 'Radiolympia girls with a

cathode television tube'.[554] In this example the women are represented with the

technology on display at the show but are framed as misusing it to highlight their

own femininity. These photographs, which were published in the press, represent

women as being able to interact with a modern technology in a way that did not

erase their femininity. Undoubtedly representations such as Figure 39 were used to

appeal to a male audience through their slightly risqué attire but this was an

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[553] 'National Radio Exhibition at Olympia Radiolympia Girls with a Cathode Television Tube'18 August 1932, The Daily Herald Archive Collection, Wireless, NSMM.

[554] 'Radiolympia Girls with a Cathode Television Tube'18 August 1932, The Daily Herald Archive Collection, Wireless, NSMM.

important representation for a technology that was being increasingly adopted by middle-class women who may have been discouraged by a more androgynous image of the modern woman.

The technology in this context is being used by the photographer to highlight the show's Radiolympia girls. The existence of the official 'Radiolympia girls' group reveals how the imagery of interwar perceptions of femininity came to represent the show visually to such an extent it became part of the official branding of the exhibition. Photographs such as this show how Radiolympia was marketed, reported on, and promoted as more than just a display of wireless technology but used gendered imagery to promote its appeal as a fun and modern event. These photographs differ starkly from the electronics industry's attempt to construct its imagery of its female workforce internally through company literature. In that instance, working-class women were shown as obedient parts of a whole and their individuality and femininity was not focused upon. In comparison, in Figure 39 the women are represented alongside the technology in order to accentuate their individuality, sexuality and their 'modernity'. Despite this difference in how the electronics companies visually gendered its different female work forces, a major similarity is present. Both are commonly shown alongside the technology but framed in a way that implies a gendered lack of understanding or concern in how it actually operated. Beyond the differences in how they were represented visually by their employers, both these new employment opportunities for women only came to be because of the advancement of wireless technology and the success of the British electronics industry.

Liz Conor argues that modernity as a visual field emerged in the 1920s and 'marked an era in which industrialized and commodified image production provided

a new way to articulate sexual difference. Although this articulation reinforced the status of women-object, it also opened up new cultural spaces to occupy'.[555] Radiolympia was one such new cultural space where the implicit contradictory role of the 'modern' woman was promoted in a heightened and public manner. The spectacle, technology, and employment of women across the event played on the public fascination with modernity and provided the opportunity for those outside the industry to come into direct contact with the latest symbols of modernity being produced by the electronics industry. Advertisements for the event were frequent and prominent across the British press and heavily utilised the concept of modernity as a promotional tool. An advert for the 1932 Radiolympia in the *The Times* proposed:

'Going for a new set this winter? Then go in for an evening at Radiolympia first. You'll never have so wide a choice — or such a splendid opportunity to examine, discuss and compare. All the new season's models are here — sets that are hardly in the shops yet — that is what brings the experts to Radiolympia. From the moment you enter, to the time you leave you'll see one marvel after another. For this is the biggest and most spectacular show British radio has ever held. You'll come away determined to be up to date in your Radio. Come to the most modern show of modern time'.[556]

Figure 39 shows that the 'Radiolympia' girls were presented as much a part of the modernity of the event as the technology, with their short hot pants and short hair. But unlike the earlier flapper archetype they retained their femininity and are

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[555] Conor, *The Spectacular Modern Woman*, p.35.

[556] 'Meet the Best Sets and Radiolympia' *The Times* 19 August 1932, p.7.

playfully applying make-up using the cathode valve to assist. The 'Radiolympia girls' were not presented to customers as knowledgeable experts to convey the technology (but were still promoted safely interacting with it) but rather as playful attractions and a part of the spectacle of the show itself. This is further evidenced in the press advertisements for Radiolympia.

Figure 40 Don't Miss These Misses at Radiolympia: The Show with a Kick in it![557]

[557] 'Don't Miss These Misses at Radiolympia: The Show with a Kick in it!' *Daily Mail* 20 August 1934, p,14.

Figure 40 shows an advertisement for the Radiolympia girls dance routine at the 1934 exhibition. In this advertisement the dancers are placed front and centre of the image. The technology itself is relegated to the text and is not presented as the primary appeal of attending the event in person. As Liz Conor describes, visual modernity upholding the construct of 'women as object' is clearly seen so much so that the female dancers have entirely subsumed the image of the wireless set or the valve, the primary reason for the existence of the exhibition taking place. Perhaps the clearest example of the exhibition's pageantry and objectification of women in the promotion of wireless technology is the exhibition's search for a 'Miss Radio'. Advertisements placed in the press prior to the 1934 Radiolympia express the desire of the large electronic manufacturers to find a female symbol to represent the wireless industry because 'radio manufacturers are a staid body of men. Their lives are spent among valves and component parts and the days before the exhibition always sees them in furious and earnest concentration, romance does not unduly enter their life'.[558] Rebecca Conway highlights how during the 1930s pageants and beauty contests emerged across a range of industries. She examines how the textiles industry attempted to find a 'Cotton Queen' who could 'simultaneously embody the mill girl and the modern young working woman as a spokesperson for her industry, a fashion expert, and as a figure that could be deployed by advertisers to connect with consumers'.[559] For the industries that employed women in their factories, as both textiles and electronics did, the emergence of the industry specific beauty pageants reflects a desire to construct an idealised image and representative of the

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[558] '10,000 Want to Be "Miss Radio' Daily Mail, 3 August 1934, p.18.

[559] Rebecca Conway, 'Making the Mill Girl Modern?: Beauty, Industry, and the Popular Newspaper in 1930s' England' *Twentieth Century British History* 24 (2013), 518-541 (p.540).

women working in those industries during a period after the war where the 'image'
of femininity was complicated and contested due to changing social standards and
the emergence of new fashions.

This advert and the search for a 'Miss Radio' by the exhibition entirely ignores the
reality that many women employed within the industry were directly manufacturing
wireless parts and were being represented internally by the most prominent
manufacturers such as Metropolitan-Vickers as steeped in the technology. The
advertisement for 'Miss Radio' posits a clear gendered division of how men and
women interacted with the technology, in which men understood it and only a
certain version of femininity could represent it. The desired image of a feminine
representative of wireless technology that was constructed in the 'Miss Radio'
search stands in direct contrast to the constructed image of gender and technology
found within the company magazines which can be accounted for by the different
audiences the electronics companies were aiming for internally and externally.
Though these pageants relied upon gendered stereotypes they also reveal that the
desire that been expressed by the state following the war for women to retreat from
public to the domestic space was not a reality by the 1930s. The search for a young
female representative for a technology also reflects the cultural context of the
interwar years which, as Jamie Stark puts it, was 'a time of heightened fascination
with anti-ageing.'[560] New technologies and electricity became linked with beauty,
youthfulness and rejuvenation. The search for this ideal feminine symbol of wireless
technology lists the most desirable attributes for a potential winner as 'youth,

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[560] James Stark, 'The Age of Youth', *The Lancet,* 388 (2016), 2470-2471 (p. 247).

beauty, animation, ambition, intellect, and idealism'.[561] Undoubtedly a similar criterion was applied to women working on the exhibition floor and those who represented the company branding. The objectification and sexualisation of women that underscores the concept of the 'Miss Radio' figure did not pass without controversy, although it took a contender for the title in 1939 to push back on the expectations placed upon the women who participated. The 22-year-old business 'girl' Miss Terri Lucas publicly withdrew from the competition before the final parade after finding out she was now expected to wear a bathing suit. After this she told the press:

> I don't think I'm being a prude I often wear a bathing costume — on the beach. I can't see the sense of wearing a bathing costume in a room with artificial lights and knowing that people are there to stare at you. When I entered the contest, I understood that they would choose a girl who was to be the spirit of radio. At least this is what they said. Someone who could be hostess to important visitors to the exhibition.[562]

It is apparent that the competition was more based around the judges' conception of female youth and beauty than anything more substantially related to demonstrating or marketing the wireless. This incident shows a contrast and conflict with how some women perceived their role in relation to the technology in comparison to the way the male owned wireless manufacturers and organisers of the event wanted to represent it. It would be misleading, however, to imply that women were only used at the exhibition visually as sexualised models, dancers and entertainers to entice a

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[561] '10,000 Want to Be "Miss Radio' Daily Mail, 3 August 1934, p. 18.

[562] 'Girl Says "No" To Wearing a Bathing Suit' Daily Mail 22 August 1939, p.7.

presumed male audience. The role women occupied within the Radiolympia exhibition is not as neatly defined as that and the photographic evidence shows that while women were used as 'objects' to represent modernity for the attendees of the show, they were also employed to act as more than advertisements and symbols of the industry. As I have shown, the British Press dedicated a significant amount of space to reporting the sights, sounds and experiences of the Radiolympia exhibition. The *Daily Herald* newspaper, which directed its focus at industry and labour, reported heavily on Radiolympia and as its photographic archive show, helped promote the spectacle of the event. From the available photographic evidence, it can be ascertained that a majority of women were employed by the electronics companies at the show outside the scope of pure entertainment. At Radiolympia these women worked directly with the technology and were placed prominently throughout the exhibition booths to represent it to the public, in ways that both challenged and reinforced traditional views of gender.

4.3 The Wireless and Promotional Models at Radiolympia

While the spectacle of the event and the women employed purely as entertainment may have been divorced from the exhibition's technology beyond posing with it, this was only one role that women occupied at Radiolympia. In fact, women were prominently featured and represented at the exhibition as directly tied to the technology and were effectively employed to be the public face of wireless. On the show floor of the exhibition each company had an individual booth to promote their individual technology and their products. Across the booths at Radiolympia female employees of the various manufacturers were positioned alongside the technology on display and given the role of public facing demonstrators and explainers. This

new position held by women in the interwar electronics industry was an early form

of the promotional model and salespeople that would be emulated in different ways

by other industries in the following decades that sold technologies.

Figure 41 Cossor stand at 1934 Radiolympia[563]

Figure 41 is from the Cossor stand at the 1934 exhibition and depicts a female

demonstrator and a male attendee 'looking into the secrets of the model Cossor

valve'.[564] At Radiolympia women were positioned in a place of knowledge and

expertise regarding the technology. This represents a shift away from women being

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[563] 'Radio show opens at Olympia' 16 August 1934, The Daily Herald Archive Collection, Wireless, NSMM.

[564] 'Radio show opens at Olympia' 16 August 1934, The Daily Herald Archive Collection, Wireless, NSMM

positioned in the domestic sphere to having a public facing role. In this case

Radiolympia reflects wider social change as in the interwar years as women were

utilised to explain new domestic goods to other women. Much like the wireless set,

vacuum cleaners and other domestic appliances represented a significant shift in the

daily lives of (middle-class) women during the interwar years. Because of this,

women demonstrators served the function of a form of advertising that could attempt

to educate women 'into the correct modes of consumption and shown the

ameliorative benefits to be found in the functional and constantly improved use

values of new consumer goods, as well as a force by which those goods could be

culturally legitimised'.[565] Figure 41 shows that the role required the female

employee to show and explain the technology to the attendees of the exhibition. This

representation of women in the electronics industry challenged traditional

assumptions around gender and technology that positioned the understanding of

technology as an exclusively masculine pursuit, as can be seen in the early

development and representation of wireless technology. Radiolympia was one of the

first public events that promoted, in the public sphere, women's employment in the

electronics industry and their connection to understanding of wireless technology.

Across the event every major manufacturer employed women in this way. For the

public attending the event, their main direct interaction with the electronics industry

and source of information was via the women employed on the company booths as it

was the first chance for customers to see 'glimpses of the latest set designs'.[566]

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[565] Martyn J. Lee, *Consumer Culture Reborn: The Cultural Politics of Consumption* (London: Routledge, 1993), p.96.

[566] JP Devlin, *From Analogue to Digital Radio: Competition and Cooperation in the UK Radio Industry*, (London: Palgrave Macmillan, 2018), p.33.

Prior to the electronics industry, the Electrical Association for Women (EAW) was one of the first organisations to employ female demonstrators as a modus operandi. After its formation in 1924 the association began to utilise women demonstrators in an effort to convince cautious housewives and mothers of the safety and benefits of adopting electricity into the home[567]. The EAW was initially under the supervision of Caroline Haslett who was also an organiser with the Women's Engineering Society. The initial reason for establishment of the EAW was that the small group of female engineers who founded it believed that 'the time had come to teach the non-technical women the value of electricity in the home'.[568] The EAW proved to be a valuable organisation and by 1930 it had 2,000 members and 22 branches throughout Britain.[569] The EAW attempted to achieve its goal of wider female acceptance of home electrification by holding 'short courses for the general public, electrical cookery classes, certificated courses for schools colleges, mounted travelling exhibitions and awarded certificates for teachers and demonstrators who passed the appropriate examinations'.[570] The EAW represents a reaction to the fact in the interwar years housewives, both middle and working-class, often made the major decisions in relation to accepting changes to the home and domestic space. Graeme Gooday has argued this was an important recognition because 'much of the early cultural anxiety about electricity centred on the female body, specifically

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[567] Carroll Pursell, 'Domesticating Modernity: The Electrical Association for Women, 1924-86' *The British Journal for the History of Science* 32, (1999), pp.47-67.

[568] Ralph S. Charles, *British Market for Domestic Electrical Appliances* (Washington, U.S Government Printing office, 1930), p.4.

[569] Peter Gordon and David Doughan, *Dictionary of British Women's Organisations 1825-1960* (London: Woburn Press, 2001), p.44.

[570] Gordon and Doughan, *Dictionary of British Women's Organisations,* p.44.

threats to its physical safety and aesthetic appearance' which resulted in this anxiety threatening 'the whole electrical enterprise, with many households resiliently maintaining gas lighting, cooking and heating well into the twentieth century as trusting 'safe' technologies in spite of gas accidents reported almost weekly in the press'.[571] Much like the electronics industry and Radiolympia the EAW provided new opportunities and career prospects within its own organisational structure.[572] The key difference between the EAW and the electronic industries' Radiolympia is that Radiolympia was a commercial enterprise with different companies competing for time and attention for the largest audience possible, whilst the EAW was specifically targeting a female audience, primarily for educational purposes.

While the electronics industry had no direct group or organisational equivalent to the EAW, the use of women in the specific role of explainers and demonstrators to the public is a similarly significant development. As a public exhibition Radiolympia's purpose was commercial in nature but echoed the EAW and its purpose of convincing a curious audience of the benefits and qualities of a new domestic technology. Graeme Gooday elucidates that women were featured heavily in countervailing 'messages in campaigns for the safety of electricity: the female body was exploited — in tandem with the fearlessness of both theatrical dancers and society ladies- to show how electricity could be both glamorous and hazard-free

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[571] Graeme Gooday, *Domesticating Electricity: Technology, Uncertainty and Gender, 1880-1914* (London: Pickering and Chatto, 2008), p.6.

[572] Graeme Gooday, 'Women in Energy Engineering: Changing Roles and Gender Contexts in Britain, 1890–1934' in *In a New Light: Histories of Women and Energy*, ed. by Abigail Harrison Moore and Ruth Sandwell (Montreal: McGill-Queen's University Press, 2021).

even to the most vulnerable'.[573] Traditional gendered assumptions cast women as the

more 'vulnerable' of the sexes. Cossor and the other interwar electronics

manufacturers present at the event adopted a similar presentation method, despite

'fear' of the technology not being a major consideration. Women occupying this

position within the public facing side of the electronics industry can be attributed to

the fact that women factory workers became synonymous with the interwar British

electronics industry and this was projected outwards publicly at the Radiolympia

exhibition, albeit in differently gendered representations. Wireless manufacturers,

including Cossor, Mullard and Marconi adopted female demonstrators and

explainers as many women employed by the companies had first-hand knowledge

regarding the construction of the technology. That said, the working-class women

whose photographs appeared in company magazines were not a common sight at the

Radiolympia. Rather, as the manufactures attempted to appeal to middle-class

notions and aspirations, the women employed on the booths were likely to be

middle-class, at a higher position within the companies and possessing some

engineering knowledge. The exhibition portrayed these women as knowledgeable

but still safely feminine and conventionally attractive. However, this appeal to a

universal image of modernity, a technologically advanced middle-class home, did

not present the women working in this role at Radiolympia as belonging to any one

class. Richard Thompson Ford posits that the flapper style and visual constructs of

modernity 'weakened older gender and class boundaries'.[574] This would have been

important visually when dealing with a potentially mixed class audience as the

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[573] Gooday, *Domesticating Electricity*, p.6.

[574] Richard Thompson Ford, *Dress Codes: How the Laws of Fashion Made History* (New York: Simon and Schuster, 2021), p.146.

demonstrators and the representations of women demonstrators function as relatable to middle-class attendees and aspirational to working-class ones. The imagery of the Radiolympia exhibition shows that the electronics industry gendered its representations of women depending on the audience that it was appealing to.

<u>Figure 42 Marconi radio and Radiolympia 1936</u>[575]

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[575] 'National Radio Exhibition at Olympia' 26 August 1936, The Daily Herald Archive Collection, Wireless, NSMM.

Figure 43 Women working at Radiolympia Marconi Stand, 1936 [576]

Figures 42 and 43 show a variety of female demonstrators from different

companies posing with and showing off their company's latest wireless set and

valve models. These photographs served to advertise and promote specific

companies presence at the exhibition, in this example the Marconi company. These

photographs were undoubtedly staged for publication, but they reveal the complex

and gendered role that women in this position were required to enact at Radiolympia

when representing their employers. Figure 42 emphasises the conventional

attractiveness of the female promotional model at the Cossor stand and has her

posing with the wireless set rather than presenting her as a knowledgeable source of

information. From these examples, it is clear women employed directly on the

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[576] 'Radiolympia' 23 August 1936, The Daily Herald Archive Collection, Wireless, NSMM.

company booths both worked to demonstrate the technology and as a way to associate femininity with the product. The text accompanying the photograph reads 'Charmers both — A scene on the Cossor Stand'.[577] Figure 43 is from the 1936 Marconiphone stand and emphasises the pageantry, such as the sailor costumes, the female demonstrators and stand models were employed to wear. The costumes in Figure 43 also connote women's wartime role and add a further element of patriotism to the exhibition. Despite the difference in the framing and presentational styles of the photographs in Figures 41, 42 and 43, all the featured women occupied the same role of highlighting their company stand, attracting audience members to it, explaining the technology, promoting and ultimately selling it. This is a significantly different role than simply being featured in an image advertising a product. Radiolympia is the largest and first example of women being employed in such a way and this would expand in the following decades to become a feature of most commercial industries and technology exhibitions. In the decades since the interwar years a similar (yet industry specific) method has been adopted by all forms of commercial technologies including televisions and videogames.[578] Nina B. Huntemann argues that the emergence of this role for women represented an evolution from 'simple product -adornment to – lying naked on a car – to product evangelist. Models are often expected to speak knowledgably about the gadget they are hocking while engaging in coquettish conversation with attendees'.[579] The

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[577] 'National Radio Exhibition at Olympia' 26 August 1936, The Daily Herald Archive Collection, Wireless, NSMM.

[578] Leo Kelion, 'CES 'Booth Babe' Guidelines Revised but Ban Rejected' *BBC News* 11 February 2013 <CES 'booth babe' guidelines revised but ban rejected - BBC News > [Accessed 19 February 2021].

[579] Nina B. Huntemann 'Working the Booth: Promotional Models and the Value of Affective Labour' in *Production Studies, The Sequel! Cultural Studies of Global Media*

Radiolympia exhibition was the first highly reported on and public event to demonstrate the manifestation and evolution of this new role for women, and it was directly tied to the valve, the wireless set and the emergence of the interwar electronics industry.

From figures 41, 42 and 43 it is apparent that such a description fits the kind of work being done by women working on the electronics booths at Radiolympia. However, in the context of the interwar years this phenomenon was not just a case of upholding the standard use of women as sexual objects. In positioning women behind the booth and in the role of demonstrators the industry was also indirectly challenging traditional views regarding women's relationship with new technologies, and even the employers' own internal representations and perceptions of how their female work force related to and understood wireless technology. These women were represented and positioned at the exhibition as being entirely apart from the working-class women employed in the factories. However, the portrayal of the female workforce being best suited to the repetitive act of manufacturing electronics was not entirely absent from the show floor despite its contrast with the spectacle and the models of female identity embodied by the other women in the show.

Industries, ed.by Miranda J. Banks, Vicki Mayer and Bridget Conor (London: Routledge, 2016), pp. 39- 45 (p.41).

Figure 44 'Girl' Mechanic at Radiolympia 1932[580]

Figure 44 is a photograph is taken from the 1932 Radiolympia show and is described by the photographer as showing a view of Radiolympia with a 'girl' mechanic at work. It must be acknowledged then that despite the glitz and glamour that surrounded the event, the technology and the women present, the electronics companies did demonstrate the work being done by working-class women in factories and workshops across the country. Figure 44 shows a group of male visitors observing a female mechanic demonstrating her role in the manufacturing process. The photographer emphasises the curiosity of the onlookers while centring the work of the mechanic. However, in contrast to the demonstrators and promotional models found at the event it appears that the women herself is not explaining the work she is currently doing. Figure 44 shows a male audience or potentially a male employee of the exhibition describing what exactly is being done

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[580] 'View of Radiolympia. Girl Mechanic at Work' 18 August 1932, The Daily Herald Archive Collection, Wireless, NSMM.

by the female mechanic. This representation and 'use' of working-class women by the electronics companies is congruent with that of the internal company magazines. However, the public and entertainment based image of the Radiolympia meant that women were represented in relation to wireless in a variety of other ways that were much more prominent and were not in line with the vision of women workers in manufacturing as quiet, anonymous and suited to repetitive tasks that is found in the company magazines and in Figure 44. The example of a female mechanic demonstrating the manufacturing work being done in the industry by women was not the dominant public image of women within the industry or at Radiolympia. Figures 40 and 44 highlight the two ends of the gendered spectrum regarding the roles that women were placed in at the Radiolympia show, one divorced from the technology and one entirely connected to it. However, as the film and photographic evidence suggests, the most common role women were employed to perform at Radiolympia was as the early form of the 'promotional model' and demonstrator that both reinforced and challenged traditional notions and representations of the relationship between women and new technology.

4.4 Challenging Traditional Representations of Gender and Radiolympia

The need for a 'modern' women to fit and embody the companies' brand image resulted in some of the women at the exhibition being sexualised and some representing middle-class femininity, but they were also positioned to show an understanding of the workings of new wireless technology, a domain that was previously accepted as masculine. In company magazines women factory workers were represented as diligent quiet and obedient workers possessing an affinity for repetitive tasks, but not possessing any genuine knowledge or understanding about

the objects they were manufacturing due to traditional assumptions regarding women and technology. In contrast, most women employed at the Radiolympia had their personality, sexuality and femininity emphasised while also allowing them to demonstrate their own direct knowledge of the technology. When historians have considered the new employment opportunities that emerged for women in the interwar electronics and engineering industries, Radiolympia and its use of female promotional models has not been given the consideration it deserves. But as Clare Wightman argues, some companies valued 'the experience and competencies of their female workforce, who were used with some flexibility across a range of operations as needed'.[581] The companies' use of female employees who possessed technical knowledge at Radiolympia is an example of this. On the surface the role of promotional model at Radiolympia was a public repudiation of long held traditional views that regarded the understanding of new technologies as a masculine trait.

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[581] Wightman, *More than Munitions*, p.81.

Figure 45 Early Scene at Olympia Radio Show[582]

Figure 46 Radio Exhibition Olympia 1933[583]

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[582] 'Early Scene at Olympia Radio Show' 16 August 1934, The Daily Herald Archive Collection, Wireless, NSMM.

[583] 'Radio Exhibition Olympia' 14 August 1933, The Daily Herald Archive Collection, Wireless, NSMM.

The reporting of the event by the British interwar press shows a fascination with the women at the event and their connection to the wireless technology. Figures 45 and 46 show that employers at the exhibition also wanted the press to promote the connection between women, femininity, and wireless in candid 'behind the scenes' shot. Figure 45 depicts 'Miss Wade rehearsing her radio girls while others test the quality of a 1934 set'.[584] The dancers are presented as truly 'radio girls', not just eager and willing to promote the technology, but curious and capable of understanding the technology. Women working at the show were not just employed as a part of the spectacle, but were also involved with the practicalities of putting on such a large exhibition. Figure 46 shows a Columbia work 'girl' putting the finishing touches to a show model.[585] This more candid shot shows that the female demonstrators were equally involved in the testing and setting up of the technology featured at the show alongside being the public facing front of the companies. This is another contrast to how women workers in manufacturing were depicted in the internal electronics company magazines and by the pageantry of the exhibition. This demonstrates how the electronics companies shifted the gendered representations of women they allowed to be disseminated based on the intended audience of the photographs. In her analysis of gender representations in interwar women's magazines, Lisa Stead concludes that the 'proliferation of alternative and contradictory representations of gendered duty and identity in some ways troubled

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[584] 'Early Scene at Olympia Radio Show' 16 August 1934, The Daily Herald Archive Collection, Wireless, NSMM.

[585] 'Radio Exhibition Olympia' 14 August 1933, The Daily Herald Archive Collection, Wireless, NSMM.

the broader narrative of post-war return to domesticity'.[586] The traditional housewife that represented this domesticity, and that was the target audience for groups such as the EAW, was not a role that women employed by the electronics industry were made to embody at the Radiolympia Exhibition. However, this does not mean that the exhibition was really challenging traditional gender notions regarding domesticity, or the traditional gendered views regarding women and new technologies. Rather, the commercial incentives undermined any serious challenge to the prevailing perceptions and representations of the relationship between women and wireless technology.

Figure 47 Pye Radio Pet Stand 1936[587]

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[586] Lisa Stead, 'Dear Cinema Girls': Girlhood, Picture-going, and the Interwar Film Magazine' in *Women's Periodicals and Print Culture in Britain, 1918-1939: The Interwar Period*, ed.by Catherine Clay, Maria DiCenzo, Barbara Green and Fiona Hackney (Edinburgh: Edinburgh, 2018), pp.103-120 (p.155).

[587]'National Radio Exhibition at Olympia' 26 August 1936, The Daily Herald Archive Collection, Wireless, NSMM.

As wireless technology became more mainstream and the audience for it grew and widened beyond experienced hobbyists, the ease of use of the technology became one of the key points in the marketing strategies for the electronics manufacturers. The Radiolympia exhibition was the perfect opportunity to show and let customers experience this development towards simplicity. Presenting this simplicity would have been one of the key selling points that the promotional models had to communicate to the public. Figure 47 is a photograph taken at the 1936 Radiolympia and portrays 'Pye radio sets demonstrated by their stand pet'.[588] Here, the manufacturer utilised a comedic demonstrator to promote the idea that their latest wireless set so easy to operate that anyone, even an animal, could do so. In representing the technology in such a way, the electronic company is attempting to promote the idea that their wireless sets require very little knowledge or technical expertise to operate correctly. Therefore, reliance on promotional models must be understood in relation to the manufacturers' desire to represent to the ease of use of the technology to the attendees. I am not arguing that the electronics companies, or the press photographers, were consciously equating the intelligence of women with that of the stand pet monkey, although that is certainly implied. I do posit that the representation of 'ease of use' regarding the technology complicates the notion that

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[588] National Radio Exhibition at Olympia' 26 August 1936, The Daily Herald Archive Collection, Wireless, NSMM.

Radiolympia was representing and promoting its women workers and the roles they inhabited at Radiolympia in a way that challenged traditional gender views on women's ability to operate new technologies and 'their inherit mechanical naiveté and ineptitude'.[589] Despite the aim to embody modernity and the exhibition's early use of women demonstrators and promotional models that publicly showed women using and understanding the technology, ultimately this was still done in relation to assumptions based on traditional gender views and motivated by commercial ambitions.

The role of the promotional model in the interwar electronics industry was a complex one that had to embody and represent modernity, sexuality, and technical understanding, while not overtly challenging traditional beliefs regarding women and technology. This complication demonstrates how the representations constructed by the electronics companies regarding the interplay between women and wireless technology differed in significant ways internally and at public exhibitions. At Radiolympia these representations were complicated and varied depending on women's position in relation to the wireless technology. However, the industry ultimately positioned all women workers in the same place visually and commercially: as innately suited to the simple, repetitive task of manufacturing electronics to justify the adoption of cheap female labour and, in turn, at public trade shows as a gendered symbol of the technology being simple and easy to operate.

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[589] Julie Wosk, *Women and the* Machine, p.115.

4.5 Radiolympia and the Growing Female Audience

The third major role that women occupied at Radiolympia was as middle-class housewives who attended the exhibition in increasingly large numbers. Press reports on the exhibition mention the 'feature which has often staggered some of the stand attendants is the number of women with an expert knowledge of wireless'.[590] As I mentioned earlier in this chapter the EAW preceded Radiolympia in the use of female demonstrators to promote a technology. However, the interwar electronics industry did so in ways that built upon the industry's specific reliance on female labour and the associated imagery. This led to the electronics industry having its own complicated gendered representations of women and wireless technology. Despite this, a continuity does exist between the two and can be seen to emerge as the consumer base for valves and wireless sets evolved over the interwar years. As the number of attendees grew year on year for Radiolympia, by the 1930s the proportions of that audience also began to shift. By the 1934 Radiolympia it was being reported by the press that 'this year the great show is attracting more women than men. Thousands of them were in the queues which waited for the opening at Olympia, London. The turnstiles clicked merrily all day yesterday without a break'.[591] This was not an anomaly and the higher number of women attendees remained a consistent feature of the show. The Daily Mail reported in 1937 that 'women are having the last word in the choice of the family radio this year,

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[590] E.H Phillips, 'Radiolympia' *The Indian Listener*, 7 May 1938, p.633.

[591] 'Women Storm the Turnstiles' *Dundee Courier* 17 August 1934, p.4.

according to several leading firms at the exhibition at Radiolympia'.[592] It was acknowledged by the press that the rising number of interested women could be attributed to the possibility that 'notable improvements in cabinet work has brought sets into the furnishing scheme, and, added to that women perhaps more than men appreciate the many ways in which control has been simplified'.[593] An example of this focus on simplicity can be seen in by the promotion of the Mullard 'magicontrol' set on display in 1937 which allowed for waveband, tuning, volume and tone to all be operated by one knob. Despite the spectacle and role of the promotional models often blurring the line between informed demonstrator and an appeal to sexuality they were dealing with as many middle-class women attendees as men. It is undoubtedly true that by the 1930s the women working at Radiolympia increasingly occupied a similar position to those who were the public face of the EAW, and those demonstrating electrical domestic equipment[594], as they had to promote and sell their technology to other women who were attending Radiolympia in greater numbers each year.

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[592] 'Women are Ruling Radio' *Daily Mail* 30 August 1937, p.4.

[593] 'Women are Ruling Radio' *Daily Mail* 30 August 1937, p.4.

[594] Katie Lloyd Thomas, 'The Architect as Shopper: Women, Electricity, Building Products and interwar proprietary turn in the UK' in *Architecture and Feminisms Ecologies, Economies, Technologies*, ed. by Catharina Gabrielsson, Helen Runting, (London: Routledge, 2018), pp. 54-65.

<u>Figure 48 Women at Radiolympia 1934</u>[595]

<u>Figure 49 Women inspecting a Phillips wireless set Radiolympia 1933</u>[596]

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[595] 'Radio Olympia Exhibition' 17 August 1934, The Daily Herald Archive Collection, Wireless, NSMM.

[596] 'Radio Show Olympia' 22 August 1933, The Daily Herald Archive Collection, Wireless, NSMM.

Figure 48 depicts two female customers inspecting a gramophone and wireless set at the 1934 Radiolympia stand, while Figure 49 highlights a customer examining her potential purchase of a Phillip Radio Set. Figure 48 shows that women working at Radiolympia had to interact and sell their product to women as well as men. In this photograph the three major roles women came to occupy within the interwar electronics industry by the 1930s are all present: the public demonstrator, the consumer and the working-class manufacturer represented by the wireless set. Noticeably, at Radiolympia, it was the working-class women valve manufacturers who received the least representation at a public level as the gendered depiction of them fostered by the company magazines was diametrically opposed to the imagery and function of the commercial event. The visual documentation of women attendees reveals the extent to which Radiolympia became a female dominated space both behind the company booth and as attendees. Figure 49 demonstrates that the middle-class women who attended the show often did so on their own, directly making the purchasing decisions regarding wireless technology for the home. Radiolympia was a unique public space where, because of commercial interests, women attempting to fulfil the demands of being the household manager came into direct contact with women embodying the glamorous 'modern woman' over a commercial transaction regarding the product of another interwar model of female identity: the docile woman worker as represented in the company magazines. Myra Macdonald argues that the housewife image in advertising 'had wider ideological influence in sustaining the importance of the home against the new libertarianism of the jazz era' while paradoxically the image of the free spirited flapper 'provided a

dream of escape for the household married women'.[597] At the interwar Radiolympia exhibitions the construct of the free 'modern woman' was used to sexualise wireless technology in the eyes of male consumers but also to present it as a modern and liberating device to the growing number of middle-class housewives that attended the show. As Richard Thompson Ford articulates 'flapper style was not just an indulgent fashion trend for the leisure class. Personal liberation, sexual freedom and, play were certainly a part of the ethos, but so were industriousness and competence'.[598] The latter of these traits was undoubtedly good marketing when attempting to appeal to the large number of middle-class housewives at the show attending under the expectation of making a smart and informed purchase.

Figure 49 depicts, in the words of the photographer: 'female interest in the working side of a Phillip Radio set'.[599] The photographer specifies a 'female interest' that positions a 'male interest' this kind of technology as the default one. Much like the exhibition itself, the reporting of the event linked women attendees to wireless in strictly gendered representations. This is can be seen in the volume of photographic evidence and newspaper articles devoted to the recognition of and fascination with this 'feminine' interest in the technology. Alongside the technological developments and a focus on the spectacle, the narrative around the feminization of the exhibition attendees is the other most reported on aspect of the event and was visually represented by photographs of women interacting directly with the technology. The

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[597] Macdonald 'From Mrs Happyman to Kissing Chaps Goodbye: Advertising Reconstructs Femininity' in *Critical Readings* in *Media and Gender*, p.45.

[598] Thompson Ford, *Dress Codes: How the Laws of Fashion Made History*, (New York: Simon and Schuster, 2021), p.146.

[599] 'Radio Show Olympia' 22 August 1933, The Daily Herald Archive Collection, Wireless, NSMM.

description of women's interest in the technology demonstrates a perception from those observing the industry from the outside that men and women related to the technology in different ways. The reporting of this feminization of the Radiolympia exhibition in terms of its attendees therefore reflects not just on the event itself but the nature of the consumer culture supporting the interwar electronics industry. As I will analyse in the next chapter the shift to the middle-class housewife as being the major purchaser and consumer of wireless technology reshaped the representation and presentation of the technology in advertisements but also in reality, as it reshaped the design of the sets and the programming schedule.

The electronics industry utilised Radiolympia and employed women in these various roles at the exhibition until its closure, maintaining the representations of women it relied upon in the interwar years. Eventually, the footage directly from the spectacle could be witnessed in the home through the television set. Radiolympia was eventually closed in 1947. It was reported in the March 1948 edition of the *Wireless World* that 'approval of the Radio Industry Council's decision that no National Radio Exhibition shall be held this year will inevitably be tinged with some regrets. The reason given — to allow the industry to concentrate without distractions on the achievement of its export target is valid'.[600] This shows the extent to which the Radiolympia exhibition was a show dedicated to fulfilling a domestic interest in a domestic product. Paradoxically, the complete success of wireless in Britain rendered the Radiolympia event unnecessary by the 1940s. As Michael John Law argues the industry shifted its focus away from Radiolympia and the domestic market because by 1938 around 72 percent households 'had brought wireless

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[600] 'Comments of the Month' *Wireless World* March 1948, p.79.

licenses and were now listening to sophisticated, easy to-operate radios. When the number of illegal listeners and people dropping into friends' houses is added to this total, it can be understood why industry commentators thought radio acquisition had hit a saturation point'.[601] Statistics from the show reflect the accuracy of such an argument. During the 1936 exhibition 80% of all sales were to replace existing sets.[602]As the statistics from Radiolympia event reveal it was in large part middle-class women attempting to fulfil the role of an effective household manager that attended the exhibition and did individual business there during the interwar years.

In conclusion, the Radiolympia exhibition was the largest and most frequent public celebration of the success of the British interwar electronics industry. Much like the manufacturing side of the industry a large part of the work being done at Radiolympia was connected to wireless which had become gendered as feminine, which led the electronics companies to justify and require a female workforce. Due to the spectacle and commercial nature of the event the electronics manufacturing companies cast women employees in more complicated and varied gendered roles than just as cautious housewives or as diligent workers. The three major roles women came to embody at the exhibition were as part of the spectacle of modernity. They were cast as sexualised yet informed promotional models and in later years increasingly as part of the target audience for the technology. The work being done by working-class women was acknowledged to some extent at the event, but the commercial incentives of the show produced an elaborate display of pageantry and an appeal to middle-class customers. Within this space women were presented in

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[601] Law, *1938: Modern Britain*, p.49.

[602] 'Radiolympia Closed' *The Times* 7 September 1936, p.10.

relation to wireless technology in multiple gendered ways by the electronics companies. Firstly, women occupied a prominent position as dancers and entertainers, so much so that the 'Radiolympia girls' became the face of the event and its advertisements often relied on their appeal rather than that of the wireless technology. These women embodied the ideas of modernity that the show projected but in safe and feminine manner than appealed across gender and class to the attendees of the exhibition. Secondly, the largest percentage of female employees at the exhibition worked as promotional models and demonstrators at the booths of the various electronics companies, who can be seen to sit in between working-class women at one end of the production cycle and female middle-class consumers on the other.

The women in the middle of this process were employed to embody the roles in equal measure of charming models and knowledgeable demonstrators. They emphasised the ease of use of the technology to a female audience assumed to either be cautious or incapable of operating complex looking technology. Women demonstrators challenged traditional gendered notions regarding women and knowledge of technology. However, they were ultimately used in a way to deemphasise the technology and simplify it for the audience and contextualise it as suitable for a domestic setting. Thirdly, middle-class women formed a significant percentage of the exhibition's attendees and the imagery of the event and its employees aimed to be a reflection of modernity that appealed to them in order to sell the valves and wireless sets featured at the exhibition. These different female roles were constructed by the electronics companies and disseminated by the press reports of the annual exhibitions. To some extent the representations of femininity at

the exhibitions contradicted and conflicted with traditional perceptions regarding women and technology and even the electronics companies' own internal representation of their female employees. This use of female representatives to promote the technology face to face to consumers has a continuity with the work of the EAW. However, the various roles that women occupied and represented in the electronics industry were unique as the technology was also in large part also manufactured by women. Internally in its company literature and publicly at the Radiolympia exhibition the British interwar electronics industry cast women within the industry in a variety of distinctly gendered roles. This included being represented as disinterested but diligent workers, independent thinkers with a full understanding of the technology, sexualised entertainers, and promotional models. In my next and final chapter, I continue to explore the role of women as consumer of wireless technology. I examine in depth how women became the major consumer base of the industry and in turn reshaped the industry and the imagery of wireless technology.

Chapter 5: Consumption and Gender: Women and the Interwar Wireless

In the preceding chapters I detailed the two major roles that women held within the interwar electronics industry. I have shown how the adoption of mass production techniques by the British interwar electronics industry facilitated a new kind of gendering of the workplace. This was developed, reproduced and managed through official company literature and publications. By highlighting this I have shown how the employment of working-class women shaped the way wireless technology was being produced during this period, and how the workplace was organised around the widespread adoption of female labour. In addition, I have argued why and how the interwar electronics industry appealed to young working-class women as a new place of work, despite the physically demanding and harsh conditions they were expected to work under. In sum, young working-class women made up the majority of the workforce that manufactured interwar electronic goods such as thermionic valves and wireless sets, and this helped develop a uniquely gendered space within the electronics industry. This signalled a shift in the production of the technology; technology was no longer manufactured by individual men but by large numbers of working-class women. I have also analysed the role women held in the main public facing industry showcase, the Radiolympia Exhibition. At this exhibition women posed with, marketed, and demonstrated the wireless technology, manufactured by other women, in a safely gendered manner.

In this final chapter I focus on an analysis of women as consumers of wireless technology. In doing so I demonstrate the important roles women held across the production and consumption cycle of the interwar electronics industry. I further my analysis of interwar class and gender dynamics in relation to wireless technology by

widening my scope to the consumption and the use of the technology alongside its production. In this chapter I therefore move away from the factory floor to interrogate the developing relationship between wireless technology and the feminized domestic space that took place in the interwar years. I show how marketing campaigns for wireless technology utilised gendered imagery to appeal to a female audience during a period when the dynamics between middle-class and working-class women were changing.

I argue that as the interwar electronics industry grew to a size large enough to allow for mass production and the increased use of cheap female labour, middle-class women became the major target audience for the marketing of the technology. I will contrast the early 1920s hobbyist production and consumption of wireless technology, which was dominated by male consumers, to the historical shift towards working-class women mass producing the technology and women consuming it in the domestic sphere of the middle-class home. Therefore, in this final chapter I demonstrate how women at both ends of the production cycle shaped the ways the technology was perceived and experienced during this period. I also examine to what extent the electronic industry's use of female labour reshaped the physical and spatial class dynamics of middle-class women and working-class women and how this impacted wireless. I consider how the use of female labour by the electronics and other industries provided an appealing opportunity for working-class women to move outside the realm of domestic service, in which they were directly employed by middle- and upper-class families. This had previously been the primary employment opportunity for young working-class women and girls. John Benson highlights the fact that in 1911 2.6 million (14 percent) working-class women were employed in domestic service: 'during this period domestic service was the largest

employer of working-class women'.[603] Other industries that were characterised by

the employment of working-class women prior to the emergence of the electronics

industry included the textile industry, in which women accounted for 57 percent of

employees in 1911.[604] It was not until the interwar period when other sectors,

including the electronics industry, began to supplant the hold domestic service had

over the employment of working-class women. However, I argue that while there

was a clear change in the employment favoured by working-class women during the

interwar period, thanks to the changes in production methods facilitating different

employment opportunities, this apparent shift in class relations was not as big a

change as it was perceived to be, and the old class dynamics were in fact maintained

in the production of electronics goods. I show that while the servant and employer

dynamic between middle-class and working-class women did change, the mass

production of wireless technology maintained, to a significant degree, the presence

of working-class female labour inside the middle-class domestic space through the

mass production and consumption cycle of wireless technology and the related

development of interwar consumer culture, rather than through direct employment

within the middle-class home (although that still existed). Historians of technology

such as Ruth Schwartz Cowan have examined the impact of new labour-saving

technological devices in the 'feminine' domestic space and argues that the

'industrialization of the home seems to have been the product of perpetually rising

expectations'.[605] Furthermore, much work has been done on the changing structure

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[603] John Benson, *The Working Class in Britain: 1850-1939* (London: I.B. Tauris, 2003), p.23.

[604] Louise A. Tilly and Joan W. Scott, *Women Work and Family* (London: Routledge, 1987), p.164.

[605] Ruth Schwartz Cowan *More Work for Mother*, p.13.

of domestic servant work in Britain's interwar period, for example by Pamela Horn who effectively charts the growing 'dislike of domestic work that had been reported in the official reports of 1919 and 1923'.[606] This chapter synergises and expands on such work by focusing specifically on wireless as representative of industrialised working-class women's labour being maintained in the middle-class home well after the 'fall' of the Victorian servant. Finally, I analyse how and when wireless technology became a viable and desirable product that appealed to working-class women listeners and to what extent this varied from the manner in which the technology appealed to middle-class women.

To support these arguments, I use a range of primary sources. This chapter turns to the wireless sets themselves as objects of study, to demonstrate how the change in production methods, the change in the gendered nature of production and the development of middle-class consumer culture altered the physical appearance and aesthetic style of interwar British wireless sets. The sets I refer to in this chapter include those found in the collections of the Manchester Science and Industry Museum and Bradford's National Science and Media Museum. These two institutes house hundreds, if not thousands, of wireless sets and their component parts such as thermionic valves. I examine them to explore exactly how the designs changed between the 1920s and the 1930s and how this can be attributed to the changing nature of production and consumption in relation to class and gender. I also show how wireless sets began to be marketed in relation to a middle-class domestic setting, with programming often conforming to this perceived feminine domestic space. To place the wireless sets in their proper context as consumer durables, I

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[606] Pamela Horn, *The Rise and Fall of the Victorian Servant* (London: The History Press, 1990), p.178.

analyse advertising material found in early hobbyist magazines such as the *Popular Wireless Weekly,* alongside magazines aimed specifically at middle-class women in the home such as *Good Housekeeping*. In doing so I highlight how wireless technology as an electronic consumer durable was marketed, how it was placed alongside other advertisements and how this evolved throughout the interwar period. I also use sources related to wireless ownership and listenership that span the interwar years. These will include the BBC magazine *The Listener* which catalogues many of the wireless broadcasts of the 1930s. I will also examine the BBC *Yearbooks* which began publication in 1928 as they provide statistical data on interwar listenership and ownership of wireless. Sources such as these allow me to examine to what extent the culture and content of wireless broadcasting changed throughout the 1930s, and in what ways it appealed to middle-class women who occupied the same domestic space as the household wireless set most of the time, especially throughout the working week. The BBC *Yearbooks* also provide insight into the number and geographical spread of wireless ownership throughout the 1930s, which facilitates a comparison between the areas where the electronics industry had established itself as a source of employment, as well as a comparison with the numbers of domestic servants in these areas. Finally, I analyse the ways companies selling wireless attempted to appeal to working-class women (despite questions of economic viability of the technology and the more limited purchasing power of working-class families). To do so it is important to look at the development of wireless broadcasting and programming outside of the BBC, such as Radio Luxembourg. I compare the kinds of programmes such stations broadcast and how these may have held a wider commercial appeal in comparison to the BBC which in its early developmental years, under the auspices of its first general manager John Reith, attempted to avoid focusing on light entertainment and

'considered that the medium should be used for the greater good by bringing into every home irrespective of class or means the best that had ever been thought of and said in the world' and 'set out to give the radio audience what he considered they needed rather than what they thought they wanted'.[607]

5.1 Interwar Wireless Ownership and Listenership

When examining the ownership, consumption and use of wireless technology alongside its ever-increasing influence in the interwar period it is important to understand the broader context in which this was taking place. As Roger Horowitz and Arwen Mohun argue, 'technology played a crucial role in the development of a modern consumer culture'.[608] As I have previously shown, wireless technology became a mass-produced consumer product during these years. However, the technology and the broadcasting service did not have an immediate influence over a mainstream British audience, at least in terms of wireless license ownership. Well into the 1930s, wireless technology remained mostly out of the mainstream, specifically in relation to ownership. This can be seen clearly from the BBC's own statistics in relation to the number of license holders across the country. The BBC *Yearbooks* provide annual statistics regarding license ownership and Table 10 shows the number of license owners from 1923 to 1929.

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[607] Martin Dibbs, *Radio Fun and the BBC Variety Department 1922–67* (St Andrews: Palgrave Macmillan, 2019) p.5.

[608] Rogers Horowitz and Arwen Mohun, 'Introduction' in *His and Hers*: *Gender, Consumption, and Technology,* ed. By Roger Horowitz and Arwen Mohun' (Charlottesville: The University Press of Virginia, 1998), pp.1-6 (p.1).

Table 10 The Growth of Wireless Licenses in Britain during the 1920s [609]
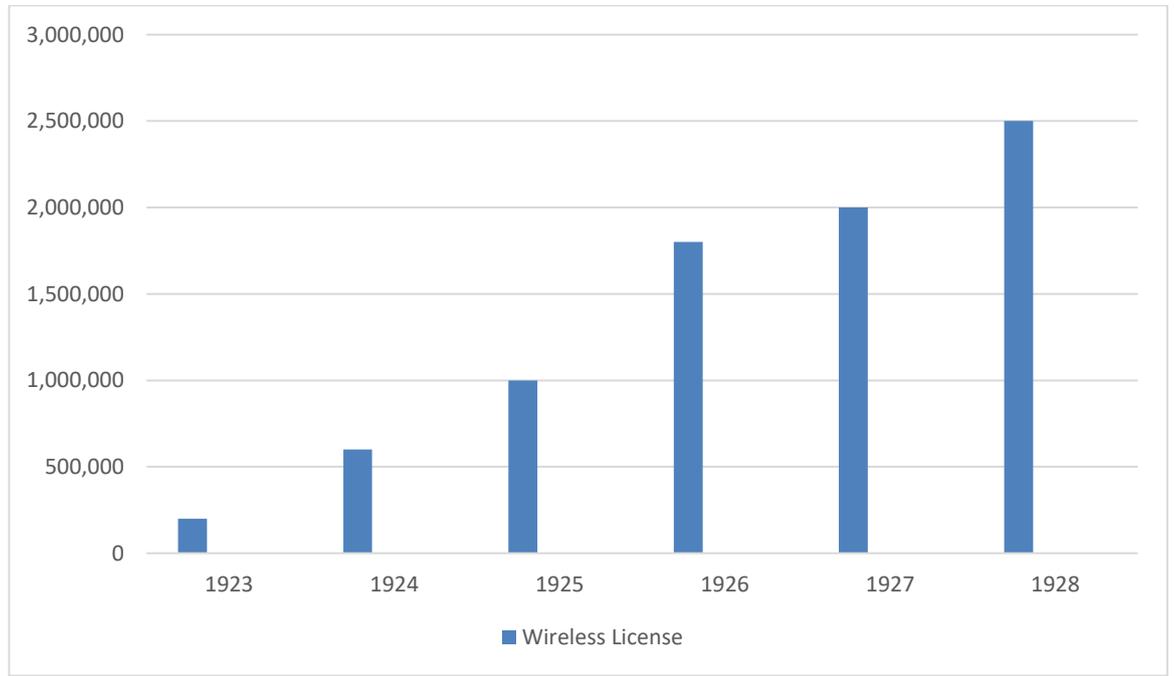
    Table 10 reveals that in the 1920s the number of those holding wireless licenses

continued to grow steadily each year and managed to surpass a million by 1925.

This fact, in conjunction with the growing number of British electronic companies

such as Mullard, Metropolitan-Vickers and many others, the development and

introduction of the BBC, and the developing wireless enthusiast culture, show how

wireless can be argued to be perhaps the most important consumer product that

emerged during the interwar period. As J.P. Devlin highlights, many commentators

and historians of broadcasting 'often describe the 1930s as the golden age of

wireless'.[610] Undoubtedly the interwar period was the most important period for the

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[609] BBC, *BBC Handbook* (Savoy Hill: London, 1928), p.45.

[610] J.P. Devlin, *From Analogue to Digital Radio*, p.2.

widespread adoption of wireless in British households. However, while this is the

case, the population of England, Scotland and Wales in 1928-1929 was, according to

census data, around 44,491,000.[611] With about only 2,500,000 people during this

period being recorded as holders of a wireless license, this equates to around 7

percent of the overall population. Evidently, while there was a rapidly increasingly

number of license owners annually, this still constituted a minority pursuit during

the 1920s. We can safely assume that owners also held licenses and therefore were

those that had an enthusiast's interest in the technology. Equally, the 7% were those

who could afford it, primarily the upper and middle-class strata of the population.

The affordability of the technology as well as the development of the country's

broadcasting system had another key impact on another aspect of the context of

wireless ownership in this period: geography. The BBC *Yearbook* from 1931

demonstrates significant differences in the number of license holders across the

various counties. For comparison, by July 1930 in London 13% of the local

population held a wireless license while in the entirety of Yorkshire only 6%[612] did.

With much of the electronic manufacturing industry being located in the south of the

country by this time, and with wages being higher in London, it is clear from these

statistics also that ownership of wireless technology was not yet a widespread

development amongst the British population but was most prevalent amongst the

urban middle and upper classes. In the 1920s, then, wireless license ownership

remained outside the scope of most working-class individuals. As Mark Pegg states:

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[611] Frank Moore Colby, *The New International Yearbook* (New York: Dodd, Mead and
Company, 1931), p. 323.

[612] British Broadcasting Corporation, *BBC Handbook* (Savoy Hill: London, 1931) p.33.

'the changing costs of radio sets and the ten shilling (50p) annual broadcast licence were important factors for potential listeners to consider'.[613]

However, ownership is not indicative of the overall number of listeners and the cultural impact the technology had managed to amass during this period. As Pegg also asserts 'radio was always a very economical means of supplying entertainment and information. It was very good value for money and eventually came within reach of all but the poorest'.[614] While this perhaps over-estimates the 7% of radio ownership in the early interwar years, later statistics lend an increasing amount of weight to this assessment as the growth of ownership continued in a rapid manner throughout the latter half of the interwar years. Furthermore, licence ownership by individuals does not give us the entire picture of how influential wireless was in this period or how far reaching its listenership was. The 'possibility of there still being a number of unlicensed listeners'[615] was acknowledged by the BBC. This cannot be measured in any accurate way and cannot be interpreted from the available statistics of ownership. Group listening was an extremely common practice among enthusiasts, clubs, friends, workers and, of course, families in the home. Martin Pugh argues wireless became the central hub for sending and receiving perceptions of British culture during the interwar period and that 'the wireless also had a formative effect in creating leisure for the family as opposed to the individuals within it. Many contemporaries recalled how, every evening, the whole family sat

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[613] Pegg, *Broadcasting and Society 1918*-1939, p.4.

[614] Pegg, *Broadcasting and Society 1918*-1939, p.4.

[615] British Broadcasting Corporation, *BBC Handbook* (Savoy Hill: London, 1931), p.32.

round the wireless in their kitchen listening to it'.[616] This assertion is borne out

further when looking at the statistics of the estimated number of people who were

able to listen to wireless broadcasts across the 1920s and 1930s, rather than purely

focusing on ownership statistics.

Table 11 The estimated number of people able to listen in interwar Britain [617]

Series 1
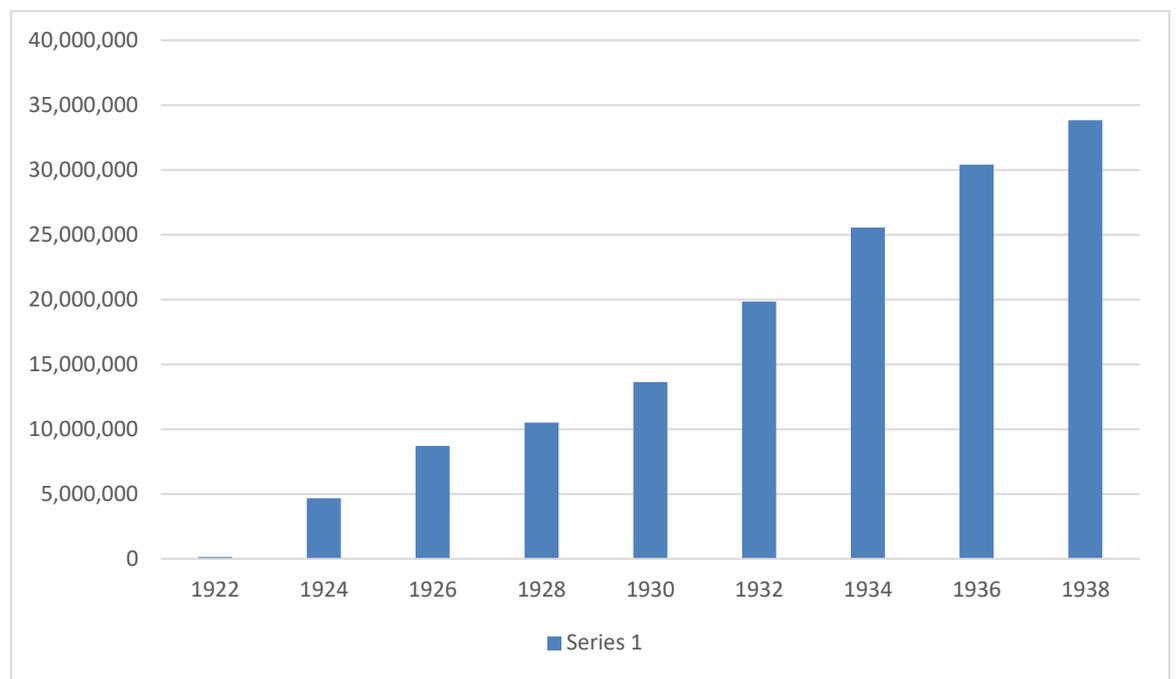
The statistics in Table 11, compiled from the BBC *Yearbooks*, show that despite

ownership of wireless sets still being limited to a small minority, there was an

assumption that many more people were in contact with the technology and the

associated BBC broadcasts to some degree. This can be attributed to the communal

nature of listening, as previously shown, but is also further evidenced by the other

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[616] Martin Pugh, *We Danced All Night: A Social History of Britain Between the Wars* (London: Vintage, 2009) p.232.

[617] BBC, *BBC Handbook* (Savoy Hill: London) 1939, pp.156-158.

available opportunities for less well-off groups and families to utilise and experience the wireless and its broadcasts. For instance, relay exchanges allowed loudspeakers into multiple homes linked to one device, similar to a large wireless set. Relay exchanges were 'a very efficient high-quality set that could be installed at a central point and the running cost shared amongst as many as could be conveniently connected to its loudspeakers.' The payment system for the relays was a rental one which was 'was an incentive for working-class individuals who wanted to listen. They could rent a relay service rather than buy a set'.[618] From the BBC perspective the relay services offered their broadcasts to those who would otherwise find them inaccessible; the working-class and those perceived as technologically impaired or incapable of operating sets themselves, such as women. Writing in 1941, the former Chief Engineer of the BBC, Peter Eckersley, argued in relation to the relays that 'the listener has no bother either in operating and maintaining a complicated wireless set which, to women especially, is often frightening and mysterious. It is the reliability, simplicity and cheapness of rediffusion which makes it so popular'.[619] This desire to simplify and remove the complicated implication of 'technology' from the product in order to appeal to women is an attitude that, as I will demonstrate, is later adopted by many wireless manufacturers as they attempted to align the technology with a domestic setting in their marketing imagery. Of course, unlike the BBC who were happy for their broadcasts to be received in whatever manner was efficient and practicable, each of the existing interwar wireless manufacturers I have mentioned so far were concerned with selling their product to as many people as possible once

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[618] Pegg, *Broadcasting and Society 1918-1939* (Kent: Croom Helm, 1983), p.58.

[619] Peter Pemberton Eckersley, *Power Behind the Microphone* (London: Jonathan Cape, 1941), p.212.

they were capable of mass producing them. This can be seen through both the changing appearance of the technology from the earlier 1920s to the late 1930s and in how wireless was contextualised through marketing and the new audiences they were being marketed to. The audience for wireless grew and included a large number of women just as the workforce manufacturing the technology also grew.

5.2 Advertising Wireless Technology in the Interwar Years

Advertising material provides some insight into the developing trends around electronics during this period, both on a consumer level and on a production one. As Lori Anne Loeb states, since the marketing industry boom of the nineteenth century 'technology and science were used to market even the most mundane products and to give them an almost magical aura.' This was even the case when appealing to those with little or no technical or scientific knowledge as 'a product did not have to be technically complex to tap the marketing strategy of newness. It only had to incorporate some changes that made it different than the products of the past'.[620] I will demonstrate in the following section that in the case of wireless sets, there was a definite shift away from focusing on the 'technology' aspect of the radio as the market for the product grew beyond the realm of male enthusiasts to incorporate middle-class women as they became the key demographic for the product. Many advertisements for electronics and radio sets throughout the interwar period continued the historical trend of depicting women 'in their traditional gender roles as either housewives, whose interests are limited to domestic needs, or as a sexually alluring background to advertisements, making the advertised goods attractive by

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[620] Loeb *Consuming Angels*, p.53.

association'.[621] However, when focusing on how the technology itself is placed in these long established contexts it is clear that there was a change in how the technology was being presented when taking into consideration where the advertisement is from, who it was targeting and when it was produced.

Roger Horowitz and Arwen Mohun argue that 'gender also matters' in relation to the consumption of technology and that the 'stereotypes of women as passive consumers and men as producers have been historically constructed' [622] through marketing, which was heavily based on gendered assumptions in relation to taste, expertise, capability, interest and was informed mostly by a male perspective. Wireless and its associated technologies did not escape this widespread trend despite, as the previous chapters have extensively demonstrated, working-class women making up the majority of the workforce regarding the production process of wireless technology. This can be attributed to the wider cultural history of the depictions of women and technology and, more specifically in this case, radio's early development as a male focused hobbyist activity. Hobbyists often operated individually and outside of the family dynamic and within dedicated groups and societies. Such groups often perceived themselves as 'experts' on wireless and they existed before the First World War. As Maria Rikitianskaia highlights, prior to the First World War 'in the UK, a pioneering country in organising hobbyists, only 69 out of 162 members of the Wireless Society of London held transmitting licenses,

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[621] Charles Chilimampunga, 'The Denigration of Women in Malawian Radio Commercials' in *Gender and Technology,* ed. by Caroline Sweetman (Oxford: Oxfam, 1998), pp.71-78 (p.72).

[622] Horowitz and Mohun, *His and Hers*, p.2.

which means that at least some of the members knew how to operate the devices and
conducted experimental work without a license'.[623]

Figure 50: Example of a Wireless Club[624]
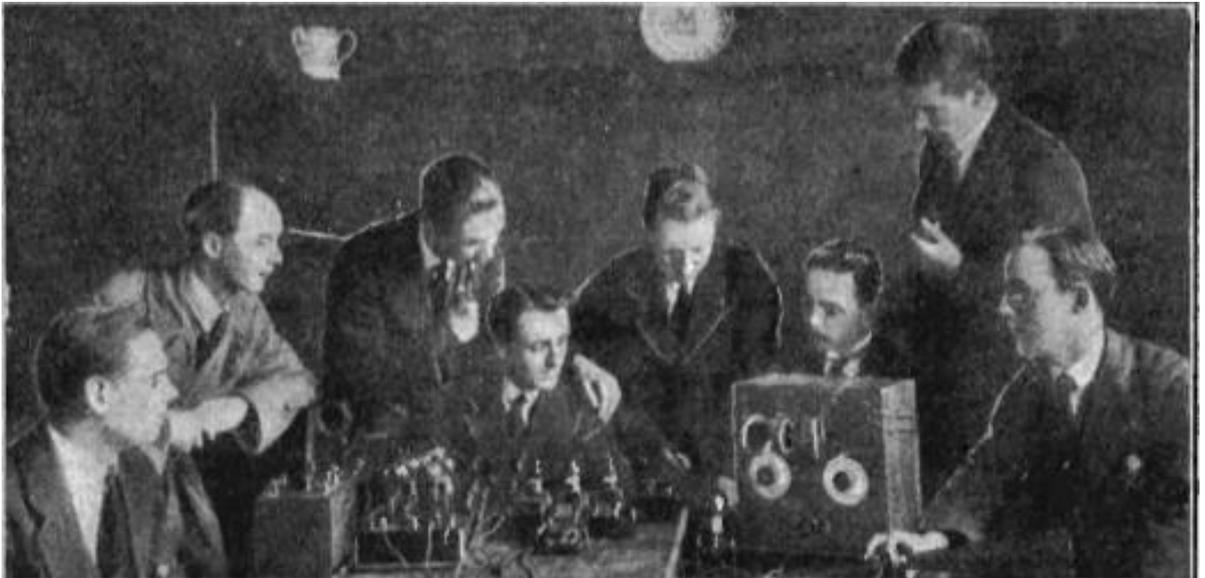
These early devotees of wireless and its capabilities were in large part made up of
men. For example, early enthusiast magazines such as the *Popular Wireless Weekly*
provide updates from the burgeoning enthusiasts clubs and meetings of the early
1920s. Figure 50 depicts an example of a wireless club meeting for the July 1922
edition in their 'Wireless Club Reports'[625] section. The article provides descriptions
of 'the south London wireless and scientific club, Bradford wireless society, the
Hackney district radio society, the Guilford district and wireless society and the

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[623]Maria Rikitianskaia, 'Listening to Concert Europe: Pioneering Radio Amateurs during
World War 1' in *World War I Media, Entertainments & Popular Culture*, ed.by Chris
Hart (Hillsborough: Lu Lu Press Limited, 2018), pp.123-144 (p.134).

[624] *Popular Wireless Weekly,* 1 July 1922, p.77.

[625] *Popular Wireless Weekly,* 1 July 1922, p.77.

Stoke-on-Trent wireless and experimental society'.[626] The article shows that such

clubs and societies were springing up across the country but it also clear both from

the photograph and the articles contents that these were predominantly made up of

men. The article mentions the positions men held within the group and what they

contributed, such as a Mr Walsh from the South London Wireless and Scientific

Club who gave a lecture on 'High Frequency'.[627] The article makes no mention of

any women participating or being associated with these various clubs. Therefore, it

was male hobbyists who initially became associated with the skilled production and

use of the technology. This was exacerbated due to the impact of the First World

War. The war shaped and defined how the technology developed during this period

and how it was utilised, in the wake of the hobbyists and enthusiasts in the

technology's nascent years. As Maria Rikitianskaia further elaborates, men who

were called up during the war 'into engineering and technology equipped units could

apply their knowledge to real-life tasks, and through their constant operation

improved and experimented with technology.' Another impact of the war was the

fact that 'amateurs significantly improved their knowledge and experience because

they got access to state of the art devices'.[628]

The male hobbyists' defining influence over the technology is also apparent when

considering the prevalent culture surrounding the technology, how it was advertised

and the visual aesthetics of the technology during the early 1920s. Early magazines

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[626] *Popular Wireless Weekly,* 1 July 1922, p.77.

[627] *Popular Wireless Weekly,*1 July 1922, p.77.

[628] Maria Rikitianskaia, 'Listening to Concert Europe', p.135.

devoted to the technology were primarily targeted at and written from the male hobbyist's perspective, such as *The Popular Wireless Weekly* which ran from the years 1922-1937. *The Popular Wireless Weekly* contains a variety of advertisements aimed at wireless and broadcasting enthusiasts and from these we can see what trends and techniques advertising agencies in conjunction with electronics companies were relying upon in this period, but also how radio technology was presented to the (male) enthusiasts. Below is a selection of advertisements from *The Popular Wireless Weekly* and the *BBC Yearbook* to demonstrate how the technology was marketed to this initial audience.

Figure 51 '40 Stations on Loudspeaker'[629]

[629] BBC, *BBC Handbook* (London: Savoy Hill, 1928), p.4.

Figure 52 'Mullard master Radio Valve Advertisement'[630]

[630]BBC, *BBC Handbook* (Savoy Hill: London, 1928), p.27.

Figure 53 'T.M.C for Boxing'[631]

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[631] *Popular Wireless Weekly,* 3 March 1923, p.73.

Figure 54 'Ediswan Valves: The Essential Part of the Receiving Set is the Valve' [632]

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The Essential Part of the Receiving Set is the Valve.

Ediswan Valves, by their actual performance, have proved themselves to be the best on the market for sensitivity, silence in working and robustness.

Type A.R. : : 15/- each
Type R. : ; 17/6 each

Why not send us your name and address? We can probably tell you something of interest regarding Wireless matters.

Ask for Leaflet W.

THE EDISON SWAN ELECTRIC Co., Ltd.
Head Office : 123/5 Queen Victoria Street, E.C.4
London Showrooms : 123/5, QUEEN VICTORIA ST., E.C.4
71, VICTORIA ST., S.W.1
Works : PONDERS END, MIDDLESEX
BRANCHES :—
Aberdeen   Bristol   Edinburgh   Leicester   Nottingham
Belfast   Cardiff   Glasgow   Liverpool   Sheffield
Birmingham   Dublin   Hull   Manchester   Southampton
Brighton   Dundee   Leeds   Newcastle   Swansea
Melbourne   Brisbane   Sydney   Adelaide
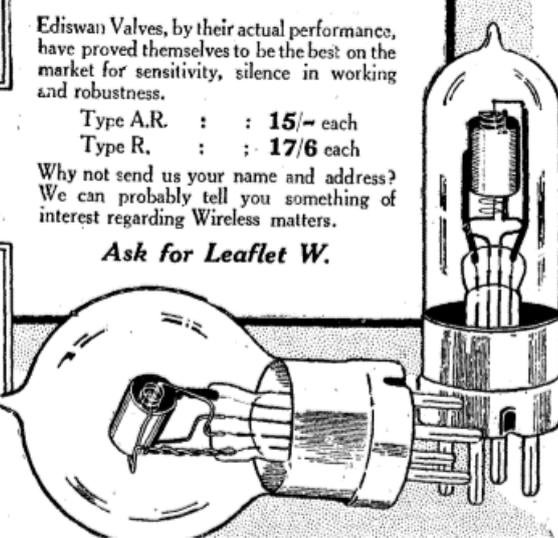
Figures 51-54 represent the most common type of adverts for wireless sets and their valves found across hobbyist and broadcasting magazines in the 1920s. As Figure 52 and 54 demonstrate, it was often individual parts such as valves that were the focus of marketing material in these magazines. This reflects the hobbyists' tinkering and the individually constructed nature of the wireless sets that they would have been working on. Being able to manually upgrade and tweak their sets was clearly a defining aspect of the hobby as it was practised by men, which defined

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[632] *Popular Wireless Weekly,* 3 March 1923, p.50.

itself by not just owning the technology or utilising it but fully understanding it and working on it, as well as a perfectionist approach to listening. For example, Figure 54 states that 'Ediswan Valves, by their actual performance, have proved themselves to be the best on the market for sensitivity, silence in working, and robustness'.[633] The advertisements appealed to those who would have been changing valves and seeking the best possible reception from their wireless set. Furthermore, Figure 53 emphasises further how notions of masculinity and class were wrapped up in the product and technology in these specialist magazines. Figure 53 shows two men listening to a broadcast of a boxing match. The text of the advert expands on this and states: 'A T.M.C wireless set will give you the full account of the fight,' adding 'you may be interested in football, the latest news, stock exchange quotations, the weather forecast, delightful concerts or an evening of dances'.[634] The two men in the image are possibly intended to be a father and son listening in the family home. Such adverts attempted to create a community of men around the types of broadcasts much like men had naturally created a hobbyist's community around the technology. Along with the associated imagery of two men in suits, it is clear the imagined audience is a man of economic means, plenty of leisure time, business interests and 'masculine' interests.

  This is not to argue that women were entirely missing or forgotten by such advertisments procured by the Mullard, Ediswan and T.M.C . Their designated role as keepers and maintainers of the domestic sphere meant that the marketing of the technology did consider women, even early in the interwar years, although it

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[633] *Popular Wireless Weekly,* 3 March 1923, p.50.

[634] *Popular Wireless Weekly,* 3 March 1923, p. 73.

probably was assumed they would not be the ones purchasing a wireless set or were even capable of using it. For instance, an advertisement from the 1928 edition of the *BBC Yearbook* is targeted directly at women readers. Entitled simply 'To the Women of Britain',[635] the advert utilises wireless to sell other products supposedly more in line with feminine interests and responsibilities. For example, the advert insists 'the radio has undoubtedly helped you keep your husband and boys away from the club and kept them at home where they thus experience the benefits of your gentle charm and influence' and that the women reader should 'must now go one step further and make your home comfy and cheerful by having Hailglass Shades and Globes on your light'.[636] It is worth highlighting that this advert is not something that would be found in the purely hobbyist magazines with their narrow focus and largely male readership. Rather, here it was assumed some women would have an interest in the development and plans of the BBC and played on the idea that wireless had benefited family life. The BBC *Yearbooks* contain articles dedicated to their programme policy which detail that the organisation was attempting to structure their broadcasts in an effort to 'please as many people as possible'[637] including women listeners. Furthermore, the advert is acknowledging the growing popularity of wireless and the likelihood the device would occupy a spot in the reader's domestic space. Such advertisements give women ownership of the space around the wireless but not the wireless set itself, which is clearly defined as something that the men of the house would be using. The advert implies that

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[635] BBC, *BBC Handbook* (Savoy Hill: London, 1928), p.17.

[636] BBC, *BBC Handbook* (Savoy Hill: London, 1928), p.17.

[637] BBC, *BBC Handbook* (Savoy Hill: London, 1928), p.28.

women would find enjoyment not from wireless themselves but by providing a pleasant domestic space for the men of the house to listen to the wireless in: 'your menfolk, as they listen to the wireless in a home made bright and comfy by our charmingly coloured glassware will indeed feel that they are in a real heaven on earth and you women of England will mutually join in on this pleasure'.[638] The placement of this advertisement in a magazine that focuses primarily on BBC radio alongside the fact that it actively uses wireless to market its own unrelated product is important to highlight. This tells us that there was a clear reaction to the growing popularity of wireless as a technology providing a form of entertainment as well as the knowledge that the technology was becoming an established part of the domestic space. Such adverts assume women would have little interest or knowledge about the technology but that that they would be acutely aware of its existence as they both occupied the same domestic space of the living room within the middle-class home.

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[638] BBC, *BBC Handbook* (Savoy Hill: London, 1928), p.17.

Figure 55 Cover of The Popular Wireless Weekly January 12 1924[639]

Mr. F. L. Hogg, the Highgate amateur, who communicated for two hours with Canada on this home-made apparatus.
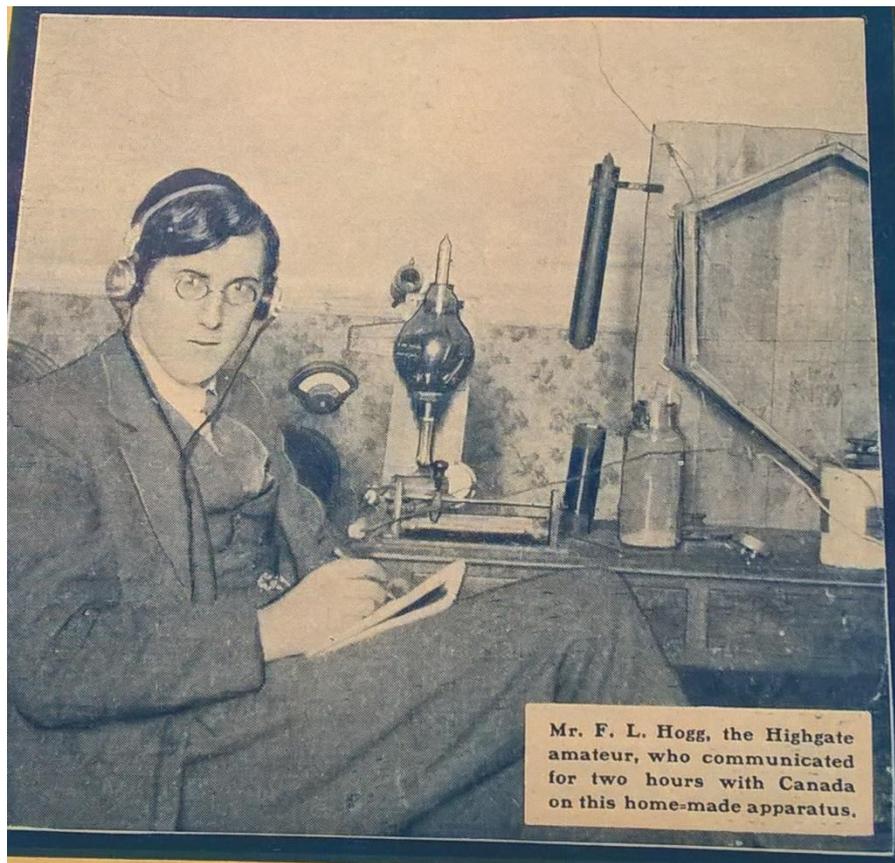
This is a prevalent development even amongst the media primarily concerned with enthusiasts and hobbyists concerns which were more directly interested in demonstrating the potential in the technology and its possible uses. Figure 55 demonstrates how wireless technology was commonly framed within the early interwar enthusiasts press. The photograph shows a lone man, dressed formally, and tinkering with his 'home-made apparatus'.[640] Such imagery embodies the type of masculinity that wireless technology was initially associated with. The technology and the male enthusiast are both placed at the forefront of image, directly facing the camera. The wireless set is described as home-made, and the hobbyist is described

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[639] *Popular Wireless Weekly,* 12 January 1924, p.1.

[640] *Popular Wireless Weekly,* 12 January 1924, p.1.

as having used it for two hours of international communication. This emphasises the hobbyist's skill and understanding of the technology and represents wireless as a solitary occupation, isolated from the domestic space. Despite this, women and the domestic space were not entirely absent from the imagery of the hobbyist press. While they were not directly targeting or speaking to a female audience, they used images of women alongside the technology to broaden its uses in the eyes of its male readership. For instance, the cover from the July 1922 edition of the *Popular Wireless Weekly* demonstrates how the enthusiast press attempted to contextualise wireless technology by visually representing it within the middle-class home.

Figure 56 The Popular Wireless Weekly July 1 1922[641]

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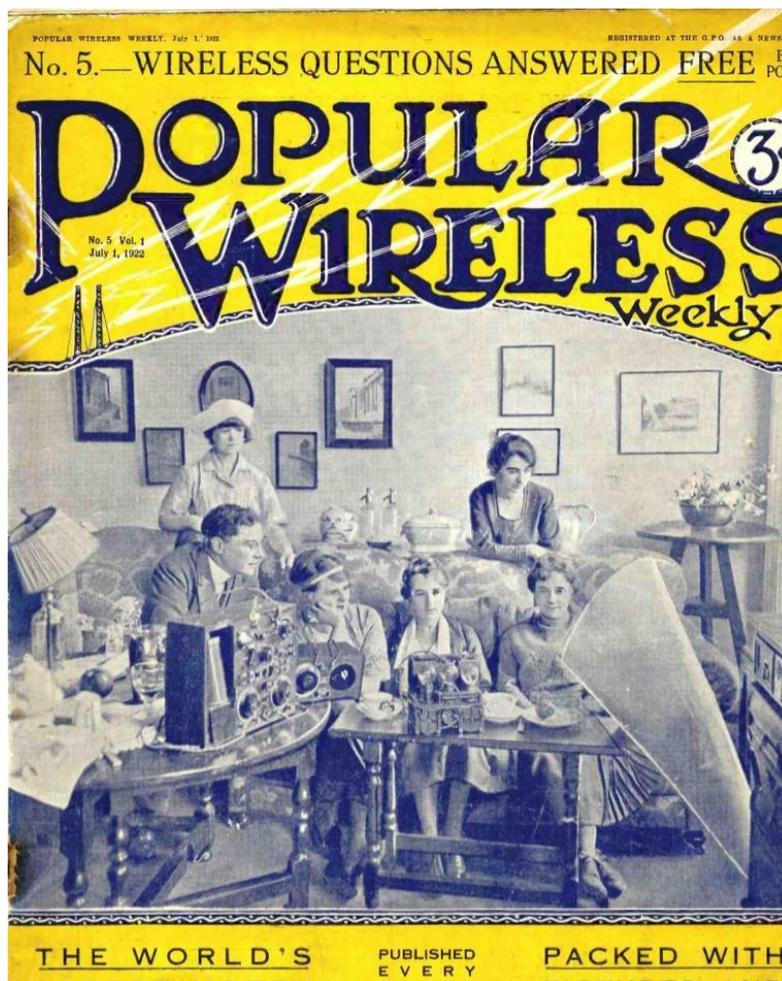
[641] *Popular Wireless Weekly,* 1 July 1922, p.77.

From Figure 56 we can ascertain much about how male enthusiasts were targeted as customers through advertising in 1920s wireless magazines. Firstly, the imagined reader of the magazine was clearly one of a middle-class background. The setting is a middle-class home which includes furniture, electrical goods, framed pictures and a house maid. This implies that the intended audience of the magazine was one who could afford such things alongside a wireless set, replacement valves, electrical goods and a spacious home. The cabinet and items present at the back of the room imply a certain level of economic standing. Alongside the home setting, the family members are also presented as very modern for 1922. The women do not possess the older elaborate Edwardian hairstyles but have shorter, 'flapper' styles which, for women, came to represent modernity throughout the 1920s. By linking this look with new emerging consumer technologies, images such as this show how the 'flapper came to signify the hallmarks of modernity, such as novelty, change, youth and innovation'[642] and in turn so did the technology the flapper was being associated with. Liz Connor elaborates further that the public visibility of 'the flapper' allowed for 'their mechanical reproduction as spectacle'.[643] In doing so this photograph is attempting to portray the cross-gender and cross-generational appeal of the wireless set. In this magazine cover, the male hobbyist is not framed tinkering alone in his own space with his technology but as presenting it to his female family members, presumably his wife, daughters, and his housemaid. These female figures are presented as part of the domestic space as much as the furniture is whilst the male

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[642] Conor, *The Spectacular Modern Woman: Feminine Visibility in the 1920s*, p.219.

[643] Conor, *The Spectacular Modern Woman*, p.209.

figure, dressed in a suit and 'his' technology are purposefully highlighted as something new and as an object of fascination for the women to witness and listen to. This can be related to the reality that in 1922 owning a functioning wireless set in the domestic setting and having it used by the entire family was relatively rare, as Table 10 shows. But it also reveals that those who had invested in the hobby were beginning to bring it within the family home and into contact with their families. Imagery such as this cover convey to the male hobbyist reader, who may have kept his interest in the wireless private, the domestic possibilities of wireless by highlighting how he could make the technology (and therefore his hobby) appealing to the female members of his family. Women are still largely presented as incapable of truly understanding the technology in the same way a man could. But here they are pictured as obtaining some recreational use from it, at the moment when the BBC was establishing itself and as programs that appealed to women began to be broadcast. Male-focused magazines such as the *Popular Wireless Weekly* visualised the potential uses and the growing public interest in wireless technology by having a man (representing the reader) explaining and demonstrating it to this wider audience. By placing the male as an authority figure the wider audience for wireless is represented as female. Yet they are represented as being ignorant in relation to the technology, despite the thousands of women employed within the electronics industry throughout the 1920s. These representations contrast strongly with how the electronics industry would later rely upon women demonstrators to convey the technology to an audience. In this regard this change demonstrates that the gendering of the technology as feminine was directly linked to its wider adoption into the mainstream.

In Figure 56, then, the wireless technology is placed within the domestic space but presented as something alien and new, and was linked directly with masculinity

rather than as inherently part of the female domestic space. This can be attributed to the fact that the cover is attempting to highlight how it was up to the knowledgeable male readership of the magazine to 'spread the word' about the technology to their family members. This understanding of the relationship between men, women and technology was not just something created by those marketing the technology or by the media aimed at wireless enthusiasts but stemmed from long-standing perceptions of gender and technology, which were often upheld by the enthusiasts themselves, who restricted and defined their hobby through resistance to female participation. For instance, in one recollection a young American woman 'recounted that when her brother failed to ground his set properly, she studied *Radio World* and memorised some of the technical phrases… and sprang them on her brother who nearly had a Dutch fit' at her familiarity with 'his pet hobby'.[644] This is not to say that all wireless enthusiasts of this period or their wireless magazines were actively hostile to female participation. But there was a cultural assumption that women lacked the interest and aptitude for such things and that being involved in such activities would distract from 'what was most natural to them: to be mothers and wives'.[645] Of course, these traditional gendered assumptions completely ignored the fact that women made up a significant number of the workforce manufacturing the wireless technology. While a traditional understanding of women's roles persisted in the interwar period, as the previous chapters have shown commercial and economic

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[644] Louis Carlat, 'A Cleanser for the mind: Marketing Radio Receivers for the American Home 'in *His and Hers: Gender, Consumption and Technology*, ed. By Roger Horowitz and Arwen Mohun' (Charlottesville: The University Press of Virginia, 1998), pp.115-138 (p.118).

[645] Mary Wyer 'High Hopes, Broken Promises and Persistence: Educating women for scientific careers', in *Women, Science, and Technology: A Reader in Feminist Science Studies*, ed. by Mary Wyer, Donna Cookmeyer, Donna Giesman, Mary Barbercheck, Hatice Ozturk, Marta Wayne (New York: Routledge, 2001), pp. xix-3 (p.1).

interests reshaped gendered discourse about the employment of working-class women and represented women as technologically knowledgeable. A similar change would happen, for commercial reasons, when it became evident that those with the most time to consume wireless and its broadcasts were middle-class housewives, despite the prevalent notion that the technology was of most interest to male enthusiasts.

5.3 Gender and Changing Interwar Set Design

Immediately following the First World War the perception that wireless, its construction and its use were masculine pastimes was embedded into the technology through its physical appearance. Sets openly displayed the electronics within them, without consideration for aesthetic appearance or ease of use. This section considers the changing physical appearance of the wireless sets from the interwar period and how this reflects the technology's dynamic interplay with gender, the cultural perceptions surrounding it and women consumers' role in shaping its development. In 1922 wireless sets were still in large part produced and constructed by individual hobbyists. This meant that they were not 'designed', but appeared as pieces of complicated technology, with elements such as their thermionic valves being exposed. These early sets reveal little concern for appealing aesthetics that would endear the product to a mass audience who did not hold extensive knowledge about the technology. This is best exemplified by a closer examination of the types of wireless sets that were being created by hobbyists during the early 1920s before radio ownership had reached a truly mass ownership.

Figure 57 Alan T Lee's Valve Radio 1923 (Photograph 1)[646]

Figure 58 Alan T Lee's Valve Radio 1923 (Photograph 2)[647]

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[646] Alan T Lee's Valve Radio 1923, 1975-0018,NSMM.

[647] Alan T Lee's Valve Radio 1923, 1975-0018,NSMM.

Figure 59 Alan T Lee's Valve Radio 1923 (Photograph 3) [648]

Figure 57, 58 and 59 show three varying angles of a valve radio set constructed in 1923 by wireless enthusiast Alan T. Lee, the founding member of the Derby Wireless Club. This wireless set was constructed at the same time as the *Popular Wireless Weekly* cover, and just one year before the BBC was launched. It exemplifies the kind of objects wireless enthusiasts were making to experiment with the technology and to 'listen in' to early broadcasts. This lack of consideration for design or for the outward appearance of the set's electronics reflects the interest such sets held for male hobbyists. As one social commentator from the period remarked 'it seems to women the last thing men want to do with their wireless set is listen to it. They want to play with it, fiddle with it incessantly'.[649] All sets,

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[648] Alan T Lee's Valve Radio 1923,1975-0018, NSMM.

[649] The Open University, 'Roaring Twenties? Europe in the interwar period', <https://www.open.edu/openlearn/history-the-arts/roaring-twenties-europe-the-interwar-period/content-section-0?active-tab=description-tab> [Accessed 01 June 2019].

including the simplest and cheapest sets that working-class men could purchase and

construct during the interwar years, reflect this through their objects appearance.

Figure 60 Home Made Single Valve Receiver 1926 [650]

Figure 60 is an image of a wireless enthusiast's home-made single valve receiver

built in 1926. While this set is simpler and smaller than the previous example the

valve and other elements remain visually prominent, and the set is designed to

facilitate 'tinkering' and the regular addition of newer and better valves. When

taking Figure 60 into consideration, it is evident that in Britain during the 1920s the

hobbyists and enthusiasts' relationship with the technology was a defining aspect of

how the technology was produced, how it looked, how it was consumed and how it

was marketed. In Britain, these gendered understandings of the technology would

remain prominent throughout the interwar period. In other countries, such as the

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[650] Home Made Single Valve Receiver, Y7001-0428, NSMM.

United States, however, the technology became a mass market product much faster, and the hobbyist aspects were not as enduring in the promotion and cultural representation of the technology as they were in Britain. However, as I have suggested, just as the manufacturing process of wireless technology became gendered so did its consumption as its availability, affordability and programming expanded.

5.4 Class, Gender and Interwar Wireless Programming

As wireless grew in popularity, sets and valves began to be mass produced at a volume previously unseen across the country and a larger swathe of the British population was increasingly capable of picking up the BBC signals as well as other broadcasters originating from continental Europe. This meant that the audience rapidly expanded beyond male enthusiasts and women were increasingly exposed to and began to consume wireless technology. As Table 11 shows, the acceptance and promotion of women listeners as a key audience for wireless can be attributed to the overall increase of those listening to wireless as a form of entertainment rather than any growing interest in the technical hobbyist culture or the self- assembly aspect of the wireless. While the figure of the male enthusiast remained a prominent figurehead in popular perceptions of the wireless throughout Britain's interwar period, it is clear wireless increasingly appealed to a mass and growing female audience through its ability to entertain and educate on a wide variety of topics. As I have shown, large public events such as Radiolympia functioned as a celebration and confirmation of this growing mass appeal of wireless technology and its broadcasts.

This development applies specifically to middle-class women. Working-class women and men, and middle-class men, spent most of the day at work whilst the majority of middle-class women's daytime domestic work and childcare took place within the home. As Anne Karpf notes, 'radio had a special relationship with women's lives in that it is an explicit accompaniment to them- a commentary, or a counterpoint'.[651] Eventually, from the perspective of electronics companies and the advertisements they paid for, it became apparent that 'radio played an important role in the lives of housewives, relieving their feeling of isolation and helping to lighten the spirits while doing chores'.[652] This newly perceived marketing opportunity both undermined and reinforced gender stereotypes. It continued to emphasise that a women's position was within the domestic space and that the 'lives' of the nation's housewives were limited to their work done within the home. Yet, noticeably, and as a function of advertising, it began to be suggested that the typical housewife actually found their position isolating and a chore rather than a naturally fitting and fulfilling role in life. The further implication was, of course, that the drudgery could be alleviated by purchasing a specific product, in this case a wireless set. A cursory glance at the daytime broadcasting schedules reveals that they developed in favour of middle-class housewives during this period once the BBC has been properly established. The BBC's *The Listener* provides a summary of lectures and speeches broadcast by the BBC which reveals how the broadcasting schedule was shaped by class and gender. For instance, the July 1924 edition of the BBC's *The Listener*

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[651] Anne Karpf 'Women and Radio' in *Women and Media*, ed. by Helen Baehr (Oxford: Pergamon Press, 1980), pp.41-54 (p.54).

[652] Caroline Mitchell, 'On A Women's Wavelength?' in *Women and Radio: Airing Differences*, ed. by Caroline Mitchell, (London, Routledge, 2000), pp.11-14 (p.3).

details popular history broadcasts such as 'Tudor Biographies'[653]. Alongside

historical, scientific and educational items such as this, broadcasts such as 'Holiday

Drama by Geoffrey Whitworth'[654] are listed, which focused on holiday experiences

and proclaimed 'on the whole I have always thought that the most enjoyable kind of

holiday is that which bears some relation to one's own interests'.[655] While reviewing

holiday destinations the article insists 'August is the worst possible month in these

great play producing cities' and that 'only the lightest forms of entertainment

survive, and my inquirer will not presumably be satisfied with these'.[656] From these

examples it is clear that the programme output of the BBC consisted mainly of

speeches and lectures directed at those with enough economic security to seek out

hobbies and holidays and with an assumed educated taste in 'higher' forms of

entertainment. Such broadcasts, and particularly the historical and scientific ones,

can also be seen as part of the BBC's ambition to 'lift up' the working-class but

realistically due to the limited applicability of many of the broadcasts and the cost of

listening, it is likely that listeners were already interested or engaged with such

topics and were primarily from the educated middle-classes. There were also more

tailored broadcasts that attempted to appeal to the middle-class housewives. For

instance, an October 1929 edition of *The Listener* summarised a talk that was

broadcast a few days prior entitled 'The Art of Easing Housework'[657] by Winifred

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[653] BBC, *The Listener*, 24 July 1929, p.94.

[654] BBC, *The Listener*, 24 July 1929, p.124.

[655] BBC, *The Listener*, 24 July 1929, p.124.

[656] BBC, *The Listener*, 24 July 1929, p.124.

[657] BBC, *The Listener*, 9 October 1929, p.485.

Spileman Raphael of the National Institute of Industrial Psychology. The talk

attempts to advise housewives how to deal more efficiently with household chores

while their husbands are away at work. In the talk Raphael states 'You owe it to

others to try and ease your housework, but you also owe it to yourself' arguing that

'the housewife's work happens to be within the home, but she deserves rest there

also as much as any other member of the family, and if she does not take it she hurts

not only herself by becoming nervy and tired she spoils the rest of other members of

the family'.[658] Such instructional programs were clearly aimed at the middle-class

housewife, and here the technology facilitated women's contact with the gendered

expectations of wider British society. Unlike the BBC's wider ambition to lift up the

population, broadcasts such as this neatly defined the female listener by their

domestic role and instructed them how to fulfil it more efficiently, just as working-

class women were experiencing the new 'efficiency' and managerial techniques

being deployed on the factory floor.

Much like the Bedaux system managed how manufacturing workers produced

goods, new technologies such as the vacuum cleaner managed how work was

conducted in the home. As Ruth Cowan states 'we try and obtain tools that will do

the jobs we want done; but, once obtained, the tools organise our work for us in

ways we have not anticipated'.[659] Furthermore, Bill Luckin highlights how the

notion of 'household science' was adopted in interwar Britain from American

specialists which attempted to manage 'the economy and rationalisation of physical

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[658] BBC, *The Listener*, 9 October 1929, p.485.

[659] Ruth Schwartz Cowan, *More Work for Mother: The Ironies of Household Technology from The Open Hearth to The Microwave* (New York: Basic Books, 1985), p.9.

movement'[660] in relation to housework. Both workspaces operated according to the

traditional understandings of women's skills. But the reality was more complicated,

and the wireless set potentially furthered the tensions surrounding these concepts.

Michael Bailey argues that 'broadcasting represented a paradoxical challenge to the

patriarchal authority of the head of the house', arguing that the 'wireless was saying

that in household matters at least, mum knows best'.[661] However, while broadcasts

about 'household science' delegated the running and workings of the domestic space

entirely to the middle-class housewife this was hardly a revolutionary change and in

large part simply reinforced old ideas through new technological means. As Maggie

Andrews argues, maintaining the domestic space was something 'the BBC saw

itself as playing a part in assisting'.[662] Other programmes and broadcasted talks

exemplify this further such as one from 16 October 1929 by A.J Bendy entitled

'How to polish your wireless cabinet'.[663] The talk includes instructions such as 'take

some ordinary linseed oil and apply all over the surface rubbing off afterwards with

a dry rag'.[664] Programming such as this gave ownership and maintenance of the

technology over to the women and acknowledged it as part of the domestic domain

and routine. While in the 1920s the wireless set was identified with the male

hobbyist, wireless broadcasting was increasingly targeting the wives and daughters

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[660] Bill Luckin, *Questions of Power: Electricity and Environment in Interwar Britain,* (Manchester: Manchester University Press, 1990), p.31.

[661] Michael Bailey, 'The Angel in the Ether: Early Radio and the Constitution of the Household' in *Narrating Media History*, ed. by Michael Baily (Oxon: Routledge, 2009), pp.52-65 (p.58).

[662] Andrews, *Domesticating the Airwaves*, p.87.

[663] BBC, *The Listener*, 16 October 1929, p.525.

[664] BBC, *The Listener*, 16 October 1929, p.525.

of those hobbyists. Speeches and programmes on the BBC such as 'Rambling Clubs for Women'[665] and 'Electrical Work for Girls'[666] also became much more frequent by the onset of the 1930s. This development started a process of 're-gendering' the wireless set to something perfectly at home in the feminine domestic space and a technology in constant contact with women both at a production and consumption level.

5.5 Re-gendering the Interwar Wireless

Programming was not the only aspect of the technology that was being shaped to appeal to a female consumer base. In the interwar years both advertisements in magazines and newspapers and the aesthetics of technology itself were shaped by the electronics companies with women in mind. Wireless technology began appearing alongside other domestic electrical goods such as vacuum cleaners and the wireless set was represented as a centrepiece of the family home in magazines such as *Good Housekeeping*. In comparison to the specialist wireless magazines aimed at men, these magazines did not feature wireless nearly as much due to their broader subject matter but began to increasingly do so by the late 1920s and throughout the 1930s. *Good Housekeeping* operated with a specifically middle-class and female audience in mind and therefore de-emphasised the technological aspects of wireless. Rather, the electronics companies that chose to advertise in the magazine recontextualised it by gendering it as a crucial aspect of the interwar

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[665] BBC, *The Listener*, 14 May 1930, p.983.

[666] BBC, *The Listener*, 1 January 1930, p.22.

domestic space and as something the 'typical' housewife must be aware of in the

quest for the 'perfect' British home.

Figure 61 Ediswan Advertisement 1922[667]

Figure 62 Efescaphone Wireless Set advertisement 1925[668]

Figure 63 Dunlopillo Cushioning advertisement 1935[669]

Figures 61, 62 and 63 are taken from the 1922, 1925 and 1935 editions of the *Good Housekeeping* magazine. The magazine focuses mainly on articles related to domestic housekeeping and how to deal with domestic servants.[670] The magazine also contains a plethora of advertisements for the emerging number of electrical goods of the period such as ovens and vacuum cleaners. Electronic goods such as wireless sets appear less frequently (especially in the early 1920s) but begin to appear more often by the later 1920s. The three examples above demonstrate how the representation of wireless technology and its assumed uses changed over the

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[669] *Good Housekeeping,* March 1935, p.149.

[670] The magazine started up in the USA in 1885 (made a monthly publication in 1891) with a focus on women's interests and began publication in Britain in 1922.

interwar years. Figure 61 is taken from the earliest edition of the magazine in 1922 and highlights the fact that electronic goods were being marketed in women's magazines to some degree. This example places the thermionic valve amongst other consumer products linked to housework and domestic upkeep. There is no indication that the wireless technology (unlike the vacuum cleaner) is being directly marketed towards the female reader or her needs. However, we can ascertain from this an assumption on the part of companies like Ediswan about the general awareness of middle-class readers regarding wireless technology. Housewives were acutely aware of their husbands' pastimes and picked up on the relevant products. For example, one woman from Warrington when recorded for a local history project recalls that in the 1930s she used to buy radio parts for her husband:

> When it was his birthday, or when Christmas came, I used to give him parts
> for his wireless, d'you see. I'd put fourpence away every week to save up to
> get him the bits he was after. All the family- not just me- bought him these
> different parts for it and he builds it up himself.[671]

Once wireless had been adopted into the living room the electronics industry at large safely assumed that housewives had a level of authority regarding purchases related to it. While the valve is placed within the advert within a women's magazine, then, the understanding was that it would be purchased by a woman but for use by a male consumer. Many articles from this period of the magazine's history attempt simply to introduce the concept of wireless to middle-class women. For instance, an article written by John Ellecot Glenner entitled 'Wireless for the Home' attempts to explain how wireless works and how to use it safely. The article states 'broadcasting will

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[671] The Open University, *Roaring Twenties? Europe in the Interwar Period,* (The Open University).

undoubtedly be welcomed by all, and in particular those who value their homes',

and that the main benefit of the technology for women is that 'it offers every

encouragement for people to receive their entertainment within the comfort of their

home'.[672] This implies the technology will help in keeping the housewife's husband

and sons at home rather than staying out to find entertainment elsewhere. The article

also attempts to reassure female readers, as the article suggests that 'women are

scared of the thought of anything electrical because they do understand the

apparatus' but that 'radio offered no such risks'.[673] Graeme Gooday highlights how

a 'fear of electricity constrained the path and scope of its domestication in strongly

gendered ways'.[674] It was therefore women 'who featured prominently in

countervailing messages in campaigns for the safety of technology.'[675] The rhetoric

found in 'Wireless From Home' thus attempts to circumvent long held tensions and

anxieties around electricity being introduced into the home. The article attempts to

separate wireless from these assumptions and also to assure female readers that it is

safe to keep and an unobtrusive (even complementary) addition to a domestic

setting. These early representations of wireless in middle-class women's magazines

contextualise the wireless set as something primarily of interest to their husband or

children but also as something women should attempt to become more familiar and

comfortable with as it gained importance in the family home.

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[672] John Ellecot Glenner 'Wireless for the Home' *Home Sweet Home: The Best of Good Housekeeping 1922-1939*, (London: Edbury Publishing, 1992), p.22.

[673] Glenner 'Wireless for the Home' *Home Sweet Home: The Best of Good Housekeeping 1922-1939*, (London: Edbury Publishing, 1992), p.22.

[674] Gooday, *Domesticating Electricity*, p.89.

[675] Gooday, *Domesticating Electricity*, p.89.

It follows then, as the interwar years progressed and wireless grew in popularity, that advertisements began to directly target middle-class women as a prospective mass audience for the technology outside of their husbands' hobbyist interests. Figure 62 shows an advertisement from 1925 for an Efescaphone wireless set. The set is presented in a fashionable cabinet casing, and it is shown being enjoyed by both a man and a woman. In comparison to Figure 51 we can see a difference in tone for different audience and at a different historical moment in terms of how the technology was being marketed to a magazine's readership. Figure 51 does not place the technology in a real-world context and focuses exclusively on how impressive its technology is by claiming how effective the set is at 'changing range and tones'[676] and protecting its valves, whilst Figure 62 assumes no knowledge about the technology. Rather, it focuses on 'the simplicity of operation' and the 'handsome cabinet work'[677] whilst presenting the technology specifically as a comfortable part of the domestic space and showing its cross-gender appeal.

Unlike the earlier valve advertisement which had assumed some understanding of a husband's hobby, this advertisement has removed any appeal to hobbyists or technical know-how and has delegated this to a wireless dealer. In doing so, advertisements such as this position the wireless set as a consumer product with a more permanent and less intrusive position within the home and not as something to be tinkered with by male lay 'expert'. As Louis Carlat explains 'the transition from male toy to a component of the domestic space required recasting radio hardware as

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[676] BBC, *BBC Handbook* (London: Savoy Hill,1928), p.4.

[677] *Good Housekeeping*, January 1925, p.143.

a feminine object and listening as a feminine activity'.[678] This was achieved through advertisements like this as well as the expansion of the BBC and its broadcasts which targeted women listeners. Figure 63 highlights how by the mid-1930s this process had significantly influenced the wider cultural perception of wireless in relation to women and the domestic sphere. Figure 63 is an advertisement from a 1935 edition of *Good Housekeeping* for Dunlopillo cushions which purport to be 'an entirely new standard of luxury and neatness in lounge furniture'.[679] From advertisements like this we can conclude wireless had been fully embraced by manufacturers such as Ediswan and the advertisers they employed as a domestic item consumed by both men and women. The advertisement is using the potential of more comfortably and easily listening to wireless as a selling point for its own product. By this point the wireless set had become part of the commonplace imagery when depicting a middle-class living room. The man and women are placed in an equal position to the technology, a significant change from the representations in the early hobbyist magazines which placed the man in a position of knowledge and authority. In comparing these advertisements, a developing trend in relation to electronics and wireless technology is clear. In the early 1920s, the technology was exclusively marketed towards male hobbyists and in women's magazines the electronics companies assumed a husband or male relative with an interest in the technology. As broadcasting shifted its content to appeal to the middle-class housewife, electronic companies shifted how they presented the technology itself. This often-meant downplaying the technology and its capabilities while consciously

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[678] Carlat, 'A Cleanser for the Mind', p.116.

[679] *Good Housekeeping,* March 1935, p.149.

placing wireless directly next to images of women and within a domestic setting to

'feminize' the product and broaden its appeal.

<u>Figure 64 Ferranti Model 31 (MkII) Four Valve Radio Receiver 1929</u> [680]

Figure 65 Ferranti Radio 1930[681]

Figure 66 Mains Minor Valve Radio Corporation 1939 [682]

This imperative also strongly influenced the designs of the sets themselves in order

be effectively integrated into the middle-class domestic space. Figures 68, 69 and 70

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[681] Ferranti Radio 1930, 1975_7 22A, NSMM.

[682] Mains Minor Valve Radio Corporation 1939, Y2004.16, NSMM.

highlight how early sets often built by single male enthusiasts emphasised their origins as constructions related to a fascination with how the technology worked. Figures 64, 65 and 66 are later examples of mass-produced sets that demonstrate new trends that mirrored the new approaches to advertising radio sets. They show that the designs of the sets changed dramatically from the examples from the 1920s to the 1930s. The sets of the 1930s conceal and mask the obvious technology that had once been displayed prominently. They are designed to look like furniture and cabinets, so they fitted more naturally within the domestic space. Such sets were assumed to be more appealing to potential female customers. With women being in charge of the domestic space and the wireless set increasingly positioned as a domestic product, women would have been making the purchase, and this change of design is representative of the fact that middle-class women's taste and judgment were a major factor in the marketing and design of the later interwar mass-produced wireless sets.

Figure 67 Radio Lamp [683]

Figure 67 shows a wireless built into a freestanding mahogany standard lamp by an unknown maker which was built around 1932. Likely manufactured in Europe, designs such as this symbolise the wireless set's complete transformation away from a masculine pastime to a feminized and domesticated product that was appealing directly to middle-class women while at the same time being increasingly manufactured by the hands of working-class women. While some historians have argued that wireless represented a change in the established relations within the domestic space[684], it is clear the domestic space of the interwar period equally shaped the technology, both how it looked and how it was sold. Martin Pugh argues

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[683] Radio Lamp, Item Number 73, Area 3, NSMM.

[684] Andrews, *Domesticating the Airwaves*.

that this development of the housewife into a proactive consumer of electronic goods, replacing the tension and worries that existed around women's exposure to the technology, was widely accepted as it was form of consumerism that was 'cosy, individualist, home-owning and materialist'.[685] Therefore, as working-class women became closely associated with the manufacture of the technology despite resistance to their role as industrial and manufacturing workers from certain groups, middle-class women came to define the consumption of the technology

5.6 Domestic Service and the Interwar Electronics Industry

Class relations were also altered, or at least were perceived to be under threat due to the developments of technology of the home during this period. A key aspect of this was the role of female domestic servants in the middle-class home. The rise of the middle-class throughout the nineteenth century had created the opportunity for the domestic service industry to flourish in Britain and by 1901 it was not only the major employer of women in the country, but, with a total labour force of nearly one and half million persons, also 'formed the largest occupational grouping of any kind, bigger than mining engineering or agriculture in which this female servants were numerically predominant'.[686] However, as I have detailed in previous chapters, new employment opportunities in industries, such as electronics, opened up for working-class women during the interwar period. The appeal of these new jobs can be attributed to the harsh conditions of domestic service and the low pay, alongside the First World War demonstrating the capabilities of working-class women in positions

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[685] Pugh, *Women and the Women's* Movement, p.292.

[686] Horn, *The Rise and Fall of the Victorian Servant,* p.13.

previously thought unsuitable[687]. Overall, by 1931 the number of domestic servants being employed across Britain had significantly dropped: 'about half a million households, or just under five percent of all private families, employed resident domestics' whilst in contrast 'in 1911 there were estimated to be 800,000 families in this country with servants'.[688] The growing middle-class anxiety surrounding this 'servant crisis' are played out in the pages of magazines such as *Good Housekeeping*, alongside the emergence of advertisements and technologies attempting to exploit it. An article from the September 1923 edition of the magazine by a Mrs Alfred Sidgwick entitled 'The professional home-maker: Another view of domestic service' bemoans the prevalent social stigma and perception of inferiority surrounding domestic service. The article highlights one working-class woman who complains that 'a man will dance with you, find out you are a skivvy and never dance with you again'.[689] In comparison, a job in a factory manufacturing thermionic valves had its own harsh conditions and repetitive work but was viewed by some as a step up from an expected employment trajectory within the domestic space and was associated with a new and exciting technology rather than the traditional subservient position as a servant. Therefore, the stigma of service combined with higher wages and better conditions, particularly working hours, shifted working-class women out of the domestic space into factories manufacturing consumer goods such as thermionic valves and electrical goods. In response, advertisements aimed at selling new labour-saving devices attempted to supplant the

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[687] Storey and Housego, *Women and the First World War*, p.31.

[688] Horn, *The Rise and Fall of the Victorian* Servant, p.167.

[689] *Good Housekeeping*, September 1923, p. 21.

domestic servant as an ideal in the minds of middle-class women. For instance, a vacuum cleaner advertisement from September 1923 insists that their product was the new 'servant to the home'.[690] Electronic devices like the wireless set were marketed in a similar fashion as a device to accompany and distract housewives from their own housework. This shows how gendered perceptions recast wireless from a purely leisure-based device to a workplace-based one when taking the female audience into consideration. When under the auspices of the male enthusiast the technology was based around free time and a hobby and marketed as such, for the housewife the technology was promoted as having inherent and practical value to her daily work with broadcasts even built around facilitating this and instructing her.[691] Unlike women who worked in factories manufacturing electronics and other goods, housework was a solitary (and unwaged) role and wireless with its targeted programming acted as a substitute for belonging to a work community, a defining aspect of work life. This stands in sharp contrast to wireless beginning as a purely recreational and solitary 'fun' activity for the male hobbyists of the household.

In this context, the manufacture of electronics goods did impact class relations between the middle-class and working-class women. While the consumption of the technology did not liberate or challenge middle-class women's role in the domestic space (often reinforcing it), the production of the technology did challenge gendered notions about working-class women's role in the workforce and in class terms, physically removed them from the middle-class home. Although, this cannot be considered an endpoint or a complete transformation of these class dynamics.

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[690] *Good Housekeeping*. September 1923, p.73.

[691] BBC, *The Listener*, 9 October 1929, p.485.

Working-class labour was still prominently featured, consumed and benefitted from in the middle-class domestic space. Working-class women were helping to produce the devices that were being marketed as their replacements. This applies specifically to electrical devices such as vacuum cleaners, but it also applies to the wireless set to some degree. As Kate Lacey argues, male wireless advertisements could admit housework could be 'a dull monotonous, and soul-destroying occupation' while highlighting how 'radio eased loneliness, ameliorated the monotony'.[692] Despite not being not a labour-saving device, the wireless was marketed to middle-class women as something to keep them company whilst completing housework and alleviating the drudgery of being alone through the day, a more common situation with the exodus of many domestic servants to the factories. In this way the adoption of electronics such as wireless reshaped but maintained class dynamics through a cycle of production and consumption.

In this chapter I have focused on middle-class women as consumers of wireless because throughout the interwar years wireless ownership remained mainly a middle-class option due to its cost. However, by the late 1930s wireless and its broadcasts more openly appealed to and came under the ownership of the working-classes, including the women who had been manufacturing them. As Table 10 and 11 showed, wireless began as a middle-class past time but did not remain so and eventually incorporated the mass of the British population. A major aspect of this was the increased availability of broadcasts and the lower costs of ownership. Another was the general appeal of the content of wireless broadcasts offered to the public for entertainment value and relaxation, especially for those who had been

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[692] Kate Lacey, *Feminine Frequencies: Gender, German Radio, and the Public Sphere, 1923-1945* (Ann Arbor: The University of Michigan Press, 1996), p.41.

working long and stressful hours. One working-class family recalls how in the 1930s they do not 'bother to go out on a Saturday night when the winter programmes begin. We just settle down by the fire'.[693] This desire for light entertainment often differed from the BBC's approach to broadcasting. The number of lectures, speeches and topics such as 'Laziness as an art form: A holiday meditation'[694] demanded an attentive audience or assumed an economic standing that working-class listeners did not possess. Working-class women were often required to work during the day and then also complete the housework in the evening. Because of this they would have listened to the wireless set in the background while completing such work: and 'this use of radio as background noise was [...] distinctively working-class; in contrast, the middle-class family would tune in at specific times and listen attentively'.[695]

This desire for lighter entertainment and music by working-class women goes some way to explain the growth of the electronics industry as more stations developed, such as those in Europe, and the increased appeal owning a wireless set had to working-class families by the 1930s. A key station in realising this appeal was Radio Luxembourg which began broadcasting in 1933. The commercial and light entertainment presented on Radio Luxembourg found a large audience in Britain thanks to its output of 'American jazz and soap operas'.[696] British listeners could tune into Radio Luxembourg on a Sunday rather than having the only option

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[693] Andrew August, *The British Working Class 1832-1940* (London: Routledge, 2014), p.211.

[694] BBC, *The Listener*, 31 July 1929, p.1.

[695] The Open University, *Roaring Twenties? Europe in the interwar period,* (The Open University).

[696] Erik Barnouw, *Media Lost and Found,* (New York: Fordham University Press, 2001), p.109.

of listening to the BBC's religious services. While the BBC captured, according to their own statistics, '33%' of the audience, Radio Luxembourg pulled in around '4,250,000 on Sunday afternoons and 3,200,000 on Sunday evening'.[697] As Table 11 shows this was a significant percentage of the entire audience that the BBC had calculated as being capable of receiving their broadcasts. It can be ascertained then that the broadcasts outside of the BBC held a large amount of people's interest, particularly those of a working-class background who were put off by the BBC's middle-class aesthetic and paternalist values. Brad Beaven highlights statistical results of research surveys that show how across the country 'a higher proportion of the middle-class than the working-class liked listening to Shakespeare, while more working-class listeners wanted more variety programmes'.[698] While it is true mass ownership of wireless sets did not fully take effect until after the Second World War it is no less true that by accepting women as consumers of the technology the industry experienced a significant growth during this time, initially facilitated by working-class women on the production end, by women as public demonstrations and middle-class women as consumers, leading to the wireless set eventually entering the majority of Britain's homes and being completely reshaped and gendered by this process.

In conclusion, in this final chapter of the thesis I have demonstrated the important role women held as consumers of wireless technology and how this was represented in advertising material and the physical appearance of the technology. I have shown

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[697] Robert S. Fortner, *Radio, Morality, & Culture* (Carbondale: Southern Illinois University, 2005), p.51.

[698] Brad Beaven, *Leisure, Citizenship and Working-Class Men in Britain, 1850-1945* (Manchester: Manchester University Press, 2005), p.205.

that while throughout the interwar years wireless technology remained a product mainly owned by the middle-classes, the technology precipitated a changing dynamic in relation to gender, class and the domestic setting. As pieces of technology the valve and the wireless set were inherently gendered through their initial association with the male hobbyists and enthusiast groups that were the most evangelical about the technology following the First World War. However, much as the manufacturing of the technology caused a re-gendering of the workplace and the manufacturing process, economic incentives and practicalities initiated a re-gendering of the technology in order to place it effectively in the feminine domestic space. This is evidenced by the emergence of the wireless advertisements in magazines aimed exclusively at middle-class women. Furthermore, the wireless sets held at the National Science and Media Museum and the National Science and Industry Museum reveal the physical and aesthetic nature of this evolution as the designs of the sets changed from resembling obvious pieces of technology to unassuming yet visually pleasing pieces of domestic furniture.

  The introduction of this new technology into middle-class households happened alongside a growing fear of the servant crisis which marketers eagerly exploited, yet this change simply maintained the influence working-class labour held inside the middle-class home through their roles in manufacturing goods for the domestic space, including the valve and wireless sets. Throughout the interwar years, the consumption of wireless technology was completely transformed from masculine hobby to a domestic product. This change in how it was being consumed shaped the set designs, marketing campaigns and output from broadcasters. While still being out of the economic reach of many working-class families, British wireless expanded its appeal beyond the BBC. Alongside this, the eventual emergence of cheaper sets ensured that the technology had permanently secured its place within

the domestic space and the British family home across all classes until the emergence of the television set finally provided a challenge to its established position as the central piece of technology in the feminized domestic space. Finally, by highlighting the roles and representations women consumers possessed in relation to the electronics industry and its major products my analysis compliments my initial overview of the electronics industry in the first chapter. This chapter has shown that the roles and representations of women in the electronics industry were just as impactful outside of the industry as they were within it.

Conclusion

Throughout this thesis I have analysed the multiple roles and representations that women held in relation to the British interwar electronics industry through a visual cultural approach. I have shown how the companies and employment patterns that constituted the British interwar electronics industry were in large part shaped by the impacts of the First World War. During the war the desire for more effective wireless communication drastically increased the need to produce large numbers of valves. Much like other British industries during wartime this facilitated the employment of women. However, unlike other industries and sectors of the economy the electronics industry consistently relied upon women workers as manufacturers and demonstrators throughout the interwar years when others attempted a reversal to pre-war norms. This was the case both in the factories manufacturing the wireless technology and at public exhibitions to promote the technology. Women, particularly middle-class women, also served as one of the industry's most important customer bases and as consistent listeners to wireless broadcasts following the establishment of the BBC.

   The BBC is an aspect of this study that highlights elements of the electronics industry and broadcasting that were unique to Britain. However, it must be acknowledged that the changes I have analysed were happening in the wider context of increasing transnational trade, and the exchange of practices in factory organisation, marketing and promotion, and consumer habits. The shaping of consumer habits through advertising in the style of the examples I have used were directly influenced by the growth of the mass market advertising industry in the US

established in places such as Madison Avenue, New York where J.Walter

Thompson, one of the earliest advertising agencies was established.

  Factory management styles and techniques were also adopted in Britain that had

initially been tried elsewhere, such as the Bedeux system which was first introduced

in American factories. This system purported to incentivise manufacturing workers

by paying paid them based on their speed at completing their work. Although, this

system led to multiple instances of strikes and industrial action in Britain following

its introduction, such as in the Rover car manufacturing plant in 1929.[699]

International trade, imports and exports, were key features of many countries

interwar economies and industries. For example, Britain and the US were the largest

exporters of machinery belting in the 1920s, leather and rubber respectively.[700] This

also applied to many countries consumer electronics industries, particularly the US

which exported its valves and other components across the world in the interwar

years. Although in Britain, exports were resisted by the V.M.A which positioned the

British consumer electronics industry as a domestic product primarily for a domestic

consumer.

  Despite conservative social opposition and direct opposition from organisations

such as the AEU women came to hold significant roles in the industry. This can be

attributed to the economic incentives of cheap labour, the experiences of the war, the

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[699] Laura Lee Downs, 'Industrial Decline, Rationalization and Equal Pay: The Bedaux Strike at Rover Automobile Company' *Social History* 15, (1990), pp.47-73.

[700] Everett Guy Holt, *International Trade in Machinery Belting*, (Washington: US Government Printing Office, 1925), p.49.

weakening of traditional gender expectations and the gendering of new jobs. Socially constructed beliefs about the relationship between women, gender and technology influenced how these roles were represented and promoted. To some degree the representations I have focused on in this thesis, capable workers, knowledgeable demonstrators, and informed consumers, challenged traditional notions of gender that positioned women as unable to comprehend new, supposedly masculine, technologies and function effectively in an industrial workplace. However, as I have argued and demonstrated, these visual representations of women workers in manufacturing, demonstrators and consumers often helped to reinforce other gendered stereotypes such as those that regarded working-class women as an unambitious and unthinking workforce and sequestered middle-class women into the domestic space. It fell to women led organisations such as the WES to publish visual representations of women that demonstrated them as skilled and capable industrial workers able to deal with complex new technology, albeit in a limited way and through the filter of middle-class ambitions and concerns. Through, a visual analysis I have shown how the presentation of women workers in the industrial space by the electronics companies evolved from a curiosity during the war to a constant and reliable presence in the interwar years.

I began this thesis by providing the context for the rest of my chapters and arguing that the conditions of the First World War hastened the development of wireless technology and the production of new valves. To some degree the continued employment of women in the industry and how they came to be represented can be attributed to the legacy of the war. The gendered justification of women's suitability for manufacturing electronics due to their supposed small delicate hands and quick nimble figures was embraced following the example set by attitudes towards women factory workers in munitions factories during the war. Statements made about the

suitability of women workers for certain forms of industrial war work, which were in themselves reworked versions of arguments made about the suitability of women and children for factory work in the nineteenth century, helped to gender light industrial work. Representing mass production techniques as feminine was the common rhetoric utilised by the electronics industry in relation to women employees when combatting patriarchal or trade union opposition to the employment of women. The British electronics industry emerged following the direct experience that many mobilised men had had using wireless technology during the war.

This created a domestic civilian market for the technology immediately following the end of the war, which influenced the establishment of new electronics manufacturers that helped to further foster an experienced hobbyist culture and community around the technology, although, as I have argued, it was the female consumer who became the major driving force regarding the mainstream adoption of wireless technology in the interwar British home. The booklets and literature produced by the industry reveal a quick transition from wireless being represented as an effective wartime tool to being primarily a consumer product. This is further evidenced by the sheer number of differing types of valves that were manufactured and sold as early as the 1920s. The requirements of the war meant that the industry was heavily based in the south of England. However, some important companies such as Ferranti and Metropolitan-Vickers established their electronics manufacturing plants in major northern towns and cities such as Manchester because the traditional employers of working-class women (especially the textiles industry) were on the decline in these areas. The employment of women and the growth of the female consumer base was something that the electronics industry set out to maintain and expand following the end of the First World War, often using gendered imagery in connection with wireless technology to do so.

6.1 Women Workers and Electronics Manufacturing

Following this necessary synthesis of the wider context of the electronics industry I answered my first set of research questions which were: how and why did changes regarding the relationship between women and new interwar technologies meet resistance and opposition from interested groups such as trades unions? Secondly, how and to what extent were women working in the electronics industry organised as a workforce? To answer these questions, I analysed a variety of sources related to the cultural opinions regarding women at work and related to the labour and trade union movement, such as *The Eugenics Review*, *The Woman Engineer* journal, trade union and press reports on the AEU and recollections by women workers within manufacturing. I analysed the visual depictions in *The Woman Engineer* to show how middle-class women organised themselves around the concept of skill when faced with opposition from male trades unions. I have shown that the large-scale employment of women to manufacture valves and wireless technology did not occur without significant and prolonged opposition from political groups and most significantly the male dominated trades unions. Groups such as the Mothers' Union and conservative political groups urged that a strong division between the supposedly masculine world of work and the feminine domestic space be upheld. This was often presented as a return to a pre-war society that had not faced the upheaval of the First World War, and to a more 'traditionally' structured society that assumed women's primary role to be that of a stay-at-home heterosexual wife and mother. However, this belief did not reflect the reality of the complex and varied lives of women, and particularly of working-class women before or after the war

who had worked in older industries such as textiles due to economic necessity. The electronics industry and the production of wireless technology provided new opportunities for women's employment, but it was a shift in the type of work being done by women rather than a complete upheaval of the reality of working-class women's lives. Despite this, the electronics and electrical engineering industry had a close proximity to the wider engineering industry which was still a male dominated industrial space throughout the interwar years. As a result, women entering the industry faced strong and consistent opposition from many of the established male trades unions. This opposition applied equally to 'unskilled' working-class women and to the idea that a woman could be as skilled and trained as a male engineer or electrical engineer. While it was possible for women workers in the electronics industry to join the general trades unions the major engineering union, the AEU, remained staunchly opposed to women members well into the Second World War.

The undercutting of wages in combination with traditional gender views regarding women in industry provided ample reasons for the skilled trades unions to oppose the industry's reliance on 'unskilled' female labour and the acceptance of 'skilled' and trained women. My examination of trade union material and literature reveals a noticeable absence of discussions and representations of women working in the electronics industry. Neither the *Labour* magazine nor TUC meeting notes make any specific mention of the electronics industry and its reliance on unorganised cheap female labour. The AEU and its resistance undoubtedly made such a discussion a contentious one. Although the literature from the general trades unions that I have highlighted, such as 1938 leaflet 'Common Sense for Women Workers', demonstrate a growing awareness of the large number of unorganised women workers in the new emergent industries, including the electronics industry and the type of work being done within it. Despite the lack of available membership

for women in the engineering union, both skilled middle-class women and the 'unskilled' working-class women organised. However, due to the economic differences between them this organisation took very different forms. Women who wanted to position themselves as skilled workers, equal to men in every part of the engineering trade, set up organisation such as the WES that could produce its own publications to argue against the presentation of women being propagated by the employers in company literature. *The Woman Engineer* highlighted the individual skills of the women it featured in comparison to the company magazines. However, the large number of working-class women had no such outlet and relied upon themselves and the women working directly around them to enact sudden and quick episodes of industrial action that often had no union backing and were rarely reported on. The differing conditions (such as the lack of an agreement with the NFWW) at the time of the Second World War in comparison to the First World War, plus the fact women were already solidly established within the electronics and electrical engineering industry, meant that at this time the AEU accepted women as members despite their opposition having lasted the entirety of the interwar years.

After answering my first set of research questions regarding women's entry into the electronics industry and how they organised in the face of opposition I moved onto my second set, continuing my analysis of women working in manufacturing. Firstly, how were the working-class women who manufactured wireless technology represented within and outside of the industry? And secondly, why and to what extent did these representations attach working-class women to the mass production of wireless sets, thermionic valves and other electronic technology? I again relied upon visual sources found in electronics companies' official publications such as the *Cossor Courier, Metropolitan-Vickers Gazette* and the *Metropolitan-Vickers Club News* which represented women inside the factories manufacturing electronics and

wireless technology. In my analysis of the company magazines, I demonstrated that the electronics companies attempted to craft a reassuring internal image of their cheap female work force to assuage the opposition that existed from male workers, other employers and trades unions. I concluded that an analysis of company publications shows how the role and representation of women working in these industrial spaces evolved from representing women workers as out of place curiosities during the First World War to an obedient and passive workforce suitable for their role because of the ease of use of mass production techniques and their 'natural' qualities such as nimble fingers and an affinity with repetitive tasks.

By the middle of the interwar years working-class women constituted a growing proportion of the workers in the British electronics industry, manufacturing thermionic valves and related wireless technology. Due to cultural perceptions of the inherent unsuitability of women in the industrial workplace, prevalent among even employers within the electronics industry, the growing number of women workers helped to push companies to adopt better regulation over safety and wellbeing, such as introducing canteens in an effort to reassure themselves and the women they employed. Similarly, the adoption of mass production techniques was justified by employers as an accommodation to assist women workers with the manufacturing process. In magazines and gazettes published by the electronics companies, mass production techniques and women workers were presented as synonymous with one another, and light manufacturing was therefore gendered as feminine. The adoption of mass production techniques facilitated a move away from 'skilled' male workers to the segmented and disconnected work performed by supposedly 'unskilled' women workers. Ultimately, these developments show an attempt by the electronics companies to characterise women workers in manufacturing as unskilled, and thus pay them less in comparison to skilled men who were also more likely to be

members of a trade union. The electronics industry and the growing number of women employees faced opposition from male workers, who argued against the undercutting of their wages, and the wider societal and political pressure to return to pre-war norms. Because of this the newly established electronics industry dedicated a great deal of time to creating a reassuring representation of its women workers internally to assuage any concerns. Company magazines, aimed at those employed in the industry, demonstrate how the electronics companies used representations of women at work in factories to reassure both women workers themselves and potentially hostile male workers, to justify their reliance on cheaper labour and also to construct a sense of belonging and paternal oversight by the employers of the increasing number of women workers.

The imagery of women was used by employers to demonstrate the suitability, effectiveness, value and obedient nature of a large cheap workforce made up of women. The internal company literature demonstrates a clear transition from how women workers were perceived and represented internally from temporary wartime curiosities to a mass of workers that were inherently connected to, and naturally suited to, the interwar electronics industries' mass production processes. These images fostered a gendered understanding of feminine and masculine work that created a space for women to take up 'women's work' within the industry with less societal opposition. The electronics companies argued that their women workers were uniquely suited to the repetitive task of manufacturing wireless technology. This challenged some traditional views that women should not be employed in such workplaces but also clearly gendered the role as light 'women's work'. In the face of opposition from conservative elements of society and male dominated industrial groups such as trades unions, the visual representations produced internally attempted to project across each company a positive but acceptable and reassuring

image showing the ability of women and their inherit suitability to working within the manufacturing process. Alongside arguing that female workers in manufacturing possessed nimble fingers that made them the ideal labour force for manufacturing wireless components, women were depicted in large groups overseen by a reassuring male supervisor. These images project a narrative that the male supervisor, because of his gender, had a greater understanding of the technology and the overall production process. The male figure in these photographs is often positioned in the role of ensuring the quality and volume of work being carried out by the women workers who were supposedly naturally inclined to only care about their work in a limited manner and needed male supervision. Furthermore, there was a clear separation of sex in the workplace beyond job type, including a separation of men and women in the canteens and social activities. Feminine and masculine spaces were rarely represented as mixed or encouraged to be so by the companies. Internal company literature such as *The Metropolitan-Vickers Club News* also demonstrates a paternal and concerted effort to foster a sense of community and belonging amongst the working-class women employees and highlights the number of clubs, groups and events that emerged within the industry following the increase in the number of women employees.

Women workers in the electronics industry were represented as a workforce uniquely suited to the gendered job of manufacturing wireless technology, and therefore within the electronics company the image of women came to represent a modern effective workforce through manufacturing a new modern technology alongside better working conditions and more amenities. As Vicky Long has demonstrated, there was a movement in interwar years on the behalf of individual philanthropists, the state, employers and the trades unions to create a 'healthy' factory environment. While the electronics industry was part of this overall trend, it

was in the electronics industry where employers explicitly linked gender, a healthier factory and modern consumer technology through visual depictions produced directly by the employers. Despite the electronics industry constructing and promoting gendered imagery of women being naturally suited for such work, recollections directly from woman workers employed in manufacturing reveal the difficulty of carrying out repetitive work on the factory floor. Testimony from women workers such as Winifred Cotterill highlights the intense production demands of the management systems, and the strictness of male supervisors. It is clear though that for many young women it was a new and preferable job due to the poor working conditions in the textile industry or the unpredictable working hours and low pay of domestic service. Due to the appeal of working in the industry women workers echoed the gendered arguments made by employers in order to defend their newfound role.

6.2 Women Workers at the Radiolympia Exhibition

Despite these consistent internal representations of women and wireless technology other roles were created for women employees that represented them in relation to wireless in significantly different ways. Throughout my research and in answering my first set of research questions it became apparent that women were employed and represented in a way that up until now had been overlooked. Another facet of employment that the industry defined and represented as women's work was in public facing roles at the Radiolympia exhibition. The roles here were represented in significantly different ways to the women in the factories. These representations provide a direct contrast in how gender was constructed by the electronics companies depending on the space the employees occupied and the intended

audience for such imagery and representations. Women occupied three distinct but related roles at these exhibitions that were visually represented by the events publicity and press reports. At Radiolympia women were represented as part of the entertainment and modernity of the show, as demonstrators and a feminising influence over the wireless technology and as attendees and potential customers. These exhibitions were a space much more concerned with middle-class appeal and imagery. While the electronics companies represented their factory workforce as groups with little personality or individual knowledge and interest in the technology they were working on, the opposite was true at the Radiolympia exhibition. The event positioned women as dancers and entertainers to reflect the modern, future facing aesthetic and to promote wireless technology. Radiolympia utilised the imagery of women placed next to technology as an example and celebration of modernity and the social and technological progress being made in Britain. Alongside this, the electronics companies employed women to work on the company booths on the show floor to explain and demonstrate the latest in wireless and valve technology directly to the attendees. Much like the imagery of the workers in the factory this connection further feminized and gendered wireless technology, albeit in a distinctly different way. The women dancers and entertainers at the exhibition were often dressed provocatively, and their role was to act as an attractive and modern image that reflected the celebratory tone the exhibition promoted around the technology. The women demonstrators, while still serving as attractive models, had to reflect a safer form of femininity and modernity in relation to the wireless technology that appealed to men and was aspirational to female customers. These women existed in the liminal space between those working in manufacturing and those consuming the technology. They functioned and were represented as possessing knowledge albeit in a feminine way.

The use and the representations of female demonstrators did, to some degree, challenge the traditional feminine construct of both the stay-at-home housewife and the unknowledgeable low skilled worker. Their dress reflected their assumed sexuality and was directly represented in relation to the wireless sets and valves. Women demonstrators were expected to show knowledge and expertise when enticing customers to their company booth which connected them directly to the use of wireless technology. However they also upheld the common representation of women as sexualised objects found in advertisements as they were equally employed to embody the role of flirtatious models as well as technical demonstrators. Overall, as employees, women held two distinct roles that were represented in distinct ways but both as specifically feminine in relation to the technology. The emphasis and representation of femininity and gender differed greatly between the reassuring docile working-class women in the factories and the image of the sexualized and liberated modern women at Radiolympia that appealed to middle-class customers. However, both the internal and external representations use women to demonstrate modernity and progress. This applied to the workplace as well as the public facing image of the technology and industry. In summation, the Radiolympia exhibition was an opportunity for the electronics industry, organised by the various companies, to publicly utilise models of modern femininity to construct a gendered image of wireless technology that appealed to both male and female attendees.

6.3 Women as Consumers

Statistical evidence as well as surviving photographs and videos show that middle-class women became prominent at Radiolympia as attendees and customers and the

aesthetics of the event attempted to appeal to their assumed sensibilities. This linked to my final chapter which focused on my third set of research questions: how were women of different social classes represented as consumers of wireless technology? And how did female consumers shape the representation of the technology as a consumer product? In answering these questions, I have shown how women were not just a high proportion of the customers at Radiolympia due to the spectacle and enticing imagery of 'liberated' femininity. As the interwar years progressed, they became a vital part of the customer base for the electronics industry and regular users of the technology. The industry and technology emerged from the war as - a largely male-dominated space. Veterans developed an affinity for the product during the war and helped to develop a burgeoning hobbyist culture around valves and wireless in the early interwar years which took the forms of local organisations and clubs across the country. The demand for regular broadcasts facilitated the establishment of the BBC and in turn provided the programming that played a key part in feminising wireless as a domestic consumer product. My analysis of the programming schedule the BBC developed throughout the interwar years shows that the broadcaster scheduled shows based around housework, 'women's interest' stories and educational programmes aimed at women throughout the majority of the day. This demonstrates an acknowledgment that the primary listener of wireless would have been the middle-class housewife whose main daily duties kept them in the domestic space. As the programming schedule of wireless shaped itself around the woman listener so did the advertising of the technology found in newspapers and magazines. Advertisements transitioned from focusing on highlighting the technical details of new models to presenting them in comfortable middle-class domestic homes often being listened to by married couple and families. Magazines such as *Popular Wireless Weekly* focused on the hobbyist side of the technology, often

representing it as the domain of the lone male figure tinkering in his shed or office. But as I have demonstrated even these hobbyist magazines began to represent wireless as belonging in central position in the middle-class domestic space alongside women listeners.

My examination of the wireless sets from the interwar years demonstrates the role women customers had in shaping the technology so that it conformed aesthetically to the interwar domestic space. The example of wireless sets I have cited show how the design of the sets began as complex looking pieces of technology with little consideration given to their appearance but eventually included cabinet designs that did not look out of place in the centre of the interwar middle-class sitting room. Furthermore, sets also became simplified and easier to use following the traditional gendered assumption that women would be put off or not understand the more complex appearances and number of buttons on earlier sets. Wireless entered the domestic space alongside other new domestic goods such as vacuum cleaners to perform the labour once performed by working-class servants. Working-class women who at one time would have worked directly for middle-class families were now manufacturing the wireless technology that occupied a central position in the middle-class domestic space. Women of all social classes occupied significant roles throughout the production and consumption of interwar wireless technology; from manufacturing it, to demonstrating and selling it, to being a major part of its consumer base. Women consumers across Britain primarily made the spending decisions when it came to the domestic space and they were the major facilitator in allowing the wireless set to take up its position as the central piece of interwar technology in the home. Depictions of the technology influenced how representations of women were gendered alongside it. But it was also the case that these depictions feminized the wireless technology itself, much like representations

of women had done for the job of manufacturing it, despite the continued existence of the traditional patriarchal assumptions around women's lack of understanding or interest regarding new technologies.

In conclusion, throughout the chapters of this thesis, I have provided a comprehensive and original analysis of the British interwar electronics industry and the prominent roles held by women of all classes both internally and externally. I argue that women occupied three distinct yet connected roles — as employees inside and outside the factory floor, as a major consumer base for wireless and as a new and unorganised labour force that the trades unions had to come to terms with during the interwar years. When looking at women workers and consumers in relation to the interwar electronics industry and wireless technology I have focused my analysis on how these roles were reported on, constructed, represented and ultimately perceived by the audience of the visual representations of women's roles in the industry. I have achieved this through an analysis of how employers, the media, advertisers, and other organisations perceived, represented, promoted, and resisted women's roles regarding the electronics industry. In doing so I relied upon sources such as press reports, trade union material, *The Woman Engineer,* company magazines such as *The Metropolitan-Vickers Gazette,* the photographic archive of the *Daily Herald* newspapers and advertisements found in *Good Housekeeping*, which was aimed at middleclass housewives. The often contradictory depictions of femininity and gender were utilised by many advertisers to sell wireless technology and by employers to promote the suitability of women as workers. Organisations who opposed women's roles in the engineering industry challenged them either by ignoring them or by relying on more traditional depictions of gender such as the working-class women who is a mother and housewife supportive of the male labour movement but is not an active participant in it.

By answering the research question set out in this thesis I have expanded on the existing literature of those such as Keith Thrower whose focus on the manufacture of electronics goods devotes little attention to the female labour behind the process. This is a significant omission that I have attempted to correct. Furthermore, I have expanded and added to the work of Miriam Glucksmann who analysed women working in the electronics industry and other new interwar industries. I have broadened the scope beyond just the factory floor and examined how women played key roles in relation to the industry on multiple levels, such as demonstrators and as customers. By focusing on one industry in a specific period of time I have devoted an analysis to these areas of the electronics industry and women workers that had hitherto received not enough attention. I have also approached the analysis of public exhibitions from a gender perspective unlike previous work such as that of Alan Q. Morton. By highlighting the various role women held at Radiolympia I have provided an original analysis of both wireless technology and interwar exhibitions in relation to gender that I hope can be expanded upon in the future. Clare Wightman has argued against the reliance on gender ideology when analysing women in the workplace. However, I have shown that both Wightman's and Glucksmann's approach are limited by demonstrating that economic incentives and gender perceptions were not separate developments. I have achieved this by exploring areas of industry they do not, such as exhibitions, company leisure activities and how women consumed and shaped the technology manufactured by other women. By focusing on three distinct roles women held in the electronics industry I have shown how these roles were gendered and represented visually by employers, which the literature mentioned above neglects to do in any extensive way. The originality of my analysis is bolstered by the sources I have used, in particular my cultural analysis of visual sources. The examples mentioned above, and other more recent

studies on gender, women and work, such as those by Valerie G. Hall, do not utilise the vast array of relevant photographic evidence and magazines. By adopting a cultural analysis of these visual sources, I have been able to analyse not just the multiple roles women had but how these the roles women were presented by different groups such as employers, women's organisations, and advertisers. I have demonstrated through how they were framed that these multiple roles embodied different versions of femininity from subservient diligent worker to knowledgeable demonstrators representative of progress and modernity, to skilled individuals and as consumers implying the simplicity and ease of use and wireless and its technology.

I have limited my analysis to the end of the interwar years as this historical moment marked a level of universal acceptance regarding women working within the electronics industry despite the consistent opposition throughout the interwar years. By the onset of the Second World War the traditional gender construct of pre-war femininity had come up against the reality of employment patterns. Women did not need to be re-recruited into the electronics industry for the demands of the Second World War as they were already there at its start. Despite my efforts this thesis has been limited in some significant ways by the global pandemic of 2020-2021. Most significant in this respect was lack of access to wider variety of company material and magazines. Furthermore, I had intended to interview relatives of women who had worked in the electronics industry, however this was not viable due to travel restrictions. Similarly, I intended to access the Mass Observation archive in person but was not able to do so for the same reason. Despite these restrictions, my thesis has shown how neglected sources such as company literature and visual representations should be assimilated and adopted into studies regarding women and work in the future. A wider implication of this study is that future historians must continue to contest the notion that the interwar period is exclusively

defined by depression, unemployment and the return of women to the domestic space. The example of the British interwar electronics challenges these accepted notions and that must be taken into consideration in future analyses of the interwar years, the electronics industry and the women working within it. However, the interwar years do not represent the end of the possibilities regarding my approach to the subject of women and the electronics industry and much work needs to be to be done on later decades and on other countries. My hope is that further studies will pick up from the conclusion of this thesis and examine the roles and representations of women in the electronics industry during the Second World War and the decades following it, as the industry expanded beyond wireless into the television and other technologies not directly born out of the First World War. Of course, in this study I have placed women and their roles and representations in the context of the emergence and success of the industry in Britain and the prevalent beliefs regarding sex, gender and technology of this specific time and place. Other studies could focus on its decline and the development of other countries' electronics industries, and the roles and representations of women within them. For instance, there is scope for comparative studies on Japan in the 1970s and 1980s as well as more contemporary studies focusing on female labour in China's prominent electronics manufacturing industry which it has come to rely upon as part of its industrial and economic growth over the recent decades, much like Britain had once done in its the interwar years.

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