An Analysis of Conversations Between Children and Teachers in Nursery Counting Activities

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Abstract

An Analysis of Conversations Between Children and Teachers in Nursery Counting Activities.

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Learning to count is a central strand to the mathematical development area of the Foundation Stage Curriculum in England and Wales. Five teachers from five nurseries in one local education authority within West Yorkshire were recorded between December 2002 and June 2003. The main data for the study was taken from 21 number focus activities recorded between the teachers and small groups of children, aged 3-4 years. Conversation Analysis was used to determine the language and interaction involved, considering both children and teachers' contributions to counts and to what came before and after counts.

The study found that the teachers were responsible for creating the conversational contexts for counting as well as being involved in the counting itself. The collaboration between teachers and children in counts included distinctive uses of intonation in ways that emphasised the status of numbers in the count sequence and the importance of the last word. Following counts, the study identified ways in which the quantitative meaning of counting could be extended or left implicit. This study depicts counting as a fully interactive activity that contrasts with the image portrayed in much of previous literature where children count independently and opportunities for teachers' participation are under-specified and implicitly passive.

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Thesis Introduction

Counting first caught my attention in my work as a Speech and Language Therapist. Working in a local health centre, many of my referrals were to see 2 years olds, often described as 'not saying as much as they should'. It began to interest me how many of them had, amongst their very few words, the first count words.

I was playing with a tractor with Harry. He knew very well what a tractor was but had not yet worked out how to use his mouth to make the sounds to say 'tractor'. When I took another tractor out of the box, Harry said "two".

I was watching George build a tower of bricks with his Mum. She pointed to one of the bricks and said, "one" in a long drawn out expectant way, George said "two" in a similar way and then "three" with a sense of achievement. His Mum said, "clever boy!" and they both beamed.

Harry and George were good communicators, they understood much of what people said to them and they responded using gesture, facial expression and a small number of words. They showed me two aspects of the word "two" and two dimensions of language learning that I had not previously seen quite so clearly.

Textbooks on 'children's first words' seldom seem to include number words as part of children's early vocabularies. The content of Harry and George's small vocabularies reflected what was important to them. For Harry, saying "two" could be interpreted as evidence of a mismatch between his language and conceptual development. For George, saying "two" seemed a very social strategy.

In textbooks for 'counting', Harry's use of "two" bore some relation to subitising, George's "two" was more like 'rote counting'. These uses were described, but somehow they were not *real* counting. There were underlying principles that Harry and George still had to learn before their use of number words would be judged as something truly useful.

As well as working in the health centre, I was supporting children in schools and nurseries. My frameworks for looking at language and at learning came from a very different professional culture to the staff I worked with and at times, there was something about my recommendations that seemed to make staff uncomfortable. I felt perhaps I was being seen

as too prescriptive and perhaps this clashed with the 'child-led' environments. It intrigued me how a curriculum area like counting would fare.

In seeking frameworks for language and learning that might be more harmonious with those of my education colleagues, I came across two perspectives that felt to me complementary. The first was Conversation Analysis with origins in sociology (Hutchby and Wooffitt 1998). The second was ideas described as post-modernism and critical constructivism, applied to early years education by writers such as MacNaughton (2003, 2004) and Dahlberg, Moss and Pence (1999). Whilst these perspectives were by no means fully coherent, either with each other or within themselves, there were overwhelming similarities in their emphases on interaction, on recognition of children's competence and on ideas about co-construction in both language and learning.

The perspectives appeared to offer a way to see Harry and George more positively. They prompted me to want to find out more about what counting looked like in nurseries, how teachers did counting, what models of learning they might apply, how their conversations with children might be adapted to include or promote counting and learning, and what other language they would use alongside the number words.

The thesis that follows represents the pursuit of these questions. Chapter 1 returns to the literature to review what is already known about the verbal context for counting and how this fits with wider literature on teaching, learning and interaction in the early years. Research questions are developed in the light of this review. Chapter 2 outlines Conversation Analysis as an approach to address the research questions. The design of the study is described in Chapter 3 followed by three data presentation chapters. The final chapter consists of the discussion of the data analysis along with consideration of the implications for teaching and learning, the limitations and conclusions of the study.

Chapter 1 - Review of the Literature

Introduction

The review of the literature is focussed around determining what is already known about the verbal context for counting and how this fits with wider literature on teaching, learning and interaction in the early years. As such, it is structured into three separate but interrelated areas: literature that is specifically concerned with learning to count; literature from teaching and learning in the early years; and finally, literature that looks more broadly at interaction. It is a telescopic journey: starting from a basic characterisation of counting, then zooming out to take in the social, linguistic and cultural contexts before zooming gradually back in again via general interaction towards research questions that demand a specific and narrow focus on the mechanics of counting. The broad scope of the review means that, necessarily, some large areas of literature are covered in a brief manner.

Learning to count

This is covered from three perspectives: *what is* learning to count, *reasons for* learning to count and *processes in* learning to count.

What is 'learning to count'?

The description of counting given in the Curriculum Guidance for the Foundation Stage (henceforth CGFS) is as follows,

> *"Counting involves saying the number names in the right order, matching the numbers to objects to be counted, knowing that you say one number for each object you count, and knowing that when you count, the last number you say gives the number of objects in the group. Children will later see that counting involves knowing that the number in a group is the same even if the objects are counted in a different order."* (QCA 2000, p68).

The description immediately illuminates counting as a complex combination of skills and concepts. The view is based on the 'counting principles' identified by Gelman and Gallistel (1978). Successful and accurate counting, as a means of quantification, requires adherence to these principles. 'Learning to count' is learning to co-ordinate the skills involved.

Before accepting this account of 'learning to count' it is valuable to recognise alternative perspectives. The counting principles derive from the link between counting and quantification. Munn (1997) illustrated the tenuous nature of this link in her findings about young children's beliefs about counting. Up until school entry (average age 64 months) children's explanations about why they counted rarely included reference to quantification. Munn argued that these children's constructions of counting should be valued rather than seen as 'deficits', and that accessing their perspective helped to explain the way in which children applied (or did not apply) counting in particular situations.

In contrast, adult understanding of counting carries with it the implication that it does not just involve a procedure (doing counting) but it also involves a purpose (to find out how many). A recent study by Fluck, Linnell and Holgate (2005) suggests that once this association has been made, it may be hard to separate. Parents in their study (of children aged 36 to 54 months) judged their child's counting skills according to the child's ability to say the count sequence. When parents were questioned about their assumptions, they believed that their children understood the link between counting and knowing how many.

The perspectives on counting revealed in these two pieces of research are important to bear in mind. They are different from perspectives held by those who are aware explicitly of the identified counting principles. Explicit awareness leads to a differentiation of counting and a perspective that includes multiple forms of counting ('quantitative', 'enumerating', 'rote' etc.). Munn (1997) pointed out how this perspective meant children could be seen as 'deficient'. Fluck et al (2005) suggest that, without this perspective, parents overestimate their children's skills, implying perhaps that parents are 'deficient'.

Alternatively, the perspectives can be seen as equally legitimate. Counting is different things at different times to different people. For researchers and educators it is a layered combination of principles; for the children in Munn's study it is a social practice separate from quantification; for the parents in Fluck et al's study the quantification element is automatically and unquestionably invoked. When these perspectives converge, in interactive counting activities, what comes to be agreed as counting may or may not reflect identified counting principles.

For the remainder of this section on 'learning to count', the CGFS description of counting, incorporating counting principles, is assumed. This perspective is of counting that, when achieved, is a powerful strategy that can be applied across a wide range of personal, social and educational contexts. In addition, this entails that part of 'learning to count' is also learning to see and appreciate the many contexts where counting is an appropriate strategy.

These issues of different contexts and different perspectives will reoccur throughout the thesis. For now, the review returns to the counting principles. The three principles relevant to this study are,

(i) the *stable order* principle – that the numbers of the count sequence are said in the same order for every count,

(ii) the *one-to-one* principle – that each thing is tagged and tagged only once (one word for each thing),

(iii) the *cardinality* principle – that the last number said refers to the quantity of the whole set.

The nature of these principles is widely agreed but there has been less agreement about how and when children come to use them. The debate is often referred to as a principles/skills debate, the argument being whether the principles are innate and guide children's learning (principles before skills) or whether children's practice of counting enables principles to be established (skills before principles). The consensus is that principles and skills develop together (Baroody 1992).

The most challenging principle to research has been the cardinality principle. Children's counting can be fairly unambiguously observed to conform (or not) to the one-to-one and stable order principles, but demonstration of adherence to the cardinality principle requires specifically designed tasks. Three research findings are of interest,

- children count when they do not need to, e.g. asked how many when they have already counted and they count again (Fuson 1992),

- children do not count when it would be useful to do so, e.g. when asked to 'give me five' from a larger number, when asked to compare sets (Fluck and Henderson 1996),
- children achieve better counting in tasks when asked to count an entire collection of objects than when asked to count a number of objects from a larger collection (Bruce and Threlfall 2004, Linnell and Fluck 2001).

The findings reveal a sub-division of the cardinality principle. It includes both knowing that you can count to find out how many and knowing that the last word indicates how many. This further complicates the picture of a unified idea of what it is to learn to count.

Overall, the debate on the status of counting principles is relevant for this study in its implications for the role for adults. There is a sense that the size of the role for adults is dependent on the level of 'innateness' assumed. A more active role is suggested by the 'skills before principles' position, where skills are shaped through interaction with and imitation of others. Sub-division of the cardinality principle presupposes a *need* to know how many and this leads to the next section.

Reasons for 'learning to count'

Quantification and the 'need to know how many' are the fundamental reasons for learning to count. Sophian (1998), taking a goal-based approach, sees this as the central and ultimate goal. Prior to this, the goal may be essentially social (Durkin 1993). Durkin's assertion was made as a result of a study of children (from 9 months to 3 years) counting with their parents (Durkin, Shire, Riem, Crowther and Rutter 1986). The study itself is discussed in further detail later on but the important finding was of counting occurring frequently in interaction at this age as a social activity, i.e. the activities were not all overtly pedagogical and occurred often without an obvious quantification goal.

Sophian (1998) suggests that goals are modified through experience and interaction. The child's initial social goal combines with adult attention to quantity. This combination promotes subsequent independent interest in enumerating small quantities. In turn this initiates a goal of quantification in the child that is further reinforced through adult provision of later number words and larger quantities.

Beyond this personal or 'internal' goal for quantification there are many 'external' goals. Reasons for learning to count come from a range of stakeholders in education. Parents expect their children to learn to count and actively seek to promote it (Fluck, Linnell and

Holgate 2005). Counting is recognised as central to early years mathematics and an important foundation for later understanding of number (Thompson 2001).

It is interesting to supplement these views with the reasons for counting given by children themselves. Reasons fall into four categories (examples taken from Munn 1997, p14),

- to please the self (e.g. "because I want to"),
- to conform to others' expectations (e.g. "my cousin tells me to"),
- in order to learn (e.g. "so I can know my numbers"),
- to know how many there are (e.g. "to know how many toys there are").

The children's responses reflect both societal and (inter)personal reasons for learning to count. At the societal level, counting is recognised as a foundation for later number skills, as an expected (by a range of stakeholders) cornerstone of basic numeracy as well as cultural practice. At the personal and interpersonal levels, counting fulfils a basic need to quantify as well as responding to social expectations and even entertaining others (Grauberg 1998). How teachers and children approach counting interactions will be influenced by their beliefs about reasons for counting as much as their beliefs on what counting should consist of.

Processes in 'learning to count'

The term 'processes' is used as a way of reflecting the lack of educational background to the some of the research covered so far. Within education, 'processes' refer to teaching and learning, these are more explicitly covered in the next section. Sophian's (1998) suggestion is that goals can account for both the reasons and the processes for learning to count,

> *"In all these interactions, children's goals may not be the same as their adult partners', but they are surely influenced by the ways the adult defines the interaction, and they surely change with age. As these changing goals direct children's attention to different aspects of numbers and the ways we use them, they therefore provide a rich set of changing constraints on their numerical learning." (Sophian, 1998, p44).*

The role for adults indicated by this position is of modelling and prompting changes in children's goals through drawing attention to particular things. For example, once children seem to notice or remark on smaller quantities, the adult's role is to introduce them to larger quantities that may only be enumerated through counting.

The stance fits well with pedagogy where the adult role is allowing the child to lead and the focus of activity is primarily the child. Adults' intervention is minimal but crucial, according to the apparent goals of the child. Sophian suggests that once children's goals become

quantitative, counting then 'flourishes', (1998, p45) aligning the image with one where there is a point at which adult intervention becomes superfluous.

This section considers three key pieces of research that refer to this interactional context in considering the processes involved in learning to count. Firstly, the study by Durkin and colleagues (1986) looking at early contexts for number use; secondly, a study by Fluck (1995) of the language involved in counting activities; and finally, Linnell and Fluck's (2001) study of the support given to children in counting tasks. All three focus on children and parents and so capture moments where conflicting goals may arise.

Durkin, Shire, Riem, Crowther and Rutter (1986)

The data from this study are at least 20 years old but it is still widely cited because of its status as a rich source of spontaneous number use between young children and their parents. Children aged 9 to 36 months were recorded at 3 month intervals in interaction with their mothers. The recordings were part of a larger study of mother-infant interaction, parents were not prompted to focus on numbers and things to count were limited (recording equipment, drinks, lights, plug sockets). All uses of number words were logged and transcribed. Six categories of number use were identified and are reproduced in table 1.1.

Table 1.1. Categories of number use in talk between children and their parents (from Durkin et al, 1986, p277)

	Category	Description
(i)	*nursery rhymes and songs*	
(ii)	*sequential complements*	routines where an extra word is fixed into the number sequence, e.g. "one two three go", "one step, two step"
(iii)	*recitation of the number string*	counting with or without co-ordination of objects – but without explicit cardinality
(iv)	*repetition and clarification of cardinality*	where the count is used to illustrate "the numerosity of a cardinal number"
(v)	*alternating strings*	wherever partners took turns saying the number sequence
(vi)	*incidental number use*	where the number word was a descriptor

There were three findings of interest from the study,

1. Within the six categories of number use, it was suggested that some types of number use had a 'pedagogical' quality (iii, iv, v). Here, number use was introduced specifically as an

opportunity to teach about number, e.g. counting the number of cameras in the room. In contrast, types (i) and (ii) were described as *"the most basic of routine strategies"* (p277).

2. The longitudinal design of the study illustrated how number use changed as the children grew older. The proportions of pedagogical uses increased with age whereas the presence of nursery rhymes, songs and sequential complements declined.

3. The study identified discrepancies and inconsistencies in the ways that numbers were used. Most interesting perhaps are the examples of adults apparently violating the stable order principle through the use of 'sequential complements'. The researchers saw inconsistencies as a positive influence: children would notice them, be curious about them and so motivated to resolve the discrepancies into a more mature understanding of number.

Alongside these findings, the importance of this study for the concerns of this thesis is that it was the first to identify and describe actual patterns of number use between two participants, i.e. it was not just *children's* use of number that they described. In addition, the emphasis is not on counting principles and children's performance compared against them, but on the contexts in which children experience numbers, the social context.

Fluck (1995)

Influenced by Durkin et al's work, Fluck (1995) also looked to the linguistic context for counting as the source for processes in children's learning to count. His study used specific counting tasks. He noted the ways in which parents (mothers again, children aged 2-3 years) introduced the tasks and the ways in which they responded to children's counts. The key findings from his study are that,

- in defining the task, mothers used 'count' and 'how many' interchangeably,
- children showed sensitivity to the two terms in that they were more likely to give a one number response to 'how many' than to 'count',
- mothers (sometimes) gave feedback to counts that gave indications of cardinality (repeating the last count word or using it in a phrase),
- mothers were more likely to repeat the last word following children's correct counts.

Fluck linked these patterns to the cardinal meaning of counting. The use of 'how many' refers directly to quantity, repetition of the last word is a way to 'separate' it from the rest of the sequence and the use of the last word was a demonstration of its cardinal function ("there are three lorries").

His study is significant in its identification of the conversational environment of counting. It is unique in paying attention to what counting *leads to* as well as what it results from. The way that counting is presented and what it results in are key sources of information for children in coming to identify reasons for counting.

Linnell and Fluck (2001)

The third study to bring into focus the potentially conflicting goals of children and adults in counting activities is by Linnell and Fluck (2001). Again parents were given two specific tasks to do with their children. The study compared how counting proceeded according to different tasks and under 'assisted' and 'unassisted' conditions.

The researchers' interest was the social context for counting. They found that the support given by parents differed between the two tasks despite apparently similar counting requirements. Both tasks involved a puppet, in the first task ('*counting*') children had to count 6 separate sets of objects, in the second ('*giving*') children had to take the required number of objects from a larger set to put in the puppet's basket. Eighteen children were involved and took part in the tasks at 32, 38 and 44 months.

Children were most successful with the first task and, unsurprisingly, performance improved in both tasks when parental assistance was permitted. Linnell and Fluck examined the nature of support given and found it to conform to two support types initially proposed by Saxe, Guberman and Gearhart (1987): one in support of the count sequence and one in support of correspondence. The levels for sequence support are reproduced in table 1.2.

Table 1.2. Levels of parental support for count sequence information (reproduced from Linnell and Fluck, 2001, p220)

Level	Type of support from parent
0	provides no sequence support
1	says count but does not provide any other strategy
2	requests next number without referring to other numbers, e.g. 'what comes next'
3	requests next number by referring to previous number, e.g. 'what comes after 5?'
4	provides a sequence of numbers up to present one, e.g. 'one, two, three …?'
5	provides hints about next number, e.g. 'se…sev …'
6	supplies the number
7	demonstrates the entire count sequence

The levels of sequence support were used in similar ways in both of the tasks. Differences occurred in the application of correspondence support. Parents gave more support for the child to achieve one-to-one correspondence in the *counting* task than in the *giving* task. Linnell and Fluck attributed this to the different social meanings of the tasks. They suggest that counting arrays is *"more suitable to a formal teaching and learning environment"* (p217), in contrast to giving objects which they suggest is, *"an informal activity that occurs spontaneously in everyday social interactions"* (p217). In the *giving* activity the focus of attention is less on individual items and more on the whole set.

Parents adjusted support strategies according to both the task and the apparent skills of the child. Linnell and Fluck felt that parents' support conformed to the metaphor of *scaffolding*. Scaffolding has various interpretations and I return to it in the section on teaching and learning below. Linnell and Fluck describe it as a process where,

> *"adults assist children by breaking down tasks into sub-goals, adjusting the level of support that is offered at each point in the procedure to suit the needs of the child; they provide more support following child errors and less support following child successes."* (2001, p203).

The picture of verbal interaction that occurs during and around counting in this study and the two others is much more complex than in research tasks where children count unsupported. Taken together, the studies illustrate how parents do not seem to 'stand back' in the way that researchers do. This reinforces the stance that children experience counting as an interactive activity. In terms of the counting principles, Linnell and Fluck's (2001) work shows that principles are more completely applied in supported interaction. There may be an expectation that supported application provides for eventual unsupported application, but in these studies the usual way to proceed is with support.

The value of all these studies, combined with Sophian's (1998) conclusions, is their focus on the adult role in counting. Perhaps because the adults in the studies are parents not teachers, they are described as 'unwittingly' doing things that teachers would hope to do by design.

Summary of 'learning to count' literature

The three strands discussed are complementary and have been used to emphasise the verbal and interactional aspects of learning to count. The body of research on counting principles has relevance to teachers (and this thesis) in its clarification of counting independent of context. Well-designed research experiments may be translated into nursery as assessment tasks if teachers want to see for themselves which counting principles children can adhere to.

The consideration of diversity in perspectives and reasons for counting highlights the differing expectations that children and adults may bring to counting activities. The consequences of these differences are evident in the three studies where it is clear how much messier things become when children and adults count together. Despite the messiness, there is consensus amongst all the authors that changes in children's understanding occur in interaction with others.

Teaching and Learning in the Early Years

The studies discussed in the latter part of the above section were all concerned with the social and linguistic context in which counting takes place. This section of the literature review broadens the context further by considering the place of counting against the background of two related teaching and learning arenas,

- teaching and learning in early years mathematics,
- teaching and learning in early years education as a whole.

Just as Durkin (1993) and Fluck (1995) argue that counting and counting principles cannot be isolated from their immediate interactional contexts, the authors in this next section argue that no curriculum area (nor interaction within it) can be isolated from their wider cultural and historical context (Walkerdine 1988, Dahlberg, Moss and Pence 1999).

Mathematics in the Early Years – 'pedagogical' versus 'instrumental' approaches

These two terms come from Walkerdine's (1988) research challenging many assumptions about mathematics and teaching and learning, in particular the alleged 'neutrality' of mathematics. She recognised that the power and attractiveness of mathematics lies in its ability to abstract away from context, but at the same time it can only be meaningful within context. The context cannot be 'neutral' (Walkerdine focussed particularly on inequalities in gender and class carried by context). The importance of this observation is to caution the view that early years mathematics (and therefore counting) can be incorporated seamlessly into nursery activity. The choices that teachers make can obscure as well as open up the underlying mathematics for different children.

Walkerdine used the terms 'instrumental' and 'pedagogical' to describe two distinct ways in which mathematics was incorporated into number activity in the home. She explains the distinction as follows,

> *"Instrumental referred to tasks in which the main focus and goal of the task was a practical accomplishment and in which numbers were an incidental feature of the*

> *task, for example cake-making, in which the number two might feature in relation to the number of eggs needed and so on. In the pedagogic tasks numbers featured in quite a different way: that is numbers were the explicit focus of the task. So, for example, a child might be asked to count her coat buttons for no other purpose than to practice the count." (1988, p81)*

The distinction reoccurs in other studies. Durkin et al's (1986) use of the term pedagogical (e.g. in counting the cameras) is complementary to Walkerdine's. Most recently, Aubrey, Bottle and Godfrey (2003) report recordings of mathematical activity in home settings that conformed to instrumental or pedagogical patterns. Alongside the recorded activity, they interviewed the parents involved and picked out two children to represent the most different styles. They found links between the parents' styles and their beliefs about their role and the nature of mathematics. For example, the parent of the child who was engaged in the most 'instrumental' activity was reported to feel, *"that mathematics should be part of everyday life"* (p100). In contrast, the parent whose style conformed to Walkerdine's pedagogical approach, *"saw mathematics in the home in terms of discrete activities where the goal was the acquisition of counting and arithmetical skills and in which the adult might assume a direct teaching mode"* (p102).

The study noted alignment between the instrumental position and staff in early years settings. Children who had experienced this approach at home would be expected to have an easier transition to seeing mathematics in embedded activities in the nursery. Whilst the two styles did not lead to different achievements in number, they did lead to different dispositions and attitudes. The child who experienced the pedagogical style was less easily engaged in activities and did so less frequently and for shorter durations.

Wider mathematics appears to be situated comfortably within the (positively described) instrumental style but counting itself presents some contradictions. Counting that is non-quantitative is consistently referred to within the pedagogical style, often explicitly contrasted with descriptions of interaction or activity that receive a more positive judgement. Counting *can* be included in the instrumental 'everyday' discourse when a quantitative purpose is deemed evident but it is not always clear whether this purpose is made explicit to the child as well as the researcher.

This placement serves to devalue non-quantitative counting in spite of the value placed on it by children and parents. Munn (2001) argues that 'social' counting is important in allowing children's *"initial entry into the discourse of number"* (p35). Knowing number names even without number meanings enables children to engage in conversation about numbers. Once numbers are within conversation their meaning can be negotiated and developed.

The discussion of instrumental and pedagogical styles suggests some conflict within teaching and learning for counting. In particular, non-quantitative counting is positioned against much of the valued instrumental construct. The instrumental style is, at the same time, aligned with *"play-orientated approaches and child-directed activity"* (Aubrey et al 2003, p103). Despite Munn's (1997) call for children's non-quantitative counting to be valued and taken seriously, a place still needs to be found for it.

The discussion highlights a disadvantage in polarising 'styles' without explication of interactional mechanisms. This is picked up in the review of literature on interaction. First, other areas of potential conflict between counting and early years pedagogy are discussed.

Early childhood education – socio-cultural perspectives and co-construction

Current perspectives in early childhood education are influenced by what Anning, Cullen and Fleer (2004) describe as a *"theoretical seachange"*, where,

> *"individualistic developmental explanations of learning and development [have been] replaced by theories that foreground the cultural and socially constructed nature of learning." (p1).*

The term 'socio-cultural perspectives' is used broadly by Anning et al to cover perspectives on childhood and learning that acknowledge the importance of social, cultural and historical influences. Many early years practitioners have welcomed the changes. Even in 1996, Munn and Schaffer, writing about literacy and numeracy in the early years, noted that,

> *"The teachers made little attempt to isolate and identify the sub-processes of reading and counting – they regarded such an analytical approach as inconsistent with a professional stance of working with the whole child" (p125)*

and that,

> *"current psychological accounts of development are difficult for teachers to translate into action in the context of individual children" (1996, p126).*

These quotes highlight conflict with the research background to counting that has sought to identify universal characteristics, independent of the socio-cultural influences described by Anning et al (2004). Such conflict may contribute to the relative lack of confidence in mathematics expressed by practitioners in Anning and Edwards's (1999) project.

Acknowledgement of the influence of cultural and historical factors requires recognition that models of learning and practice reflect beliefs about children and childhood (MacNaughton 2003). Challenges to the implications of beliefs implicit in a 'child-centred' approach have been difficult for practitioners to engage with (Meade 2000). The literature on counting portrays an image of a child who comes to abandon incomplete or misguided counting practices in favour of a 'mature' understanding that is portrayed as fixed and 'true'.

As well as rejecting one unified and fixed construction of children and childhood, socio-cultural perspectives also reject one unified and fixed construction of knowledge (Dahlberg, Moss and Pence 1999). The rejection enables a loosening up of constructions of counting complementary to the suggestions at the beginning of the chapter: rather than principled counting being the fixed, 'right way' to count, it is one possible way to count. Non-quantitative counting is another possibility, not inferior, but suitable for particular occasions.

From socio-cultural perspectives comes recognition of children's role in constructing knowledge in co-operation with adults. The term 'co-construction' is used to describe this and emphasises a more equal relationship between teacher and learner (Jordan 2004). Whilst it may seem possible to extend constructions of counting as an activity to include both teacher and child perspectives, there are further challenges in practice. If teachers and children are to co-construct something on the level of deciding how many teddies are in a jar, it is quite a challenge to teachers to be flexible about accepting anything other than the 'right answer'. This is taken up when co-construction is discussed within the section on interaction in teaching and learning below.

Summary of early years literature

Ideas from socio-cultural perspectives and co-construction extend the discussion of counting to link it with broader issues in early childhood education and mathematics. The earlier section on 'reasons for counting' established that counting is a permanent part of the early childhood curriculum. However, its association with 'right answers' and 'pedagogical' teaching styles means that it may not sit easily in this environment. This association is based on a construction of counting taken from the literature. It is important to determine if the same inconsistencies emerge when counting is encountered interactively between teachers and children in nursery settings.

Interaction

The previous section raised issues about early mathematics and early years contexts in general that have implications for interaction in learning to count. All writers place interaction as central in developing counting yet there is still a lack of specification. In a review of research, Munn (2001) compares the relatively limited knowledge about teacher practice in this area with what is known about children's skills. She concludes that,

> *"there is a pressing need for further research into classroom discourse processes in the early years"* (p36).

Meade (2000) suggests that research into learning through talking is less developed in the early years because of the resistance to 'telling' as a historical model of teaching implied.

The summaries of literature here are tackled from two perspectives. The first, 'interaction in teaching and learning' is so called to cover the way that interaction has been recruited into models of teaching and learning. In contrast, but complementary, is the second section 'teaching and learning in interaction'. This starts with generic interaction and looks for teaching and learning processes within it.

Interaction in Teaching and Learning

This section covers three aspects of interaction in teaching and learning currently prevalent in the early years literature. They are not mutually exclusive and are unanimous in their emphasis on active participation by both teachers and learners.

Scaffolding

The metaphor of scaffolding has received considerable attention and maintained its popularity through different interpretations over time. Scaffolding refers to the nature of support provided by an adult that enables a child to achieve or complete something that he or she could not do unsupported (Wood 1998). Support is contingent, adjusted according to the needs of the child.

Linnell and Fluck's (2001) interpretation given earlier in the chapter (p11) describes a broad scale of adjustments in parents' behaviour but limits children's behaviour to just two dimensions, 'errors' or 'successes'. Munn and Schaffer (1996) discuss scaffolding in relation to early years numeracy and literacy and caution how as a metaphor it can appear too rigid or place children in too passive a position. They emphasise interactivity by suggesting that adults, *"step back when child succeeds in order to **make room for initiative**"* (p112, my emphasis). The inclusion of 'initiative' is more flexible and gives the child an active role. However, it is still unclear what it may actually look like in a counting activity.

Co-construction

Co-construction was introduced in the discussion of changes/directions in early years education. Jordan's (2004) contention is that the metaphors of co-construction and scaffolding differ in the notions of power and control. She suggests that scaffolding reflects and reproduces asymmetry of knowledge because it implies that children are being guided to an established adult position.

In contrast, co-construction enables a more symmetrical relationship whereby knowledge and perspectives on the world are different for each person. Teacher and child have different perspectives but neither is inherently superior. In co-construction, through interaction with one another, child and teacher construct a shared view based on contributions from both their perspectives. Rather than adult involvement being minimal and strategic, activity is shared with both parties contributing and working with each other's contributions. There is more equality between adult and child's contributions to the task, learning occurs through interaction with adults who control and structure activity *with* rather than *for* children.

This is more challenging for previous studies where counting has been described. Interaction was contingent in Linnell and Fluck's (2001) study, but described in terms of how parents adjusted support in either appropriate or inappropriate directions up and down a hierarchy of support forms determined by whether the children's responses were correct or incorrect. The description obscures any sense of negotiation or intersubjectivity being involved or recognition that a child is active in seeking a particular level of support.

Jordan suggested that both co-construction and scaffolding have a place in early years pedagogy but that co-construction has more potential for transformation. Co-construction has not been applied to learning to count as a specific curriculum area. The earlier suggestion, that the physical 'evidence' of so many teddies in a jar prevents genuine negotiation of numerical quantity, may mean that this is a curriculum area where co-construction is inappropriate.

'Joint involvement episodes' and 'Sustained shared thinking'

These two terms are also in use in recent discussions of early years pedagogy (Anning and Edwards 1999, Siraj-Blatchford 2004). The use of 'joint' and 'shared' reflect the emphasis on intersubjectivity in interaction. 'Joint involvement episodes' occur when adults and children pay joint attention to and act together on something such as an object or event (Anning and Edwards 1999). 'Sustained shared thinking' is associated with quality in early years settings (Siraj-Blatchford, Sylva, Muttock, Gilden and Bell 2002) and is described as,

> *"An episode in which two or more individuals 'work together' in an intellectual way to solve a problem, clarify a concept, evaluate activities, extend a narrative etc. Both parties must contribute to the thinking and it must develop and extend."* (Siraj-Blatchford et al 2002, p8).

Clearly, both concepts warrant further discussion but for the purposes of the literature review for my study it is relevant to contrast them with the nature of studies involving counting. The interactions in Fluck (1995), Linnell and Fluck (2001) were concerned with establishing

one quantity per interaction, e.g. how many objects in a basket. This is a very brief 'problem'. In the quality interactions conveyed by the descriptions given here, the establishing of a quantity may be seen as a small piece or contribution towards solving a bigger and more sustained problem. If so, it suggests that counting has a different status in co-constructed interaction.

Teaching and learning in interaction

An alternative perspective is not how interaction practices can be recruited to serve the goals of teaching and learning but how are teaching and learning recruited into interaction. This may provide a way forward in considering counting. Rather than speculate about how counting can fit into models of teaching and learning, start by looking at interactive counting. Two systematic approaches to analysing interaction (as interaction first, teaching and learning later) are Discourse Analysis and Conversation Analysis.

Discourse Analysis

The term 'discourse analysis' covers a broad and disparate number of approaches to research through the examination of spoken and written discourse. Its relevance for this thesis is in the identification of 'triadic dialogue', referred to as the IRF sequence (Wells 1999). Discourse analysis, through large-scale studies of dialogue in classroom interaction, has consistently found structural organisation conforming to cycles of three-part talk sequences. The three parts are referred to as Initiation, Response and Follow-up although 'Follow-Up' has also been termed 'Feedback' and previously 'Evaluation'.

The structure has been described as restrictive for student participation but more recently, a greater pedagogic potential for the sequence has been recognised dependent on the flexibility of how the initiating turn (Hughes and Westgate 1998) and follow-up turn (Nassaji and Wells 2000) are deployed. Fluck (1995) is the only study to link counting within such a three-part sequence.

Conversation Analysis

Conversation Analysis (henceforth CA) is less well-known in educational research but has a strong history of providing valuable insights in the study of interaction (Hutchby and Wooffitt 1998). Seedhouse (1997, 2004a) has used it to look at interaction in language learning classrooms and to reconsider the IRF structure. A key difference in his approach is that talk is not classified by researchers' interpretation of what it might intend, but according to what it achieves and how it is received.

A second difference is that CA starts from the position that dialogue in classrooms does not have to have systematic differences to ordinary conversation. Differences that occur are talked into being on each occasion. Revealing how this happens provides insight into how children and teachers respond to one another.

Finally, CA also starts from an assumption of equality between speakers. This is complementary to the aspirations of early years writers such as MacNaughton (2003). Neither claim that inequality is not a feature of interaction, but both argue that the inequality is reproduced on each occasion and is not merely something acting externally.

Summary of interaction literature

The two perspectives presented are of course not entirely distinct but it is helpful to separate them when considering approaches to research. Models of interaction that are presented as models of teaching and learning make intuitive sense and it is possible to then look at a particular interaction through the lenses of the models. The models provide an external reference point in a comparable way to the counting principles: the counting principles provide a standard for *children* to measure up to, models of co-construction (and of discourse) provide a standard for *teachers* to measure up to.

However, when researchers have tried to apply such standards to everyday interaction it has proved difficult. The unambiguous identification of the presence or absence of counting principles has only been possible through specifically designed tasks. Ireson and Blay (1999) found scaffolding difficult to apply to open-ended activity. The difficulties result because the models/standards do not cover contributions from both parties in the interaction. Presenting specific tasks under specific conditions minimises potential variability in contributions and, in doing so, limits contingency.

This is not to say that models of counting principles, scaffolding or co-construction are inappropriate in less controlled interactions, just that there is not enough yet known about how they are achieved interactionally. CA requires attention to contributions from both children and teachers and as such is well placed to extend the concerns raised from the review of literature on counting and teaching and learning in the early years. The next chapter includes examples of research where valuable insights have emerged in the treatment of encounters as conversation until proved otherwise. It requires interaction being fundamentally prioritised over other activities such as counting, teaching and learning.

Conclusions and research questions from the review of the literature

The review of the literature finds that counting is by no means an unexplored area of interest. Different cognitive aspects of counting have been extensively investigated, the importance of counting for mathematical development is established and counting is recognised as prevalent in pre-school activity.

What is missing in the literature is description of how counting takes place interactively and how it is located in nursery activity. The reason it is important to know this now is that the way counting is portrayed in the literature has incompatibilities with changes in wider early years perspectives. If it is to sustain its importance and claim a worthwhile piece of foundation stage activity, then these incompatibilities need to be at least verified. If teachers and children are finding ways to iron out incompatibilities then it is important to know what kind of counting they are achieving.

There is a need to know what practitioners can and do do in supporting children learning to count. It is important to know when children say count sequences and where these count sequences fit in the conversations between children and their teachers. Fluck (1995) illustrated the importance of considering what kind of things children count in response to and how counts are received. This needs extending into the educational context where children are older than in Fluck's study and are in interaction with teachers whose goals may be less social and more educational.

Beyond the talk that occurs immediately on either side of a count sequence, counting is embedded into wider conversation and wider nursery activity. How does this conversation become counting? Previous research has taken 'children's counting' and 'adults supporting' *out* of conversations. There is a need to put them back in. With this in mind, the central research question proposed for the study is,

> ***What features of conversation do teachers and children recruit during nursery counting activities?***

Using the phrase 'features of conversation' and the verb 'recruit' reveals a particular stance of looking at talk. It is about talk as activity rather than message transmission, seeing conversations as 'arenas of action' (Hutchby and Moran-Ellis 1997). The framework comes from CA, discussed in detail in the next chapter.

To further specify the nature and orientation of 'features of conversation', four 'sub-questions' are proposed,

- How do counting conversations unfold? Are there recurrent patterns and where are the conversations embedded?
- How is turn-taking organised in counting conversations?
- What are the features of conversational turns in counting activities (their vocabulary, grammar and intonation features)?
- What asymmetries of knowledge and participation are there?

Again, the questions reflect more clearly a research approach than specific issues raised through the literature review. However, the next chapter provides an outline of CA with explicit links to its suitability in addressing the aspects of counting discussed. The research questions are then returned to with a clearer justification.

Chapter 2. The Research Framework – Conversational Analysis

Introduction
Overview and Underlying Principles — Origin of research concerns and concepts; Sequential analysis; Conception of rules; Order in interaction

Applications
Techniques — Sequence organisation; Turn-taking organisation; The organisation of turn construction/design
- *the 'wind tunnel' metaphor*
- *syntactic design*
- *lexical design*
- *prosodic design*

Interactional asymmetry

Summary and Limitations
Research Questions

Introduction

The thesis introduction, literature review and research questions propose that *conversation* is a suitable and timely source for extending the study of teaching and learning to count. Conversation Analysis has been described as,

> *"the systematic analysis of the talk produced in everyday situations of human interaction"* (Hutchby and Wooffitt 1998, p13).

Not all of this talk is *conversation* in the conventional sense, carrying with it the implication of talk that is perhaps social rather than educational. Psathas (1995) uses the broader term 'talk-in-interaction' and this is helpful to emphasise the assumption in this study that talk (at least some of the time) between teachers and children is *more* than conversation.

This chapter introduces CA as the framework for this study and presents key aspects of CA in relation to the concerns raised in the literature review. The value of CA in this endeavour is discussed using examples from a variety of research contexts together with a consideration of the potential limitations of using CA in an educational context.

The discussion is divided into five parts – firstly, an **overview** of CA's stance to locate it amongst other research methods, secondly examples of **applications**, thirdly details of **techniques** used in CA, these are followed by a **summary** of the issues raised and finally a return to the **research questions** for the study.

Overview and underlying principles

Pomerantz and Fehr (1997) propose three significant characteristics of CA that differentiate it from other approaches to talk data. They suggest that CA is distinct in three areas,

- the origin of research concerns and contexts,
- sequential analysis,
- the conception of rules.

Alongside these areas, Pomerantz and Fehr reiterate a central claim: the belief that there is 'order in interaction' and that CA can uncover this. I have extended this and their three areas to form this part of the chapter, as an introduction to CA within the concerns of my study.

Origin of research concerns and contexts

CA's position is *inductive*: concepts are drawn from data rather than from the pre-existing theories, predictions or hypotheses of the researcher (Hutchby and Wooffitt 1998). It seeks a view from the perspective of internally (rather than externally) constructed factors (ten Have 1999). It achieves this through analysis of the way that participants interact, how they respond to one another and what their interaction, together, makes relevant.

This stance requires an approach to teaching and learning situations that is very different from practitioner reflection, for example, where situations may be viewed in search of specific learning objectives. It is different from the approach to counting described in the literature where the search was for learning objectives being present (or not) or for specific support strategies having been offered (or not). Letting go of such lenses may be just as difficult as viewing children in isolation, but CA offers techniques for suspending them at least. Primarily this is by a strict approach to context. Context is acceptably multifaceted and in any interaction there are many contextual aspects that researchers could see as relevant, depending on their (external) perspective. CA accepts that context is important, but only in so far as aspects of context are demonstrated as relevant by the participants.

This means that issues of context are not pre-judged. At the extreme this would require roles of child and teacher to be proved before labelling transcripts as such, hence the use of terms like 'participants'. However, the advantage is that it guards against automatic assumptions for instance, that teachers' talk is judged on an enabling/not enabling dimension.

Sequential analysis

How participants *make* aspects of context relevant is revealed through sequential analysis. Turns at talk occur in sequence but this is not just 'serial' i.e. one after the other; turns link back and forth (Hutchby and Wooffitt 1998). Each turn is a response to what has gone

before and a prompt (and often constraint) to what comes next. Turns cannot be made sense of independent of the sequence of turns in which they are located. This sets CA apart from traditional linguistic approaches, where language is taken to have a consistent and abstract relation to meaning. In CA, language is seen as action, making sense through its timing and interactional location as much as content. Meaning is negotiated and created in interaction.

Goodwin and Heritage (1990) link context and sequential analysis in this description,

> *"every action is simultaneously context shaped (in that the framework of action from which it emerges provides primary organisation for its production and interpretation) and context renewing (in that it now helps constitute the frame of relevance that will shape subsequent action)"* (p289).

Hence context is a fluid rather than fixed part of interaction. By looking for what is being focussed on, turn-by-turn, moment-to-moment, a richer picture emerges. It is quite possible that this could then add up to a picture that conforms to a metaphor of scaffolding or as 'instrumental', but it has to be built rather than applied.

Fluck's (1995) study is unique in approaching counting in a sequential way. He considered different kinds of turns (e.g. whether children gave single word or count sequences), not just in terms of what they looked like but also what kind of turns they came after.

Conception of rules

The third characteristic suggested by Pomerantz and Fehr refers to the notion of rules. The identification of rules and models as explanations for participants' behaviour is a frequent goal of research (Edwards 1997). However, Edwards argues that rules do not exist in this separate and abstract way, instead they are actually part of the behaviour, as resources that participants can optionally make use of. Hutchby and Wooffitt (1998) describe this as rules being, *"**embodied** in actions, not **determinants** of action"* (p244, my emphasis).

Rules in CA are seen as 'the way that things normally go' and participants can be shown to *orientate* to them. Rules can be identified through two conditions,

(i) interaction occurs that is consistent with the rule and this is received in a positive or unmarked way, i.e. is treated as 'normal',

(ii) interaction occurs that transgresses the rule and this is remarked upon, it draws attention and may become a topic of the talk itself.

This is a very significant point to bring to the issue of counting principles. The literature implies principles as rules that *govern* the way that children count. From a CA perspective,

principles need to be *orientated* to, and so should be *embodied in* counting practices. Following the two conditions given above, this does not mean that all counts occur in a principled way. However, if a count occurs in a non-principled way (perhaps an object is counted twice), unless this is remarked upon, the one-to-one principle ('rule') *was not relevant* for the participants in this count.

Taking this approach frees up the research from trying to establish who is or is not following rules and how this might link to their psychological intentions, knowledge or capabilities. It instead focuses on how and whether rules are made relevant by teachers and children together through their interaction.

Order in Interaction

In addition to these three points Pomerantz and Fehr describe a key assumption of CA from the work of Harvey Sacks (discussed in Silverman 1998). Sacks (1992) demonstrated how apparently 'messy' characteristics of conversational language (e.g. hesitations, repetitions, previously excluded in traditional linguistics) revealed a sophisticated degree of order in the way that people interact. He described this as 'order at all points'. Order is accomplished collaboratively, within each interaction, rather than as a result of external forces.

This attention to 'messy' detail is where the resonance with contemporary issues in early childhood is again striking. Practitioners are rejecting pared down, stripped away, isolated and simple views of children and learning in favour of more complex views that attempt to engage with contradictions rather than exclude them (MacNaughton 2003). Practitioners trying to engage with truly collaborative learning and assessment have noted how difficult this is (e.g. Fleer and Richardson 2004) but like Sacks, by paying attention to the messiness, orderliness may be revealed that was not previously recognised.

In terms of counting, it is not known how far children's counting within nursery activity conforms to counting principles. It may be assumed (given that children are not expected to arrive at nursery applying principles consistently) that at least some of the time counting does not follow principles. If teachers are accustomed to counting in a principled way, how do children and teachers negotiate this? Do teachers make children 'accountable' when they count in non-principled ways? How might they achieve this in an orderly manner?

Applications

Applications of CA have been many and varied and the identification of orderly practices has evolved. Seedhouse (2004b) suggests that there is sufficient information to refer to a concept of 'normal' or ordinary conversation with which 'other' talk in interaction may be compared. The most prolific arena for this is the use of CA in 'institutional' interaction (e.g. Drew and Heritage 1992, Heritage 1997).

The same conditions apply as discussed in the previous sections. Interaction is not just 'institutional' by way of occurring within an 'institutional' setting. It is shown to be institutional through the way in which it proceeds, shaped by orientation to overarching institutional goals and that at least one person's interaction is constrained according to their role as a representative of the institution (Drew and Heritage 1992). Talk between children and teachers in nursery settings falls into this, but is not restricted to it.

There is some criticism about the use of previous research in this 'comparative' way (e.g. Billig 1999). Schegloff (1999) responds by reiterating the need for caution in comparison, i.e. treating each analysis as independent. This is especially important when using CA with children. Where there are well-established 'norms' of conversation (e.g. the outline of turn-taking organisation given below), these are based on adult-to-adult data. There is not yet enough corresponding data from talk between children or talk between adults and children.

Despite these cautions, CA is being increasingly applied in research within a range of professions where interaction with others is a central part of professional practice (Peräkylä and Vehviläinen 2003). The centrality of interaction to practice requires such professions to have what Peräkylä and Vehviläinen call 'Stocks of Interactional Knowledge' (SIKs), theories about interaction within that particular profession. The degree to which these theories are refined and referred to is more explicit in some professions than others. As well as revealing the interactional order that is present in professional activity, CA studies provide feedback that can extend, elaborate or challenge the professional knowledge base.

As an example, Peräkylä and Vehviläinen describe research by Ruusuvuori (2000). This examined the use of so-called open-ended questions in GP practice. Assumptions from the professional SIK were that these should be used at the beginning of consultations to enable a 'patient-centred' approach, giving patients more scope to describe symptoms than 'closed' questions (leading to yes/no answers). CA revealed that patients' responses were not constrained by question type, they supplemented (and were given time to supplement) yes/no answers to closed questions in a way that was consistent with a patient-centred approach.

The interest in this example is because the issue of closed/open questions cuts across many professional SIKs, including teaching. Open questions feature recurrently as a 'good thing' in professional interaction. The discussion by Aubrey, Godfrey and Bottle (2003) of the differences between the two parents' styles of interaction is an example from early mathematics. They discuss how open questions give space for children to expand and explain their ideas and reasoning. This is not in dispute, but it is salutary to remember that open questions do not on their own create this opportunity.

Within education, applications of CA have been mostly limited to language education classrooms, in particular where students are learning English as an additional language (e.g. Seedhouse 1997, 2000a, Koshik 2002). These classrooms are concerned with interactive aspects of language learning, recognising that students need to learn language in a functional rather than abstract way (Seedhouse 2004a). This is slightly different from other areas of education where, despite also being increasingly interested in interaction, the underlying focus is concern with *outcomes* of interaction rather than necessarily the interaction itself.

Whilst not explicitly discussed as such, models of scaffolding, co-construction and triadic dialogue all contribute to educational SIKs. Triadic dialogue has been re-examined using CA perspective by a number of authors (e.g. Hellermann 2003, Ridley, Radford and Mahon 2002, Seedhouse 2004a). These authors have shown how a turn-by-turn analysis of educational dialogue can illustrate flexibility in the three-part structure that is less apparent from a strict coding of the dialogue.

The starting point for CA is 'unmotivated looking' at the data (Psathas 1995). A variety of practices have been developed to extend the 'looking'. The different levels that can be considered in attempts to specify how conversation unfolds are the focus of the next section.

Techniques

The term 'techniques' is used loosely, to refer to pointers to looking and ways to cut into data that have emerged through the development of CA. Rather than use one particular framework, I have drawn from a combination of sources to identify four areas that are most appropriate in the light of the literature discussed in Chapter 1.

The main sources used are two general CA texts (ten Have 1999, Hutchby and Wooffitt 1998) and two more applied/institutionally motivated frameworks (Drew and Heritage 1992, Heritage 1997). The four areas are,

- Sequence organisation,
- Turn-taking organisation,
- Turn construction/design,
- Interactional asymmetry.

These areas describe different levels of organisation and, at the same time, are places to look for organisation. The different texts accord different significance to different areas depending on their background and intended audience. Differences between authors are pointed out below as appropriate. There is some overlap between areas but they are introduced individually and illustrated with reference to previous studies where relevant.

Sequence organisation

As mentioned earlier in the chapter, a distinct and central aspect of CA is the focus on sequential analysis. This concentrates on determining how subsequent turns are related to previous turns and how some turn types 'require' or 'set up' other turn types or sequences. Heritage describes this as,

> *"how particular courses of action are initiated and progressed and, as part of this, how particular action opportunities are opened up and activated, or withheld from and occluded. All of these possibilities, while explicitly analysed by us, are also implicitly grasped – to a greater or lesser extent – by the participants"* (1997, p169).

In taking this perspective, the way in which speakers respond to turns provides 'next turn proof' (Hutchby and Wooffitt 1998). Each speaker's turn is a display of their treatment of the previous turn and so claims about the turn must be made based on its next turn treatment. Next turn proof has been used in the identification of two other concepts: 'adjacency pairs' and 'preference'. The adjacency pair is another unit of organisation (Koshik 2002), a pair of turn types that are inextricably linked, for example, requests/grantings or reciprocal greetings. Once a 'request' occurs, it sets up the expectation for a granting (or refusal).

Questions and answers are a common adjacency pair, but question-type turns also project a third turn to be taken by the original questioner (Silverman 1998). In the answer turn, speakers will offer an opportunity for the questioner to comment before extending their response or taking up a new topic. In many instances, particularly institutional contexts, the third turn is then used to ask another question and so establishes a cycle of roles in the interaction (Silverman 1998). This is often how the IRF sequence proceeds (Wells 1999).

The concept of preference is a further aid in understanding how sequences develop. Some second pair parts are 'preferred' to others (Goodwin and Heritage 1990, Koshik 2002).

Preferred second pair parts tend to align to the activity set up by the first pair part, for example a request followed by a granting rather than a refusal. Both granting and refusal are relevant responses but preference is shown by systematic differences in how the responses are done. Granting-type responses tend to be short and given immediately whereas refusal-type responses are comparatively delayed, longer and often accompanied by mitigation (Goodwin and Heritage 1990).

Attention to the sequence of turns therefore enables patterns to be identified in the data. The way that turns unfold gives insight into participants' treatment of each other's contributions and how the interaction is begun, advanced and concluded. Within counting conversations Fluck (1995) has already shown how counts tend to occur following a 'how many' or 'count' suggestion and how they sometimes lead to a statement about cardinality. These preceding and succeeding turns contribute to the notion of context for counting. Including these as part of the activity of counting that children are learning to take part in enables a more complete treatment of counting than previously achieved.

Turn-taking organisation

The way that turns at talk are organised is also a central concern of CA. Turns are conventionally organised so that only one speaker speaks at once, although classroom settings are one example where two or more parties speaking in unison is not unusual (Lerner 2002). In the majority of everyday conversations, turns are organised in a way that minimises both overlapping talk and silence. This is achieved through quite an intricate set of 'rules' that conversational participants can be shown to orientate to and appear to be robust across a range of speaking situations and participants (Hutchby and Wooffitt 1998).

The organisation is reliant on two key concepts: 'transition-relevance places' (TRPs) and 'turn-construction units' (TCUs). TRPs are points in the talk where speaker could change (without it seeming to be an interruption). TCUs are units of talk that are sufficient to make up a complete turn. Units can be as small as "yeah" or "mmm" and do not always correspond to an identifiable linguistic unit such as a 'complete sentence'.

When a first speaker is talking and reaches a TRP, there are three options: speaker nominates someone else to take a turn, another speaker self-nominates, or the first speaker continues. These options are described by two 'rules' that are invoked at the first TRP (Sacks, Schegloff and Jefferson 1974),

> "*1a. If the current speaker has identified or selected, a particular next speaker, then that speaker should take a turn at that place.*

b. *If no such selection has been made, then any next speaker may (but need not) self-select at that point. If self-selection occurs, then first speaker [to do so] has the right to that turn.*
c. *If no next speaker is selected, then alternatively the current speaker may, but need not, continue talking with another TCU, unless another speaker has self-selected, in which case that speaker gains the right to that turn.*

2. *Whichever option has operated, then rules 1a-c come into play again for the next TRP."* (from Hutchby and Wooffitt 1998, p49-50).

Silence occurs if a speaker is selected but does not take up their turn and also if no speaker is selected and the current speaker chooses not to continue. *Overlap* may occur when the current speaker does not select another speaker and continues despite another speaker self-selecting. In the spirit of the perspective on rules described earlier, the system does not mean that silence and overlap do not occur in conversation. When they do occur, inferences tend to be drawn from them. For example, pauses may indicate a lack of willingness to take a turn and overlap may indicate competition for a turn and be treated as an interruption.

Another contribution to the avoidance of silence and overlap is the 'projectability' of TCUs. Speakers do not *wait* for the end of a turn and then begin their turn, they are able to anticipate the end of a TCU (and therefore the placement of a TRP) and begin their turn immediately and smoothly at this point. Ford and Thompson (1996) identify the importance of intonation in projecting TCU completions. In a large study of speaker change they found that change coincided with boundaries of intonation units rather than syntactic boundaries. By monitoring the rhythm and 'tune' of what someone is saying (within the larger rhythm and tune of the conversation) it is possible to predict where the tune will end. This *design* of TCUs is the next level of organisation to discuss.

The organisation of turn-construction/design

The way turns are designed also has consequences for how sequences develop. There are two senses in which turns are designed: in terms of the action they perform and in terms of the resources that are selected to achieve this (Heritage 1997). This first sense is salient in institutional settings because of the more overt need for some kind of task or business to be achieved. This is discussed under the heading of the 'wind tunnel metaphor'. The second sense of design relates to choice among alternative ways of saying thing. This is discussed under three areas: syntactic, lexical and prosodic design.

The 'wind tunnel' metaphor

This is an intriguing metaphor suggested by Heritage (1997) to describe the design of turns that are used repeatedly to achieve the same function. The example given by Heritage is taken from telephone calls made by a school secretary to parents of children who are absent

from school. She habitually uses an opening turn (reason for calling) that is designed not to cause offence but at the same time reveals that the reason for the absence is not known by school and implies that it should be (i.e. "Was Martin home from school ill today?").

She could achieve this action through other designs but this one is most efficient because it elicits a response to her reason for calling with little interactional 'resistance'. 'Resistance' refers to problematic interaction such as need for repair, dispreferred responses or further explanations. Heritage suggests that people in this position have not intentionally designed their turn this way but by the repeated placement (in the interactional 'wind tunnel'), the most effective design has been honed. The school secretary will have used many different possible designs, some will have led to resistance, misinterpretations and even arguments.

Heritage suggests that this effect is seen in many different settings and it can be argued that this effect should be apparent in turns used by teachers in counting activities. This is not to say that teachers do not adapt their language according to individual circumstances but that teachers who are experienced in encouraging children to count are likely to have favoured ways of doing so. By implication then, any *regularities* in the design of repeated turns provide a fruitful source of information about counting in interaction.

Syntactic design

This aspect of turn design refers to the grammatical form of turns. Its significance was illustrated in the discussion of the use of open and closed questions in medical contexts. Koshik's (2002, 2003) studies of teachers supporting students in production of written assignments are good examples from an educational context. Koshik (2002) looked at the use of 'reversed polarity questions' (RPQs). In these questions the preference set up by the turn's action is opposite to the preference set up by its grammatical design. She gives an example in the design of the turn *"you're not going downtown are you?"* (Koshik 2002, p1853). Used as a request for a lift, this turn has a preference for "yes", to be granted, yet grammatically it prefers "no" because of the negative design.

In linking her research to her professional SIK (language education), Koshik claims that, just like the 'resistance' concept, the design has been honed to achieve a particular kind of teaching-learning interaction where teaching is done through eliciting student performance rather than direct informing or teacher demonstration. Her analysis of the consequences of the RPQs illustrates that this is exactly what their use achieves.

Syntactic design of turns in counting is problematic for the count sequence itself. An utterance such as "one two three" does not have an underlying grammatical structure and its completion is dependent on what is counted. The closest structure it resembles is a list but, unlike lists, there is not generally an "and" before the final item. Options in syntactic design of the count sequence are then limited to deciding when to stop.

Fluck (1995) has already looked one aspect of design in adult turns that follow counts. He noted that parents sometimes followed children's counts by using the final word of the sequence in a phrase with a plural noun and suggested this pointed to the cardinal meaning of the last number. Parents only used it in 7.5% of counts. Given that teachers are more aware of cardinality, they may be expected to use these patterns more frequently.

Lexical design

This refers to the vocabulary aspect of turn design. Heritage (1997) assigns importance to this in institutional talk because of the tendency for specific institutional encounters to have associated specialised vocabularies. As well as jargon vocabulary, he notes the use of "we" instead of "I" by professionals to speak as representatives of the institution, distancing what they say from their personal view. Teachers' use of "we" in announcements (e.g. "we're going to do counting") can be a way to emphasise their role as leader of the group.

Fluck (1995) has already shown how different lexical choices in the opening turn of counting activities may have different consequences. The use of "how many" was more likely to lead to single word responses, whereas the use of "count" led to sequence responses. In terms of the count sequence itself there are limited options with lexical design as there are with syntactic design. The words used for the count sequence are fixed conventionally. There may be a choice of which language to say them in, but then the order they are said in should conform to the 'stable order' principle.

Prosodic design

This final aspect of turn design is increasing in importance within CA (Couper-Kuhlen and Selting 1996). Prosody (for the purposes of this study) can be used interchangeably with the more familiar *intonation*. Both terms refer to the way that parameters of pitch, length and loudness are combined to shape talk in rhythm, rate and a tune of emphasis across sections of talk (Cruttenden 1997). Its significance for CA was mentioned in the section on turn-taking organisation because it is the most consistent way in which speakers can anticipate the ends of turns and opportunities for transition (Ford and Thompson 1996, Selting 1998).

What is also very important is the way in which adjustments of prosodic parameters achieve *relative* prominence of different syllables within an utterance. It is not just that a syllable is 'loud' or 'high pitch', it is loud/high pitch *in relation to the talk around it*. New and/or important words receive this relative prominence in contrast to surrounding words that are said with reduced emphasis (often quicker and/or quieter).

Given the restrictions for the count sequence in terms of syntactic and lexical design, this a particularly interesting aspect to explore both within and across turns. Within turns, it is already recognised that the final number of a count sequence may be emphasised in comparison to the other numbers of the sequence (Maclellan 1997). Fluck (1995, Linnell and Fluck 2001) also noted this and suggested it was an indication that children knew the last word to be 'different' from the rest of the sequence.

Prosody across turns is also important but was not explored in Fluck's (1995) discussion of parents' repetitions of children's last number. In repeating the same word, turn design is fixed in lexical and syntactic terms. How the turn relates to the previous turn must be achieved through prosodic design. Emphasising the number in the same way as the child *affiliates* the two numbers across the two turns. Emphasising the number in a different way is a way to *contrast* the two numbers.

Hellermann (2003) looked at the prosody of repetitions in teacher-student dialogue. He found that this was an evaluative device used by teachers. In (what came to be seen as) positive evaluations, teachers' repetitions of student contributions were done with similar pitch movements. In negative evaluations, teachers used the same words as the students but with contrastive prosody. This device enables a 'confirming' or 'questioning' of students' contributions without an overt acceptance or rejection.

Interactional asymmetry

The concept of interactional asymmetry is taken up by Drew and Heritage (1992) as a central feature of talk in institutional settings. They quickly concede that it is erroneous to imply from this that non-institutional conversations are somehow 'symmetrical'; they acknowledge that all interactions have asymmetries. They argue that asymmetry in institutional settings is different to 'normal' asymmetry because of the recurrence of interactions. A particular interaction is one of many for the professional and as such becomes routine, in contrast to the customer/client/student for whom the encounter may be unique.

Two types of interactional asymmetry are relevant in an educational setting: 'asymmetry of participation' and 'asymmetry of knowledge'. Asymmetry of participation is evident in talk that includes question-answer organisation. The participant who takes on the role of questioner is able to direct the course of interaction. This is evident in classroom IRF cycles where children are positioned in the role of 'answerer'. Furthermore, the answerer is often obliged to provide answers to questions without awareness of where the questioning may be leading. Drew and Heritage (1992, p50) describe this as a 'hidden agenda' that is only revealed as the questions unfold.

This hidden agenda is just part of the asymmetry of knowledge in institutional interactions. It is not just that one participant holds more professional knowledge (for example in terms of medical or mathematical theory) but they also have more knowledge about interactional formats for knowledge discussion (Heritage 1997). This includes the right of teachers to determine rights to participate and ease in using comments such as "I wasn't asking you" that can 'cancel out' a contribution.

The essential point about asymmetrical knowledge in institutional interactions is that professional knowledge is treated as superior. If there appear to be differing versions of events or diagnosis, the professional version is the one that is taken forward. Despite this, studies have also identified what Heritage (1997) calls 'epistemological caution' whereby professionals may avoid or delay 'jumping to conclusions'. This caution is evident in Heath's (1992) study of doctor-patient consultations. Despite doctors citing diagnosis-making as a central part of consultations, analysis of the interactions indicated a reluctance to give diagnoses and when they were given, they were 'delayed'.

The suggestion of asymmetry of knowledge and the way that it is played out has implications for models of teaching and learning. Koshik (2002) identifies the preference for learners to display their knowledge, with teachers to some extent keeping theirs hidden. More widely, Sacks (cited in Hutchby and Wooffitt 1998) refers to the weaker position for the first person giving an opinion. The speaker who elicits an opinion is enabled to comment on that opinion in a way that the other speaker is not. These preferences are embedded into the IRF sequence, and teachers who have ambitions to achieve a more equal status of knowledge need to combat these interactional preferences.

These ideas present an obvious parallel with Jordan's (2004) discussion of asymmetries of power in models of co-construction and scaffolding. She argues that a co-constructive approach can reduce asymmetry. CA offers a way to determine how far interaction

conforms to expected asymmetries, but it is important not to attribute asymmetries to power roles automatically, without demonstrating that this is the way in which participants are orientating to them (Schegloff 1999).

Summary and Limitations

This discussion of CA has been intended to illustrate its potential as a research method in educational activity. Within this study, CA is used with the aim of clarifying the interactional processes involved in counting activities. It has the advantage of avoiding concern with what children or teachers 'know' or may claim to 'intend' in their interactions, limiting inference about these to what is actually revealed to take place. This advantage can also of course be seen as a disadvantage. However, there is already a reasonable amount of research on what children 'know' about counting and what they can achieve (most recently, Bruce and Threlfall 2004, Threlfall and Bruce, in press). There is much less research about how teachers approach counting interactions and CA offers a unique way to uncover this.

There are two areas of limitation in particular for the application of CA to educational research. Firstly, is CA's approach to context and secondly, the means of dealing with analysis of changes in sequences of interaction over longer stretches of time that may be taken to imply learning.

The first of these, context, has been referred to at different points in this chapter. CA recognises context as it is made relevant by participants and requires analysis of conversations as conversations first and examples of teaching and learning or institutional interaction second (Schegloff 1992, Schegloff, Koshik, Jacoby and Olsher 2002). This approach works well for those who are interested primarily in interaction. For those whose concerns are teaching and learning application, the rigid application may be limiting.

Those who spend time working in environments where counting takes place need to be able to relate the conversations to familiar environments. To address this, the study design chapter (Chapter 3) includes a description of the 'data contexts' that reflects my own interpretations of what may or may not be relevant to these interactions.

The second limitation, learning, is more problematic. Rampton, Roberts, Leung and Harris (2002) are critical of CA's ability to show change, a crucial element in research that strives to demonstrate educational value of interaction. CA provides an analysis of interactions at one particular time, without reference (unless the reference is made by participants) to

previous interactions. Differences in interactions from occasion to occasion cannot be linked unproblematically, particularly in links that imply some 'progress' or development has occurred independent of the interactions (Hutchby 2005).

Despite this, CA can contribute valuably to notions of learning as 'transformation of participation' (Fleer, Anning and Cullen 2004, MacNaughton 2003). CA is able to provide examples of interactions where there are differing degrees of participation from children. Rather than attribute this to a more-skilled, more-developed child (within child factor), the focus would be on what circumstances within the interaction led to (and followed from) this greater participation. Essentially, what this means is rather than using research to provide indicators of finding out what a child 'knows', the idea is to use research to provide indicators of how participation is constrained or facilitated.

The final section of this chapter returns to my main research question and addresses the sub-questions in the light of this chapter's outline of CA.

Research Questions

The central research question for the study, formulated through the initial review of the literature was,

> ***What features of conversation do teachers and children recruit during nursery counting activities?***

Four 'sub-questions' were identified but not discussed. The discussion in this chapter has shown that CA does not lend itself to specific research questions, but that there are generic areas of interest for many CA endeavours. The relevant areas for this study were described as issues of sequence organisation, turn-taking organisation, turn design and interactional asymmetries. In linking these to the previous literature on learning to count, four sub-questions are proposed,

- How do counting conversations unfold? Are there recurrent patterns and where are the conversations embedded?
- How is turn-taking organised in counting conversations?
- What are the features of conversational turns in counting activities (their vocabulary, grammar and intonation features)?
- What asymmetries of knowledge and participation are there?

How do counting conversations unfold? Are there recurrent patterns and where are the conversations embedded?

Heritage (1997) predicts that true examples of institutional talk create recognisable episodes. Because counting activities are a relatively regular practice for nursery teachers, regularities may be anticipated. This question is posed to attempt to determine whether patterns can be identified (and justified) in sequential organisation.

As well as identifying patterns, CA also pays attention to exceptions. This is referred to as 'deviant case analysis' where there is an attempt to broaden analysis to one that can account for all cases (Peräkylä 1997). In contrast to methods where infrequent and exceptional patterns are dismissed or excluded, it is a principle of CA that these cases are looked at in more, rather than less, detail.

How is turn-taking organised in counting conversations?

The importance of insights from analysis of turn-taking organisation was discussed earlier in the chapter. Whilst the standard 'rules' proposed by Sacks, Schegloff and Jefferson (1974) apply in general to all interactions, the rules need to be created within each interaction and this in itself can be revealing. It reveals the kind of units that participants feel are complete or incomplete, their preferences for turn allocation (who talks when) and consequences of silence or overlap.

What are the features of conversational turns in these activities (their vocabulary, grammar and intonation features)?

This question is concerned with what the turns in counting activities look like. Features of conversation are the syntactical (grammar), lexical (vocabulary) and prosodic (intonation) choices made in the three turns identified by Fluck (1995): the turns that lead to counting, the count itself and the turns that follow counting. The potential in looking at prosodic features, especially in the count turn, was raised in this chapter. Aspects of syntactic and lexical design have been identified by previous research as features of parent-child conversations in counting, but there is no comparable research for teacher-child conversations.

What asymmetries of knowledge and participation are there?

The final question is of importance in the light of recent aspirations in teaching and learning theories to reduce asymmetries between children and adults in early years settings (e.g. MacNaughton 2003). By examining how interaction supports or challenges asymmetry it should be possible to identify possibilities for change. A fundamental asymmetry in knowledge about counting is the suggestion that when teachers count it is quantitative yet

when children count it is not. What is crucial to this claim is how the counting of children and teachers is treated in their interactions, finding the evidence for this asymmetry.

Additionally, the interaction might not be asymmetrical at all. Assumptions about differences in roles and competences need to be demonstrated if they are to be accepted as relevant. For this reason, interactional asymmetries are less a feature of the analysis of data and more a feature of what is revealed through analysis. The focus is on the features of conversation that the participants orientate to and what this then reveals about asymmetries.

All questions carry the implication that features and patterns will be described and discussed in terms of their relation to previous research and their implications for counting as an area of teaching and learning in the early years. The design of the study to address these research questions is the topic of the next chapter.

Chapter 3 - Study Design and Procedures

Introduction

The research questions for the study were introduced in Chapter 1 against the background of relevant areas of literature. It was argued that questions needed to be asked about the way that counting took place interactively, within conversations. Chapter 2 extended this rationale by considering the approach of Conversation Analysis. Together these discussions point to the need for recordings of children and teachers counting together.

This chapter details the design of the study. Recordings of children and teachers during specific counting activities constituted the main data set. These were supplemented by two further data sets that take a much smaller role in the analysis:

- exploratory recordings,
- teacher feedback sessions.

The status of these supplementary data needs explicit discussion. They are used to look at aspects of context that conflict with the approach to context taken by CA and discussed in the previous chapter. The approach to context, along with the focus on interaction, is a key difference between CA and previous research into counting. These contrasts contribute to

what makes CA a valuable way to address the issues raised about counting in Chapter 1. However, in order to locate the study alongside previous research, there is a need to describe more conventional aspects of context and the supplementary data address this.

The exploratory recordings gathered information about counting's place in nurseries in terms of organisation and materials, they are described in more detail later in this chapter. There were two further purposes. As well as providing some background context for the thesis, the recordings provided some initial background context for me. I was familiar with nurseries in my professional role as a Speech and Language Therapist. In this role, visits to nurseries focus on individual children, considering their interests and their communication skills and needs within the setting, across all curriculum areas. Approaching nurseries as research environments required a shift in perspective: towards the teachers, towards groups of children and towards the organisation of activity both generally and in one particular curriculum area. The exploratory recordings assisted this change in orientation.

In terms of the design of the study, the exploratory recordings were a means to gauge the extent of counting activity that teachers engaged in. The literature review provided little information about how much counting could be expected in nursery sessions. Munn and Schaffer's (1993) study suggested that numeracy events were scarce in the day nurseries they studied. Information from exploratory recordings could be used to plan effectively for the capture of a main data set.

The second supplementary data came from feedback sessions with the teachers involved. CA has been criticised for not taking into account participants' own reflections on their interactions (Billig 1999). The study largely adheres to CA principles on this issue in terms of data analysis. However, it was important to go back to the teachers as potential 'end-users' of the research (Meade 2000).

The sites and participants were the same for all three data sets. They are described first before going on to detail the collection and preparation of each data set. A section on data context follows this before turning to the treatment and presentation of the main data set.

Sites and Participants

Five teachers and five nurseries were chosen to be involved in the exploratory recordings. The choice of these particular nurseries was related to their location within mainstream primary schools that I was supporting through my work as a Speech and Language Therapist.

Robson (2002) describes the use of this 'convenience' sampling as "sensible" (p265) when the purpose is exploration of issues or piloting of approaches. It was therefore suited to the exploratory stage of the study, where priorities were to determine the extent and concentration of counting opportunities and the means by which they might be captured. However, Robson is also critical of such an approach because of the potential for bias and limitations on how far findings can then be claimed to be representative.

In spite of these concerns, it was decided to use the same sample again for the main data collection. Justification for doing so came from the quality of data found in the exploratory recordings. Each teacher engaged in a variety of counting interactions and it was therefore straightforward to request observation of more such activities. The small scale of the study limited potential to identify the relevant variables needed to seek out a more robust representative sample of teachers and nurseries. Without this it would be difficult to justify the additional time and ethics of initiating new relationships. The chosen schools do however represent a diverse collection from the point of view of type, size, socio-economic catchment and curriculum approach. The sample therefore provides variation along dimensions of interest (Patton 2002) so that data characteristics are unlikely to be a result of something unique to these five schools. It is still important to acknowledge the limitations to the study resulting from the sampling approach. Some description of the sites and participants is given here and discussion of the potential for bias is included in the section on 'Quality' at the end of this chapter (p53).

Three nurseries lie within a mile of each other and have a similar catchment area. The area has been involved in a number of government initiatives such as Sure Start, Education Action Zone, Excellence in Cities. The fourth and fifth nurseries are two and three miles outside of this area, with a mixed but generally more affluent catchment area. Staff and children in all five nurseries are of predominantly, but not exclusively, white British origin with English as a first language.

All five nursery teachers have been teaching for more than 10 years. All apart from one (T3) has more than 10 years experience of nursery teaching. None have additional training in mathematics, although one (T5) is an advanced skills teacher for the Foundation Stage. The experience of the teachers meant that the recordings gained would be of adults who may be expected to have developed established patterns in their treatment of counting interactions and who would be confident and comfortable in carrying activities out.

The children involved in the study were some of those who attended the five nurseries, whose ages would therefore be between 36 and 58 months. Teachers were given the freedom to select children to take part in each activity, rather than choosing particular children to take part in the entire study. The age range of the children means that their counting experience and skills would be expected to be quite variable but it did not appear to be the case that children were chosen for activities based on their age, as children of differing ages took part within the same activity. Choices were not explicitly discussed but may have been more related to the teachers' expectations of children's counting skills and/or their ability to take part interactively.

Timescale

The recordings for the study took place between December 2002 and July 2003. The teacher feedback sessions were completed in April and May 2005. Conversation Analysis took place from the exploratory recordings in December 2002 up until the writing up of the study in July 2005. The data presented in this thesis to some extent represents an 'analysis-so-far' in that the data gathered still contains many avenues for exploration.

Data collection

CA principles taken from Heritage (1997) and Hutchby and Wooffitt (1998) suggest that the type of analysis suitable for an exploration of interactive counting was one of multiple examples rather than of specific individuals. As a result, it was decided to select a small number of nurseries and to focus on the teacher without attention to specific children. This meant that the project could be minimally invasive to everyday nursery activity.

Exploratory recordings

The exploratory recordings were audio-recordings of the five teachers during whole nursery sessions. Audio recording was achieved through a tape recorder worn by the teacher around her waist in a 'bum bag'. A separate microphone was clipped to clothing and was powerful enough to pick up both the teacher's voice and the voice of someone close by.

The sessions were not observed. Teachers were aware of my interest in counting, but were not asked to include number activity specifically in their activities for the session.

Through these recordings, one of the teachers (T2) introduced me to the concept of *number focus activity*. The term 'number focus' was the teacher's own term used in the way she

planned and organised curriculum activity. The concept of 'focus' activities is used in early years settings to plan relatively structured activities on a particular theme or curriculum area (Drake 2002). Whilst the other teachers did not use 'number focus' as a descriptor, they too engaged in small group activities that conformed to a focus activity format (presentation of specifically designed stories, rhymes and games).

Main data collection

Analysis of the exploratory recordings indicated that counting occurred most intensely in the number focus activities. There did not seem to be any differences in the patterns of counting and interaction between the different number focus activities or between the counting that occurred in these sessions and the more incidental occasions. Discussion with the teachers indicated that the small group activities were typical of the way in which they plan for this area of the curriculum. Recorded number focus activities were thus chosen to form the main data set for the study. As no patterns could be detected in relation to activity, it is presumed that counting is not strongly influenced by the context of the activity. For this analysis then, the data set is considered as a whole rather than separated by activity type. The variety of activities recorded is described in the section on data contexts later in this chapter.

Activities were planned to last for approximately 20 minutes each, to be undertaken by a small group of children and to include a general objective to cover the early learning goal of saying and using number names in the right order and counting objects reliably (QCA 2000). This broad remit meant considerable variation in the sample of activities for the study. The alternative would have been to prescribe activities but this was rejected because it was felt that typical interaction patterns might be inhibited if teachers felt obliged to adhere to a plan rather than respond spontaneously within the territory of familiar activities.

The sessions were audio-recorded using the same equipment as the exploratory recordings. Unlike the exploratory recordings, these sessions were all observed in order for field notes to be taken. Notes were made about group turn-taking, speaker identity and non-verbal behaviour such as gesture and pointing.

Teacher feedback sessions

The final part of the study was a feedback session with each teacher. Each teacher listened to two short data examples in conjunction with the transcripts. They were asked to comment on the accuracy of the transcripts, and to offer their reflections on the content of the sessions in relation to their typical counting practices. One teacher (T4) was unfortunately not available.

Summary of data collection

Table 3.1 provides a summary of each type of data gained from the five nurseries. The mean length of the exploratory recordings was 110 minutes (range 90-120). The mean length of the focus activity recordings was 18 minutes (range 5-35). The mean length of the teacher feedback sessions was 37 minutes (range 30-50)

Table 3.1. Summary of data collected from each nursery.

Nursery	Exploratory recordings	Main data collection recordings	Teacher feedback sessions
N1	2	3	1
N2	2	6	1
N3	3	6	1
N4	1	4	0
N5	2	2	1
Total	10	21	4

Data preparation

Exploratory recordings

Recordings were listened to at least twice and a log prepared for each tape to map general topics and the location of stretches of any talk involving number related vocabulary, the number words and instructions or comments that used 'count' or 'how many'. Transcripts were made of these stretches and included talk before and after each incident in order to determine, where possible, what may have prompted a reference to number. Different types of activity were identified and given a glossing description that was written onto a sticky label. The labels could be arranged into different groups and themes. The groups and themes obtained are presented in the section 'data contexts'.

Main data collection

For the tapes of the observed number focus activities, transcription was done where possible immediately following the observation. Field notes were taken using a procedure similar to that described by Edwards and Talbot (1999). They suggest concentrating on a 'target child' and noting their interactions. For my purposes, the target for observation was the teacher, noting when she spoke to individual children within the group, which child was talking when, how materials were manipulated and use of non-verbal communication. Time was taken to 'tidy-up' and reflect on the notes immediately after the observation and then again in conjunction with the tape recording.

The field notes were invaluable in differentiating between different speakers but were ultimately inadequate for analysis of non-verbal counting behaviour. They gave a record of the presence or absence of behaviours such as pointing or moving alongside verbal counts. However, they could not verify the timing of behaviours in relation to the spoken record.

Transcripts consisted of almost all talk in the activities and were re-transcribed with more detail as themes and patterns emerged from repeated listening. Further prosodic detail was obtained through the use of Praat software (Boersma and Weenink 2005). The software is described in Appendix II. In essence it allowed extracts from the tapes to be loaded onto computer and analysed acoustically. It was used to verify my own judgements about intonation and to compile a CD of the extracts used in the data presentation.

All tapes were kept and treated as the primary data sources for re-consultation and re-listening (following Hutchby and Wooffitt 1998). They are also available for judgements about the reliability of my transcriptions. Each focus session was given a reference and these are used to label extracts used in the data presentation chapters. The coding 'T1F1' refers to 'Teacher 1', 'Focus session 1'.

Teacher feedback sessions

These sessions were also recorded and transcribed. Teachers' comments were then coded according to recurrent themes and/or issues directly relating to my own analysis. Teachers were not given information about the way that my analysis had proceeded although they were clearly aware of my professional interest in language. More extensive interviews would be necessary to elicit a robust view of these teachers' opinions on counting but this was not the aim of the sessions. Pertinent comments made are used in the data presentation and discussion where they support or challenge findings from the analysis.

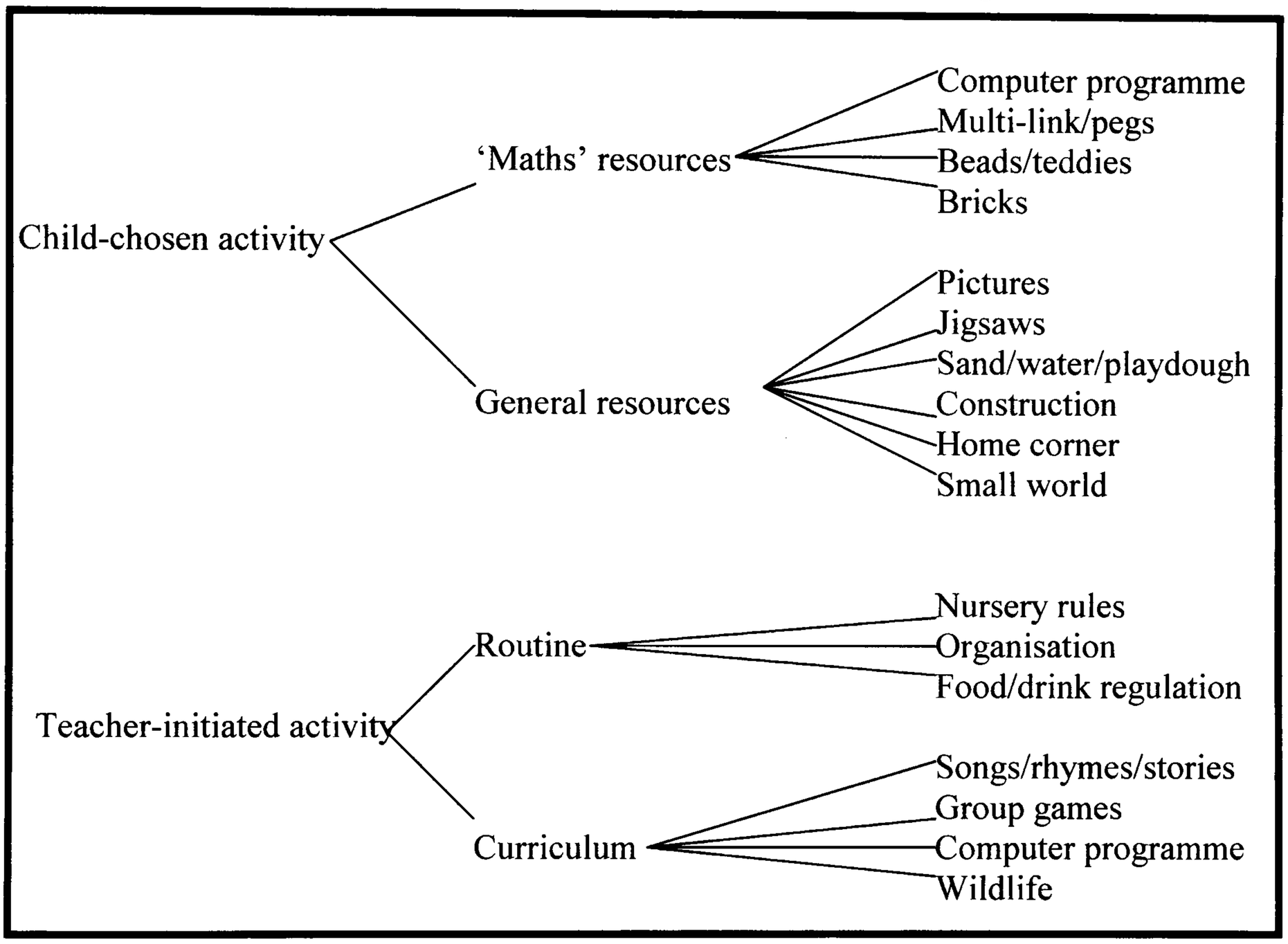
Data contexts

The chapter so far has outlined the places and procedures for the data obtained. Only the focus activity data are used for the main analysis. This section is concerned with the wider picture of the data context referred to in the chapter introduction. It outlines findings from the exploratory recordings about counting in whole nursery sessions and then describes the focus activities. These are followed by a suggestion about the mathematical contexts for counting found and then a summary of this approach to context.

Counting in whole nursery sessions

The exploratory recordings confirmed the variety of *possibilities* for both planned and incidental counting opportunities within these nursery environments. From the tape logs, 124 activities were identified including some repeated across settings and teachers. These were grouped according to similarities and the initial grouping is presented in figure 3.1. It is based on my own perceptions of divisions around traditional nursery areas, resources and activities, influenced by the literature I was reading at the time. The recognition, and hence division, of counting in regulation and routine for example, was clearly influenced by Walkerdine's work (1988, 1998).

Figure 3.1. Nursery activities and materials involved in counting conversations



Child-chosen activities were divided according to the type of resources involved. The justification for judging resources as 'maths' or 'general' was based on whether resources were found in 'maths' areas of nursery or not. Four of the five nurseries had such a 'maths' area: an area of the nursery containing a cluster of resources such as different coloured shapes, teddies, beads; number symbols on laminates, bricks or jigsaws; and (in one nursery) examples of the early learning goals for mathematical development displayed in the area.

Teacher-directed activities were divided according to curriculum or routine. Again this was based on my own judgement that these could be contrasted. There were regular occasions when teachers introduced or adapted curriculum areas to include counting. There were also

examples by all teachers of using counting in routine: counting how many children were present or absent from nursery; counting the number of children allowed in a particular nursery area or activity; counting fruit or biscuit allocation.

Further groupings drew out similarities and differences independent of materials, resources or instigator. A triad elicitation process was used to generate constructs (Aldridge and Aldridge 1996) where three activities were chosen at random and described in terms of how two were similar to each other and different from the third. The process was repeated until no new descriptors were generated. In Personal Construct Psychology (Kelly 1955) this process is used to elicit individual's idiosyncratic constructions of meaning and as such, the process represents *my* constructs about nursery activity: drawn from reading, personal experience and theories about data. The constructs elicited and the groups they formed (Table 3.2) therefore merely represent a limited range of *possibilities* for the dimensions on which counting activities may be grouped or distinguished. The brief outline here is sufficient for the purposes of this thesis and does not intend any more general application.

Table 3.2. Possible dimensions on which counting activities in the data differed

a) ***How the counting related to other aspects of the activity***
Whether counting was the 'main objective' or a 'sideline' to what the children were doing, whether the conversation included talking about other attributes (e.g. size, function, colour etc)

b) Patterns of ***participation*** in the activity
Whether the activity was initiated by child or teacher, were children invited or conscripted, was there a prescribed order for taking a turn, could children come in and out of the activity or were they tied in until the end?

c) The ***role of solutions*** to counts
The importance of the cardinal values, whether they were open to negotiation or were fixed.

d) The ***purpose given*** for the activity
These included purposes that teachers gave but also ones that were more implicit, whether counting was used to aid organisation, associated with order or disorder, joining things together or taking them apart.

e) The nature of ***what was counted*** in the activity
Activities could be differentiated according to whether what were counted were three or two dimensional (objects vs pictures), objects or parts of objects, whether there was just one thing to count or more (e.g. counting spots on dice and then counting the same number of spaces)

Figure 3.1 and Table 3.2 provide a loose view of the contexts for counting in the study. There is little that adds to or conflicts with previous descriptions of counting in nurseries (e.g. Montague-Smith 2002). The next level of context for the study is the planned number focus activities. Number focus activities occurred in 9 of the 10 whole sessions recorded and contributed extensively to the proportion of counting. Most counting activity engaged in by teachers was concentrated in these kinds of activities. This does not negate the less frequent 'incidental' counting but supports the rationale for investigation of the focus activities.

Counting in nursery number focus sessions

There was a wide variety in the type of planned activities for number across the nurseries and teachers. Within the whole nursery sessions all teachers engaged in dice games, stories/rhymes/songs involving counting. Dice games were also the most popular format chosen by teachers for me to observe, with three out of the five teachers providing these.

Table 3.3. Types, frequencies and location codes of counting activities found in number focus sessions

Type of number focus activity	Frequency (all data)	Frequency (main data)	Main data session codes
Dice games	10	7	T1F1, T1F2, T1F3, T3F4, T3F5, T4F1, T4F3
Stories and rhymes	16	4	T2F1, T2F2, T2F3, T2F4
Outside games	5	4	T2F6, T4F2, T5F1, T5F2
Assessment	2	2	T3F3, T4F4
Craft	1	1	T3F6
Other	8	3	T3F1, T3F2, T2F5
Total	42	21	

Dice games

Many of the dice games were board games that gave two opportunities to count for each child: firstly, following the roll of the dice, and then again in moving a token the required number of spaces. Other dice games also had two counts, e.g. in T4F1 the product of the dice roll was used to determine how many bricks children could count out to post into a tin.

Stories, rhymes and songs

These were the most common opportunities to count, occurring in all but one nursery session recorded. Only T2 chose them as focus activities for me to observe. In rhymes and songs, opportunities to count came at predictable points: an 'event' in each verse reduced the

number of things to count until there were none left (snowmen melted by the sun, frogs jumped into pools, men flew away from flying saucers, bottles fell off walls, and so on).

The stories were more flexible. T2 re-told the story of the 'Three Little Pigs' using props and encouraging the children to count the pigs or houses when there were changes in the course of the story. T3 used 'Goldilocks and the Three Bears' in the same way.

Outside games

Not all of the teachers spent time outside during their recordings. One of the exploratory recordings for T2 was entirely outside and contained only two number uses in 85 minutes of recording. In contrast, T4 and T5 planned explicitly to include number work outside.

T5 chose both of her observed recordings to be outside and reported that this was a conscious strategy to exploit physical activity and larger resources. In T5F1 children used hooks to catch ducks from the water tray, each duck was numbered and children were encouraged to write this onto a board. Counting was used to help identify numbers on the number line and later to count how many times a duck had been caught by counting how many times its symbol was written. T5F2 involved throwing quoits into a bucket. Children counted how many were in the bucket after each round.

T4 had numbers painted onto a hopscotch and a 'snake' on the playground concrete. She encouraged children to jump or ride bikes from space to space shouting the numbers. Her outside number focus session (T4F2) used a washing line set up with clothes that had spot patterns on them. Children rolled a dice and chose the corresponding item of clothing to hang up. Counting was not necessary to do this but the teacher encouraged it, counting the spots on the dice and the clothes.

Assessment

Two of the observed activities involved the teachers in assessment type tasks. T3F3 was recorded whilst T3 was waiting for another member of staff to cover during T3F4. T3 chose to work one-to-one with a child that she had pointed out as good at number. First she asked him to show me that he could count to 100, then she involved him in what was recognisable as an assessment of conservation using plastic dinosaurs.

T4F4 was a planned assessment to document children's abilities prior to moving to Reception. She asked children (one or two at a time) to make 'towers' of 10 bricks, then of 5, then asked to say how many they would have if she gave them one more.

Craft

There were no obvious number focus activities in the exploratory recordings that could be categorised as craft. Where craft activities took place, teachers occasionally introduced opportunities to count but this could not be seen as the main focus of the activities. In T3F6 the teacher reported to me that the craft focus had a specific intention of engaging a few particular children in counting. She felt these children would be less reticent than in activities where counting was more central. The activity involved making ladybirds using pre-cut pieces of coloured paper. Children were encouraged to count eyes, spots, legs on a finished ladybird and then as they chose them to stick on their own ladybird.

Other

T3F1 involved counters for children to put onto cards. The cards had pictures of 'buns' with differing number of circles. Children took turns to choose a card to put counters on (referred to as 'cherries' or 'smarties'), counting the spaces and then counting out the counters. In T3F2, each child had a piece of paper with pictures of teddies, they took turns to colour a teddy, then counted how many were coloured in/not coloured in, how many red etc.

The final main data recording categorised as 'other' was T2F5. It occurred spontaneously following recording of T2F4 and I agreed with the teacher to continue recording. One child who had been involved in the game stayed in the area when the other children left, she started to count out teddies from the jars of coloured teddies and the teacher responded.

Mathematical contexts

For counting to occur, whether in incidental activity or in specifically planned opportunities, there is a further, essential level of context. Aside from purely oral counting, there needs to be more than one of something. Quantity and plurality are what make activities 'counting-specific' and at this level of context, there were three themes linked to occurrences of counting,

- attention to the saliency of quantity,
- attention to the saliency of plurality,
- attention to the saliency of a change in quantity.

Attention to the saliency of quantity

Counting occurred when quantity was salient in the main focus of an activity. A typical example is dice games: here there was a clear stated objective to find out quantity of spots on a dice and this was linked to quantity of spaces a child could move.

Attention to the saliency of plurality

This second theme contrasts with the first in that the focus of these activities was not overtly related to number yet the occurrence of multiple 'things' provoked an incidental attention to quantity. Quantity (i.e. how many) was not initially important but tended to *become* important once plurality (i.e. remarking on more than one) had been remarked upon. Extract 3.1 is an example. The conventions for extract format are discussed in Appendix I and in the Data Presentation section of this chapter (p55).

Extract 3.1. T2F5-B01.

→	1	Child	there's lots of colours
	2	Teacher	I wonder how many there are

Attention to the saliency of a change in quantity

With elements of both of the above, this reflects occasions where attention to quantity was brought about as a result of a *change* in quantity. This is most established in traditional rhymes and stories described above. It is also a feature of how wildlife was used by at least three of the teachers, e.g. when looking at nursery caterpillar collection 'how many are there *today*'

There were some occasions where none of the three premises was apparent, for example, in whole group counting at carpet and (on two occasions) where teachers suggest that a child show 'how far' he can count. In these counts, nothing is 'done' with the last number in terms of solving a problem or remarking otherwise.

Summary of contexts for counting

This section has given an overview of the different contexts for counting in the study. It is a means to locate the activities amongst those described in the counting research literature. Only one of the 21 main data activities involved children being asked to take a certain number of things from a larger number, an activity comparable to the 'give x' task (Linnell and Fluck 2001). The only 'fixed' items counted were the spots on dice, in contrast to the tasks used by Fluck (1995, Linnell and Fluck 2001) where objects were fixed to boards.

It is therefore important to note that these different external aspects of context (in addition to aspects of study design) will have a bearing on any comparisons between my data and that of these previous studies. The value of the CA approach to context is thus reinforced: the

'external' aspects of context described here do not form part of the main analysis unless specified internally in the verbal interaction.

Data coding and unit of analysis

The unit of analysis for the main analysis was developed against the background of the premises identified in the previous section of this chapter. Concepts and patterns were developed through repeated listening and examination of transcripts. As these emerged it became possible to develop some coding and division of the data into counting *bouts*.

Choice of the term counting *bout* is influenced by Gardner (1994) and is defined as, *a stretch of turns at talk during which the search for a (potential) quantity is proposed and resolved. Proposal* may be explicit or implicit in that a search takes place. *Search for a quantity* refers to the use of a single number or a count sequence. The use of *potential* reflects the issue that the concept of quantity may not be explicitly referenced. *Resolved* is recognisable by an impression of agreement that the proposal has been satisfied, either explicitly or by shift to another topic of talk. In practical terms, bouts were opportunities for a count to take place, the counts themselves and the receipt of counts.

The transcripts were marked and divided into individually numbered bouts, numbered according to teacher, activity and their position within the session. For example, 'T2F3-B05' refers to 'Teacher 2', 'Focus session 3', 'Bout number 5'. Each bout was entered into a spreadsheet using Microsoft Excel and codes were added to identify characteristics of the three main turns. Characteristics and distributions are discussed more fully as part of the data presentation chapters. Table 3.4 shows the number of bouts recorded for each teacher.

Table 3.4. Number of bouts for each teacher

Teacher	Number of bouts	Mean number of bouts in each activity
T1	73	24
T2	93	15
T3	198	33
T4	111	28
T5	46	23
All	521	25

Quality

Quality of research can be judged along how far the design addresses the ethical issues in the study context, the potential for bias, the reliability of the data, the validity of the data and the degree to which findings can be generalised to wider contexts. Different research traditions approach these areas differently and have different criteria or standards. This section covers the four areas in relation to CA in general and to my study in particular.

Ethics

In order for me to carry out the research through my job, the study design required approval from the ethics committee governing research within my NHS trust. The ethics committee approved a consent procedure for participation. For the exploratory recordings, consent forms requiring signatures were provided for the teachers and for the parents of all children who attended nursery on the day of the recordings. For the rest of the study, as approved by the schools' head teachers and the ethics committee, all parents were sent a letter informing them of the recordings but rather than signing to give consent, they were asked to signal lack of consent. No parent did so.

Children themselves were not consulted or individually recognised. This is in contrast to the general approach to my research, which seeks to acknowledge and respect children's competence. The large numbers of children involved would have made individually informed consent (or assent, Coady 2001) difficult. Children were invited by teachers to join in the focus activities and their refusals were accepted, but this was not equivalent to the children being aware of the implications of my presence or the nature of the study.

Bias

Maintaining the original sample of schools for the entire study meant the study was vulnerable to bias as highlighted by Robson (2002). In particular, the sample necessitates reflection on the potential influence of my dual role as researcher and as Speech and Language Therapist. At the organisational level this was tackled through explicit discussion and agreement with the teachers involved and their schools' head teachers. My employers provided the support to enable me to maintain my normal level of service to the schools whilst carrying out the recordings. The recording visits took place on separate occasions from my visits as therapist. The teachers respected this separation of roles, confining discussions about children's speech and language skills to my therapist visits.

At an interpersonal level, a small number of children who took part in the recordings were also on my caseload. These children made up less than 10% of the children involved but it

was possible that observing them in the research activities would present information about their communication skills that I may not have seen otherwise. Should this information have consequences for the way in which children's difficulties were being supported then this would need to be addressed. I planned to make a note of any such observations and discuss them with the teacher. In the event, I was not aware of any such incidences occurring although this may be an indication of success in shifting perspectives from speech and language to counting.

Whilst I had prior knowledge of a minority of the children, I had worked with all of the teachers to some degree in the three years before the recordings. The previous contact meant that, at some level, I had preconceived ideas about the teachers in terms of their knowledge and skill in supporting and identifying children with speech and language difficulties. It was not the purpose of the study to make connections between approaches to counting and speech and language difficulties, not to draw conclusions about teachers' underpinning beliefs. In addition, the CA principle of dealing only with the interaction meant that any statements I made about teachers' styles or preferences had to be demonstrated in the recordings.

Reliability

Reliability refers to how far results may be replicated, how similar the findings would be if the study was repeated. It also refers to reliability of coding and observation. Robson (2002) describes *observer consistency* as an element of reliability. To address this in my study I have returned to the transcripts to re-identify bouts and to re-code a random selection of 50 bouts on 8 aspects. Agreement was 96%.

Peräkylä (1997) discusses reliability in CA in terms of how recordings are selected and their quality. The purpose of my recordings, collection of counting opportunities, means that a sufficient number of opportunities must be recorded to ensure that the recordings are 'reliable' examples of counting opportunities in the nurseries studied. The exploratory recordings support the decision to concentrate on focus activities, and allowing teachers choice strengthens the authenticity of data gathered.

Validity

This is about whether my research represents what it claims to represent. Including extracts from the original transcripts means that the conclusions drawn can be compared directly by readers for themselves.

Validity in qualitative research is also characterised by the 'credibility' of the process and findings (Robson 2002). The teachers involved in the study have not yet been given the chance to judge the findings of my study but the feedback sessions enabled them to see two sample transcripts in conjunction with the original recordings. The teachers agreed that these were typical representations of their practice.

CA's use of 'next turn proof' and 'deviant case analysis' (Chapter 2, p28, 37) offers an alternative approach to validity, requiring validation from the data rather than other sources.

Generalisation

This refers to the extent that the research can be applied to other contexts. The large amount of data from each teacher may enable findings to be generalised in the sense of claims about a particular teacher's 'style' or preferences in counting interactions. However, the small scale of the study is insufficient to claim that patterns may be generalised to other teachers, children or nursery settings. The aim is that there will be enough that is recognisable for other practitioners to feel the findings are relevant to consider within their own context.

Data Presentation

The data analysis for the thesis is presented in three main chapters that focus purely on the conversational context for the counts from the main data set, the number focus recordings. The presentation of this narrow conversational data is done in three separate chapters that reflect the general format of counting occurrences in the data. The format is loosely complementary to both Fluck's (1995) work and the triadic IRF sequence (Wells 1999). Extract 3.2 gives a typical example.

Extract 3.2. T2F1-B26

1	Teacher	how many snowmen have we got	***I***
2	Child	one two three	***R***
3	Teacher	three that's right	***F***

A note of explanation is needed on the way that extracts are presented throughout the rest of the thesis. A full list of transcription conventions is provided as Appendix I. Extract 3.2 is relatively straightforward but later extracts are more difficult. Each line receives its own number to aid reference in the text. This is followed by identification of the speaker and

then the talk. Comments about non-verbal activity are written below the talk that they accompany. Codes (such as IRF in extract 3.2) are written at the end of the line in italics.

The data presentation chapters are organised as follows,
Chapter 4 (**'count opening'**) looks at the turns that occur *before* counts. It describes the ways in which teachers elicit counting from children, at the same time illustrating the kind of turns that children see as appropriate to count in response to. It is the start of the CA approach to context, the context for counting that the children and teachers show as relevant.

Chapter 5 (**'count middles'**) is the largest chapter and covers the count sequences themselves. 'Middles' is a clumsy term but is the most accurate way to refer to the surprisingly complex activity between the opening and closing turns of a count.

Chapter 6 (**'count closing'**) is concerned with what happens *after* counts, the kinds of conversational turns that counting leads to. These turns are part of the conversational context for counting and therefore another element of what it means to do counting in the nurseries studied.

Despite being addressed in different chapters, the three turn types are clearly interrelated. Relationships between turns are discussed within chapters where appropriate but a more complete integration is achieved through the discussion chapter when findings are linked to my original research questions.

Chapter 4. Data Presentation – Count Opening

Introduction

This chapter is concerned with the immediate conversational context where counting occurs, examining the kind of conversational turns prior to sayings of the number sequence. It builds on Fluck's work (1995, Fluck and Henderson 1996) in examination of the use of the words 'count' and 'how many' to prompt counts, but is extended to include the other introductory turns used in my data and an analysis of how different prompts are combined. Typical examples of turns prior to counting are given in table 4.1.

Table 4.1. Examples of turns used prior to counting

Turn Example	Source
"how many spots have you got"	T1F1-B02
"you could count the spots"	T2F4-B02
"what number is it?"	T2F6-B03
"can you move your spider 4 spaces"	T3F4-B17
"what did you get?"	T4F3-B17

'Quantity Engendering Turns'

In neither a linguistic sense nor the circumstances of my data do the turns in table 4.1 lead exclusively to counting. They did engender counts predominantly, but other responses were given and accepted. The main condition of acceptance, what could be seen to link responses to these turns, was the use of a potential reference to quantity. The most frequently accepted response (besides a count sequence) was a single number response, as in extract 4.1 (p58).

All responses in the main data set were either counts or single numbers. In the exploratory data some non-numerical quantity answers were also accepted e.g. "none", "loads", "lots and lots". To be comprehensive, the turns preceding counts are described as 'Quantity

Engendering Turns' (abbreviated to QETs). The term is cumbersome but enables me to cover all turns in the data that prompted *opportunities* for counting. The design and placement of QETs are the focus of this chapter.

Extract 4.1. T1F3-B13

	1	C	((rolls dice))
	2	T	how many
→	3	C	two
	4	T	good boy

Types of QETs

The most frequent and unequivocal QETs in the data were 'count' and 'how many'. Table 4.2 shows the number of bouts containing these QETs. There were 148 bouts in the data that contained other ways to prompt counts. These 'other' QETs were categorised and are described in the section 'alternative QETs'. The proportions add up to over 100% because not all bouts contained just one QET.

Table 4.2. Frequencies and proportions of bouts containing each type of QET

QET type	Frequency of bouts	Proportion of bouts
'how many'	318	61%
'count'	135	26%
Other	148	28%

The terms 'count' and 'how many' embody two fundamental aspects of counting: the process (enumeration) and the purpose (quantification). Fluck (1995) reports parents using the terms apparently interchangeably and (in Fluck, Linnell and Holgate 2005) attributes this to the finding that parents were not explicitly aware of separate aspects. Teachers, assuming a greater awareness, would be expected to use 'count' and 'how many' more distinctively.

Table 4.2 indicates that 'how many' was the most popular way in teachers prompted counts and as such could be seen as an emphasis of the purpose of counting. More distinctions in the use of the terms emerge when they are combined and this is considered in the later part of this chapter. Here, extract 4.2 gives an example of the terms used in a contrastive way.

Extract 4.2. T1F2-B10.

	1	C	((rolls dice))
→	2	T	d'y'know how many that is?
	3	C	I don't know
→	4	T	shall we count them, put your finger
	5		on the spots
	6	C	one two three four ((pointing))
	7	T	oh let's put on every one so you don't
	8		miss any ((holds child's finger))
	9		w: ⌈one⌉
	10	C	⌊one⌋ two three four five
→	11	T	so how many?
	12	C	five

The child responded to the 'how many' question (line 2) by saying she didn't know (line 3), the teacher suggested counting them and once they had done this she reissued her 'how many' question (line 11). The child's single word 'last number' response (line 12), together with her previous responses, indicate that she knows the link between 'how many' and 'count', at least in conversational terms.

The contrastive use of terms in extract 4.2 is a very useful example but was a rarity in my data. This repetition of 'how many' following a count (discussed further in Chapter 6) is frequently referred to in the literature (e.g. Fuson 1992), but extract 4.2 is one of only three occasions when it occurred in this study.

Another influence on the use of 'count' or 'how many' by teachers was plurality. It may seem unsurprising that teachers did not use 'count' when there was only one thing to count (or none) but this is important to note for two reasons: first as an illustration that teachers already 'know' the answer when they ask the question; and secondly, that *counting* is associated with more than one, but *quantity* has wider meanings.

Teachers used 'how many' more frequently than 'count' and for a greater proportion of counts than the parents in Fluck's (1995) study. The difference in children's treatment of the terms was also replicated in my data. Table 4.3 gives the proportion of counting responses

following each QET. Unlike table 4.2, which includes all QET uses, table 4.3 just gives the frequencies of QETs used immediately prior to the count or number response.

Table 4.3. Proportions of response types following each QET

QET type	Number of bouts	Count Sequence	Single number
'how many'	230	72%	28%
'count'	105	100%	0%
Other	106	81%	19%
All counts above 'one'	441	81%	19%

Children always gave a count sequence in response to a 'count' QET, but gave single word responses at least some of the time for the other QETs. They recognised 'count' as a prompt to engage in a process or activity. Counting was the most frequent response to 'how many' yet some children, some of the time, recognised (like the child in extract 4.2) that 'how many' could lead to a single word answer as well as a process.

Alternative QETs

Turns categorised as 'other' (tables 4.2, 4.3) were turns that led to quantity responses but did not include use of 'count' or 'how many'. Turns could be categorised into five groups based on their lexical or functional similarity. Examples and frequencies are given in table 4.4.

Table 4.4. Examples and frequencies of alternative QET groups

Group	Example	Frequency
Dice throw	[alone]	22
'What'	"what did you get?"	33
Directive	"move your spider 4 spaces"	51
Monitoring	"let's just check"	24
Completion	"and that one makes…."	9
Not categorised		9

The first three groups are associated with activities that used dice or dice spot patterns. The three QET types link to the structure of dice games -

- First, the dice throw alone can be a QET. In 22 of the 108 bouts that occurred following dice throws, there was no spoken QET. The throw itself was enough to prompt a determination of the number of spots on the top face.

- Second, more usually, a child's dice throw was followed by a verbal QET from the teacher. This turn was the most likely location for QETs using "what number" or just "what" (e.g. *"what did you get?", "what is it this time?"*).
- The third part of dice activities is prompted by a 'directive' turn based on the consequence of the dice throw: something was moved so many spaces, or so many objects were taken (*"move your spider three spaces", "you get five bricks then"*). Other verbs used in this turn were "put", "do", "go", "give" and "choose".

The fourth group of QETs was more associated with groups of objects than with dice or spaces. The verbs used are linked by a monitoring or checking connection (*"have you got 10 now", "make sure I've got the right number"*).

The requirement for counting from the directive and monitoring QETs is optional and implicit. There is no direct requirement for a count following these turns. In a similar way to "how many", they set up a purpose for which counting is a suitable process. When children count in response, they demonstrate awareness that counting fits these particular conversational contexts.

The final group I could identify are 'completion' QETs. In these, teachers appear to provide a gap for children to fill in (*"you only need...."*) or use the sequence structure as a cue (*"what comes next"*). These are difficult to categorise unambiguously and it is important just to note that counting was treated as the expected response. The nine turns not categorised in table 4.4 had no clear connection and there were 11 bouts where a count sequence occurred with no identified QET.

The nature of the alternative QETs would benefit from further analysis. For the purposes of my study there are two important contributions from the brief treatment of these turns so far,

(i) It illustrates the variety of turn designs that teachers used to elicit counts, and so the multiple conversational contexts in which counting can occur.

(ii) It illustrates the variety of turn designs that children recognised, albeit to varying degrees, as occasions in which counting was an appropriate way to respond.

In summary, QETs operate as the link between contexts and counting. The alternative QETs extend the "count"/"how many" link discussed by Fluck (1995), providing a richer source and taking counting into a much wider arena of purposes and contexts. The analysis points to the difficulty for children responding to Munn's (1997) question "why do you count?".

Among the possible responses for children experiencing activities in my study, counting includes,

- to know how far to move a spider/mouse/car,
- to get bricks from a tin,
- to say what pattern is on a dice.

To adults with an understanding of the abstraction of cardinality these can all be reduced to 'how many'. Indeed, the variety of activities is the teachers' means to present this to children so that they may extract such an abstraction themselves. The next part of the chapter looks at the ways in which teachers combined QETs, another means by which different contexts for counting were presented.

Combining QETs

The figures from Table 4.2 indicated that many bouts contained more than one QET before a count or quantity response was elicited. Such instances provide further information about the relationships between QETs. This section looks first at "count" and "how many" before considering other combinations.

Combining count and how many

Fluck (1995) identified occasions when parents combined "how many" and "count" in task prompts (e.g. *"count how many lorries"*, p138). The combination links explicitly the procedure of counting with the purpose of finding out how many. The teachers in my study did combine count and how many but rarely in this direct way. More often, the terms were combined through use in separate turns.

Extract 4.3 provides a good illustration of the terms being combined in a semi-systematic way. Here, T3 has four different coloured clock-shaped boards from a game box. She has drawn attention to them individually by colour and then as a group with her question to Jack (lines 1-2), *"can you tell me how many clocks we've got?"*. Jack began to count, but not confidently and she prompted him with (lines 4-5), *"you count them"*. Two subsequent QET pairs (lines 24 and 27, lines 41 and 44) followed this same pattern where the teacher first used "how many" and, when there was no response, she then used "count".

Extract 4.3. T3F5-B01-03

	1	T	it's a blue one. (0.5) so Jack can you tell me
→	2		how many clocks we've got?
	3	Jack	w:o:ne (0.3) /?°two°/
	4	T	t- >can you see? let me put them near-< ((moves clocks))
→	5		<u>you</u> count them
	6		(2.0)
	7	T	count the clocks Jack
	8		(4.0)
	9	Jack	°one°
	10		(1.0)
	11	Jack	/?°two°/ ((pointing generally at clocks))
	12		(0.9)
	13	Jack	`fo:ur
	14	T	shall we count again? ((points to each clock))
	15		(0.8)
	16	T	w:o:ne
	17		(0.6)
	18	T	⌈two: ⌉
	19	Jack	⌊two::⌋
	20		(1.0)
	21	T	⌈three:::⌉
	22	Jack	⌈°three:° ⌋
	23		(1.2)
→	24	T	↑four::: well done. how many d'<u>you</u> think
	25		we've got. `Michael ((moves clocks to face Michael))
	26		(1.0)
→	27	T	you count the clocks
	28		(0.8)
	29	Callum	one
	30		(0.9)

Extract 4.3. (continued)

	31	T	d'<u>you</u> want to count them Callum. okay
	32		(0.9)
	33	Callum	one two three four ^fi:ve ((points to last one twice))
	34	T	we've got o:ne
	35		(0.6)
	36	T	⌈two: three:⌉
	37	Callum	⌊two three ⌋
	38		(0.3)
	39	Callum	↑f⌈ou::r ⌉
	40	T	⌊↑fou::r⌋ haven't we. we've got <u>four</u>
→	41		altogether. how many d'you think we've
	42		got Abigail. how many clocks?
	43		(1.0)
→	44	T	shall we count?
	45		(0.6)
	46	T	you count=
	47	Abigail	=o:ne two three (0.5) ^fou:r=
	48	T	=brilliant that's lovely . well I'm going to
	49		give you a clock each

In this extract T3 seemed to use "how many" as her preferred QET but followed by a second QET, using "count" to further specify what is expected. Functionally, a question/purpose (how many) was juxtaposed with direction/process (count). Two points suggest this combination was purposely designed -

1. Although *literally* the use of "how many" links to a one number answer, across my data (and in this extract) it was not used this way. Sequence answers were accepted and positively received, they were not followed up by a further "so how many?" type question as in extract 4.2. There is no indication (within the data itself) that the teacher was looking for a single word response.

2. If, however, the teacher was looking for a sequence response, the evidence (from Fluck (1995), the current study, this extract) indicates that the most direct route to a sequence response is through the use of "count". If she only wanted the children to count the clocks then her use of the first "how many" QETs was superfluous in conversational terms.

The two points conclude that the QETs used in extract 4.3 achieve more than the elicitation of a count. They are used to construct a conversational context in which counting can occur. The significance and extent of this is explored in the rest of this chapter to consider whether this kind of QET combination is an example of Heritage's (1997) wind tunnel metaphor, i.e. a design honed as a result of the teacher's repeated experience in hosting count sequences.

Explaining QET combinations

Unlike Fluck's study, the teachers used other QETs as well as "count" and "how many". It is important to consider how these too are combined. The next part of this section considers two explanations for combining QETs,

(i) QETs are combined in order to demonstrate relationships between QETs, specifically the purpose/process relationship,

(ii) QETs are combined as repeated but independent attempts to elicit responses from children.

Two sources of evidence are available to explore these explanations.

1. Speaker Transition. In extract 4.3 pauses between the QETs gave children opportunities to take a turn and so prevent the use of more than one QET. The design described by Fluck (1995), "count how many", ensures that process and purpose are juxtaposed. Using the terms in separate turns and pausing between them jeopardises this juxtaposition. Deliberate juxtaposition would therefore avoid long pauses.

2. Combination Patterns. If multiple QET uses are independent, 'equal' in status and used interchangeably to elicit counts, then combinations should not be predictable. If there are predictable combination patterns, then this suggests that the combinations have been honed in the wind tunnel manner described by Heritage (1997).

These two sources are considered separately below.

1. Speaker transition

Conventions for turn-taking organisation (and so speaker transition) were explicated by Sacks, Schegloff and Jefferson (1974). They account for the minimal occurrence of overlap and pausing in everyday conversation. Speakers anticipate points of possible turn completion, and so opportunities for transition, through recognition of turn structure, most significantly intonation contour (Ford and Thompson 1996). When a speaker reaches the end of a possible turn they can choose to continue or to nominate another speaker. The model infers that *pausing* is actively *not continuing,* and makes speaker transition expected.

Jefferson's (1989) analysis of pausing, in data from conversation between adults, found that a pause length of around one second was treated as significant. In adult speech to infants, pauses tend to be longer overall than in speech between adults (Cruttenden 1994). In the absence of norms comparable to the context of my data, I have used Jefferson's (1989) standard of one second. The assumption is that if pauses between QETs did not last for one second or more, then they would not have been seen as opportunities for transition.

A random sample of 40 bouts was taken from the 86 bouts where combinations of QETs were used. Pauses were timed using the Praat software (Appendix II). In 29 of the 40 bouts (73%), QETs were separated by pauses of 1.0 second or more. Not only did these uses of more than one QET appear designed as separate turns, they were received as such by children with 15 of the sample separated not just by pauses but also by child turns.

Table 4.5. Pause lengths between combined QETs

Pause length	Frequency (%)
≥ 1.0 second	29 (73%)
< 1.0 second	10 (25%)
Overlap	1 (2%)
Total	40

In 10 of the sample (25%) pauses were 0.9 seconds or less. Extract 4.4 is an example. The teacher gave the two QETs separate intonation contours but did not pause between them.

Extract 4.4. T3F4-B02

	1	T	we've got some ^spiders `children (0.4)
→	2		I wonder how many spiders we've `got * let's
	3		`count w[o:ne]
	4	C	[o:ne]
	5		((rest of count omitted))

Line 2, *"I wonder how many spiders we've got"* was a potentially complete turn, there was a clear pitch fall on "got". The teacher began another TCU "let's count" immediately, maintaining the floor and cementing the two QETs together. Local and Walker (2004) describe this practice as 'abrupt joins', where two functions are joined together in a way that makes it difficult for other speakers to separate. The opportunity for speaker transition is not

eliminated and, in extract 4.4, another speaker could have begun to talk at *. However, the teacher's intention to continue would have led to overlapping talk. The one example (deviant case) of overlapping talk at such a point in the data is shown as extract 4.5.

Extract 4.5. T4F1-B22

1	T	shall we <u>count</u> them and <u>see</u> *
2		[let's see how many]
3	C	[o n e t w o] three four five
4	T	shall we start with Thomas

The child has treated line 1 as complete. His turn began immediately as the teacher finished "see". The teacher either was not expecting this or did not want it because she also began another TCU here. Both parties started speaking at * and continued to do so, both completing their turns. The teacher completed her second QET (line 2) and so achieved the juxtaposition of process and purpose. The child continued counting and the teacher waited for him to complete before starting her next turn. She did not provide any feedback on the child's count and to some extent dismissed it by suggesting they 'start' with another child.

The overlap in extract 4.5 is an exception that highlights the importance of examples where teachers did not pause between QETs. In the majority of the sample, teachers did pause between QETs; support for the suggestion that combinations of QETs function, conversationally at least, as multiple attempts at the same thing. However, the examples where teachers did not pause between QETs form a sizable minority and, supported by extract 4.5, indicate that at least some of the time, QETs *were* combined intentionally.

2. Combination patterns

The second source of evidence is patterns in the way that QETs were combined. Table 4.6 shows the number of bouts that contained each category of QET and the proportion of uses where they were combined. The last two columns indicate *how* the QETs were combined, i.e. whether they were followed by another QET: firstly, as a percentage of all uses and secondly, as a percentage of combined uses.

"Count" was most likely to be combined and this might suggest that it was in some way a weaker QET. However, it was also least likely to be followed by another QET. When it was combined, it was predominantly used *after* another QET, where a "how many" or alternative QET was not successful in eliciting a count or single number response.

Table 4.6. Patterns of QET combinations (excludes dice throws)

QET type	Frequency	Proportion of occurrences where QET was combined	Proportion of all occurrences followed by another QET	Proportion of combined occurrences followed by another QET
How many	318	18%	15%	87%
Count	135	61%	6%	10%
Other	126	24%	24%	100%

In contrast to "count", the 'other' QETs *never* followed another QET. In 71% uses they led to a count or single number response on their own. Of 36 (29%) combined uses, they were followed by "count" 28 times, "how many" 4 times and both 4 times.

"How many" was least likely to be combined. In 45 of the 52 bouts (87%) where "how many" was combined with "count", "how many" was used first.

The patterns of combinations indicate that QETs were *not* combined randomly. When more than one QET was used, there was a kind of 'hierarchy',

- QETs that did not use "count" or "how many" were most likely to be followed by another QET,
- "Count", the most explicit QET, was least likely to be followed by another QET,
- QETs that set up a *purpose* ('how many' and 'other' QETs) were most likely to precede QETs that specify *process* ('count' QETs).

It is also useful to note that *teacher* counts were most likely to occur following 'other' QETs. The distribution of teacher counts needs further exploration but it may be that teachers followed less explicit QETs because children did not. Children were least responsive to these because they were not recognises as QETs without the use of "count" or "how many".

Combining QETs - summary

The two sources of evidence discussed are initially contradictory in terms of how they address the uses of more than one QET. Only 25% of the sample appeared to be deliberately combined in that there was a lack of opportunity for speaker transition between them. Despite this, 95% combinations juxtaposed a 'purpose' QET with a 'process'. In 94% of these, the purpose preceded the process. Taken together, the two discussions suggest that teachers did not use more than one QET habitually (only 17% of all bouts) but when they did combine QETs, it was done in a systematic way.

Beyond QETs – 'one-prompting'

The final way in which teachers engendered counting functioned as a QET but at the same time blurred into the beginning of the count itself. I describe it as 'one-prompting' because it refers to the production of the first count word (by teachers) in a particularly distinctive way. A typical example is at line 3 in extract 4.6 (taken from extract 4.3). It is distinctive in the lengthening of each sound in "one", starting from quite a low pitch that rises in an expectant way. The use of pitch movements on individual numbers is discussed in more detail in the next chapter. The distinctive production is evident to me but was also distinctive to the teachers and children in the sense that it was never treated as an 'answer'.

Extract 4.6. T3F5-B01

	1	T	shall we count again? ((points to each clock))
	2		(0.8)
→	3	T	´w:o:ne
	4		(0.6)
	5	T	[two:]
	6	C	[two::]
	7		(1.0)
	8	T	[three:::]
	9	C	[°three:°]
	10		(1.2)
	11	T	↑four::: well done. how many d'<u>you</u> think

One-prompting lies somewhere between QETs and counting together. The teacher acted as though she was beginning the count herself yet there was an expectation that the child would perform the count (even if it was ultimately performed jointly or by the teacher on her own). There are comparisons with the above discussions about combining QETs. A possible interpretation could be that it gives further clarification of what is required from the child, actually showing them. It is demonstration that what follows a prompt to count; is that activity where you point and start by saying "one".

Chapter Summary and Conclusions

Looking at the complete data set, 'deliberate' combinations form only a very small part of the way in which counts were prompted. For the most part, teachers used just one QET to

initiate bouts, predominantly one that specified a *purpose* for counting. If this did not elicit a quantity response then another QET was used and, on most occasions, the subsequent QET was more specific in requesting a count, thereby conforming to a metaphor of scaffolding.

However, looking at individual activities suggests teachers interchanged different QETs throughout sessions. The use of a small group format provided further opportunities. In T2's introduction to the story of the three little pigs she asked each child to count the pigs before they started. She was able to juxtapose different QETs in this larger sequence. Although each child was being asked to do the same thing, the teacher used five different turn designs to achieve it (*"how many", "can you count?", "you count see how many", "you make sure as well", "can you check and see how many pigs there are"*).

It is not suggested that the teachers used this hierarchy consciously but, if it is seen as a consequence of their repeated experience in providing a conversational context for counting then, its existence indicates that teachers started from a position of defining purpose. They provided multiple reasons for counting before specifying (and perhaps finally showing this in 'one-prompting') that counting was expected.

Alongside this, the variety and combinations of QETs seemed to replace explicit explanations about purposes and practices in counting. There were few mid-game explanations or use of vocabulary such as "if", "then", "when", "so" or "because" to make explicit the links between number uses. Durkin (1993) suggests that this deliberate omission of explicit connections prompts learners to construct connections for themselves.

Finally, it is important to recognise that QETs were not a 'context-free' beginning of the bout. They were themselves a response to what went before them. It is notable that,

- if there was only one thing or all had gone, then QETs with "how many" were used, teachers did not use "count" in these contexts,
- a prompt to count with a QET using "move" always followed another bout where a dice had been thrown.

This point is considered in the discussion section. The next chapter covers the analysis of the turns that occur following QETs.

Chapter 5. Data Presentation - Count Middles

Introduction

Once a quantity/quantifying response was made relevant through the opening turns described in Chapter 4, there were two acceptable ways to answer: with a single number or with a count sequence (i.e. starting at "one", stopping at the desired number/quantity). Count sequences were the most frequent response (table 5.1).

Table 5.1. Frequency and proportion of different response types

Type of response	Frequency	% all bouts
Counting sequence	370	71%
Single word response (answer not 'one')	84	16%
Answer 'one'	67	13%
Total	521	100%

If the answer is 'one' then only a single number response is appropriate so the frequency of these is given separately. For bouts where the answer was more than 'one', 81% were answered using a sequence response. Figure 5.1 is a tree diagram providing the frequency of responses given by child, teacher, or child and teacher together. Table 5.2 gives the frequencies of each quantity counted and the proportion of responses that were count sequences rather than a single number.

Figure 5.1. Tree diagram to show type and frequencies of response types

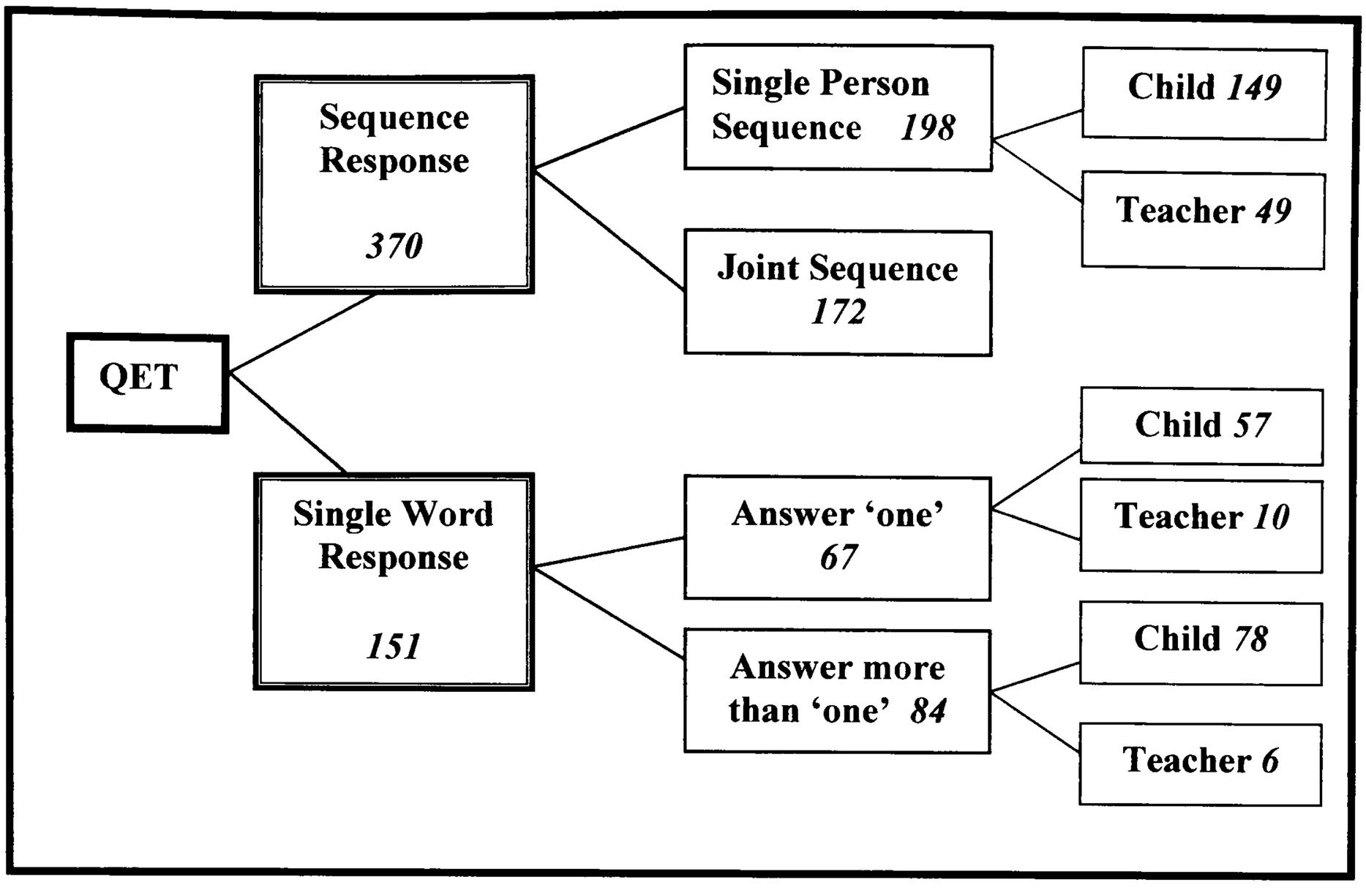


Table 5.2. Frequency of quantities counted and proportion done by count sequences

Quantity	Frequency	Proportion of responses done by count sequence
1	74	-
2	96	57%
3	103	86%
4	69	93%
5	79	95%
6	54	85%
more than 6	46	83%
All	521	71%

Count *sequences* are the main focus of the study. Analysis is divided into two sections: the way that sequence turns were designed and the way that turns were allocated. Turn design covers the different ways sequences were said. Previous research has found variation in design against the stable order principle (Fuson 1991) and noted emphasis of the last number (Fluck 1995). My analysis extends to examining sequences in an interactional context. Turn allocation has not featured in previous research, it refers to how turns are exchanged and was important to my analysis once it became clear that children and teachers exchanged turns frequently *within* counts and, as a result, shared the production of 172 sequences in the data.

Count Sequences – Turn Design

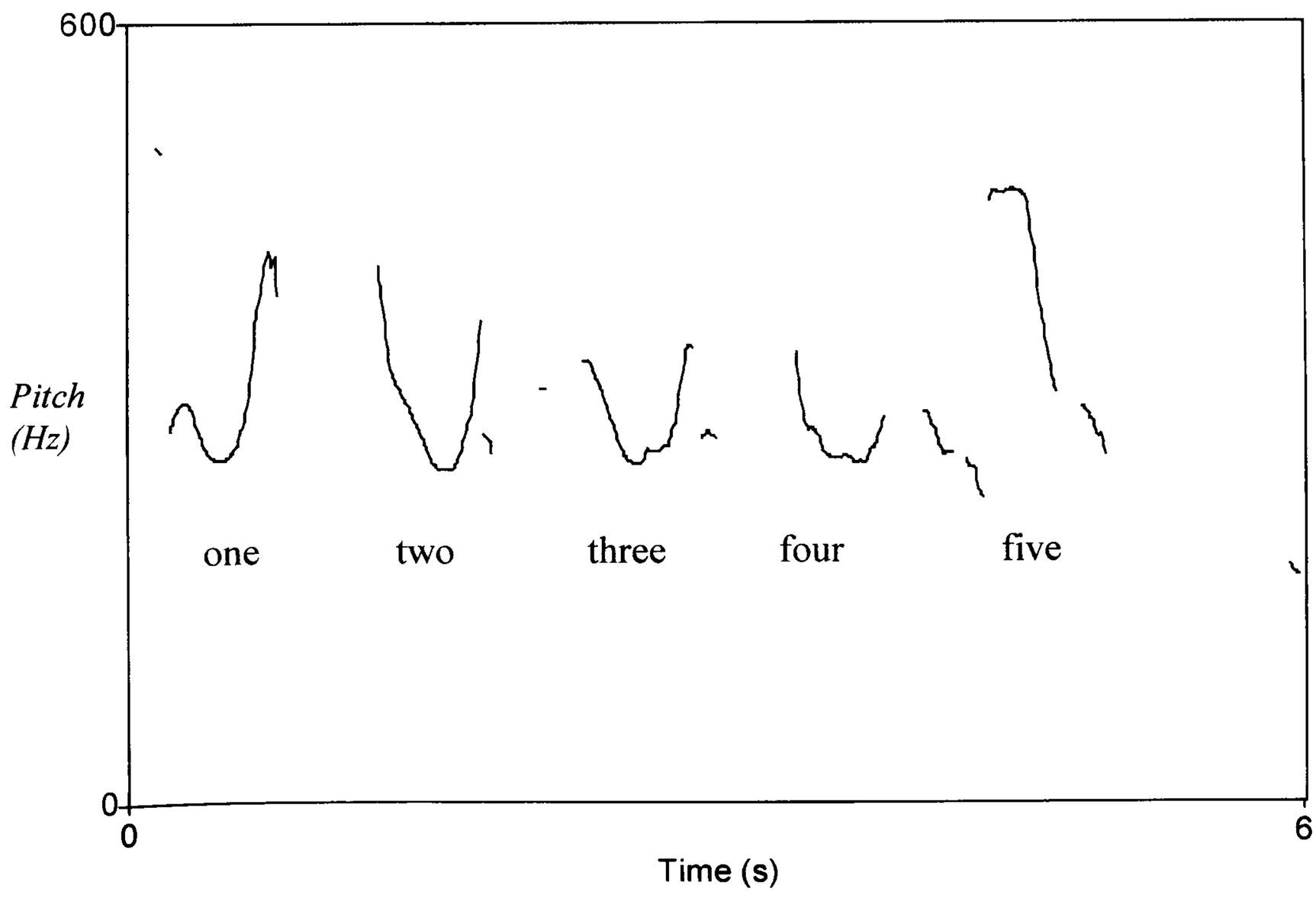
Figure 5.1 showed how 370 of the bouts in the data were achieved using count sequences, 149 said by children alone, 49 by teachers alone and 172 achieved jointly. All 370 sequences provided the basis for analysing variations in prosodic and lexical design.

Prosodic design of count sequences

The discussion of prosodic design in Chapter 2 (p32-33) outlined the importance of the parameters of pitch, length and loudness in shaping talk to achieve prominence of particular syllables/words relative to surrounding words. The most important word of a count sequence, spoken in response to a QET, is the last word.

Prosodic analysis was done initially through repeated listening and impressionistic marking on the transcripts. Regular patterns emerged and were confirmed using the Praat software (Boersma and Weenink 2005, see Appendix II). I describe the dominant pattern as an *'enumerating intonation sequence'*, both because of its use in enumerating contexts and because of its prosodic features. Figure 5.2 is a pitch trace (generated by Praat) of a count done in this typical pattern.

Figure 5.2. Pitch trace for a standard (enumerating) count sequence



The lines in figure 5.2 represent the pitch of the recorded segment. A noticeable 'u' type pitch movement is replicated on numbers one to four. There is pausing between each

number. The pitch of the final number, five, starts much higher than the other numbers and falls steeply. This pattern was found across sequences of different lengths and spoken by many different speakers.

A random sample of 30 of the 198 single person sequences in the data found 27 following this pattern. The remaining three sequences conformed to a second pattern. I have called these *'whole contour sequences'* because they take one intonation contour across all the numbers. This pattern was also recognisable across different speakers and contexts but was more frequently used by teachers than children, often in a summary position.

The analysis finds three prosodic features used consistently in the majority of productions of the count sequence,

- *Separation* of each number – achieved through pausing and individual pitch movements on each number,
- *Replication* of pitch movement patterns on all but the final number,
- *Contrasting* pitch movement on the final number.

The potential significance of these features is explored in the next section. Their actual significance, in the context of interaction, is considered in the discussions of turn allocation in joint sequences.

Implications of prosodic design

The patterns in my data indicate that the description of 'emphasis' on the last number is insufficient. In enumerating sequences, speakers did not just emphasise the last number, they emphasised *every* number. The emphasis of the non-final numbers was done with a careful uniformity, similar to the way emphasis is used in lists (Selting 2003). Couper-Kuhlen (cited by Szczepek 2000a, p14) suggests that this uniformity is a means of signalling the similarity (of different vocabulary items) iconically. In counting, all these non-final numbers are important, and *equally* so, in tagging the one-to-one correspondence to what is being counted. The equal rhythm set up contributes both to the physical process of counting and to the differentiation of numbers within the spoken sequence.

In this way, each number of the sequence receives an individual pitch movement, and this is my rationale for using the description *enumerating intonation*. It is different to standard utterances, in which a flow of undulating prominence provides a 'tune' (intonation contour) with a predictable end point (Ford and Thompson 1996). Number sequences *could* be said in such a way, and when they were, these are the sequences I described as 'whole contour'

sequences (Appendix II gives an example). The contour starts with a higher pitched "one", there can be uniformity in length and loudness for the subsequent non-final numbers but, essentially, pitch movement occurs across all the numbers rather than individually. The 'next-to-the-last' number may show some slowing down before the final number receives a pitch movement that, whilst prominent, is usually less so than in the enumerating sequences.

Single contours signal coherence in talk as well as provide information about possible turn completion and transition points. When a single contour is not used, and every number is emphasised, there is potential for uncertainty about completion and transition. The need to indicate end of turn, end of sequence *and* to mark the last number as different and most important may account for the significant *contrast* put on to final numbers. It is not just that they are most important, they are different from the others, they are not just 'one of the list', they encompass the list and they are 'the answer'. Whilst teachers manage this indication routinely by using a 'high fall' pitch movement, there is more variety in children's attempts.

Lexical design in count sequences

The 'stable order' principle refers to the order and lexical form of the words used in counts. If counts are to be principled (and therefore accurate), then there is no lexical choice (other than whether to count in English or Turkish for example). In practice this means design is limited to the conventional count word sequence, i.e. "one two three four five". There was a shared *orientation* to this design in my data.

The concept of *orientation* in CA was introduced in Chapter 2 (p24-25). The sense here is that participants did not exclusively use the conventional sequence order, but (aside from two instances) on the occasions that they did not, they were made accountable; the unconventional order was remarked upon and became a topic of the talk itself. It means that if I did not already know the order of the count words in English, I could find it out from my data, it is evident in the way that the teachers and children treated the words of the sequence.

Extract 5.1 provides an example of orientation to the stable order principle in a rare occurrence where a sequence did not start with "one". The repercussions of starting with "two" went beyond just the child's count not being accepted, they continued across many subsequent turns at talk.

Extract 5.1. T2F1-B26-27

1	T	how many are we left with now?
2	Jordan	two three four
3	T	do we start counting at number two?
4	Jordan	yeah number two
5	T	no we don't start at number two what do we
6		start at when we're counting?
7	Jordan	I don't know
8	T	well we've got to find out how many snowmen
9		we've got first . Daniel how many snowmen
10		have we got?
11	Daniel	one two three
12	T	three that's right you start with number
13		one Jordan
14	All	one two three
		((Rhyme continues – lines omitted))
15	T	how many are left?
16	Jordan	one two
17	T	good you remembered that time . good you
18		start with number one . one two

Traditional discussions of counting principles frame them as existing independently of the interaction, somehow 'operating' (or not) on children's counting. The discussion of rules in Chapter 2 described how CA does not recognise external forces in this way. Order is only recognised if it can be seen in the interaction and so counting principles are only evident if they are recognisably created and orientated to on each occasion. The orientation to the conventional count sequence order across my data supports the existence of the stable order principle from an interactional standpoint.

Summary of turn design

The analysis of count sequence turn design produces two important (related) areas for discussion. Firstly, is the way in which it starts to find a different kind of evidence for the counting principles discussed in the literature review and secondly, its confirmation of the importance of prosodic design.

The analysis of lexical design shows how teachers and children produce or re-create the stable order principle as they count together. It is tempting to see prosodic design and the apparently iconic embodiment of the one-to-one and 'last number' principles in the same way. However, this is a pertinent place to heed Schegloff's (1998) caution about the intuitive attraction of prosody. Pre-assumed knowledge of cognitive aspects of counting makes the interpretation irresistible, but it is necessary to determine how such iconicity is received and produced in the interaction, whether it is orientated to. It requires considering how speakers design their turns *in response* to previous turns and how turns are exchanged. Turn transition at sequence ends is discussed more fully in Chapter 6. Turn transition within sequences provides the arena to consider the significance of prosodic design and is discussed in the section on turn allocation.

As issues of prosodic design are taken forward in this chapter and the next, some key concepts benefit from review at this point (Table 5.3). I have argued for the distinction of certain kinds of intonation in both individual count numbers and whole count sequences. At this stage the distinctions are justified mostly on descriptive grounds but hopefully it will be seen in the ensuing analyses that these are also justified on the grounds of children and teachers' use of and response to the distinctions.

Table 5.3. Description of key terms used in the prosodic design of count sequences

Key terms	**Description**	**Pitch representation**
Count sequences prosody -	**Intonation patterns that apply over the whole sequence -**	
• Enumerating Sequences	Numbers are emphasised and said separately with individual pitch movements on each number	
• Whole Contour Sequences	Pitch movement is carried across all numbers	
Individual number prosody -	**Categories of pitch movement that can be used on individual numbers -**	
• Enumerating Pitch Movement	Usually lengthened, starting from mid-pitch – essential feature is the pitch rising over the number	
• Final Pitch Movement	Always involves a fall in pitch – characteristically is a high-fall	
• Neutral Pitch Movement	Usually mid-pitch, numbers are said with level pitch and are often short in length	

Count Sequences – turn allocation

Figure 5.1 showed that children's independent sequences made up 149 of the 370 sequences (40%). Only 49 (13%) sequences were produced entirely by teachers. As teachers initiated the bouts, the 'answer' or 'response' turn was preferably allocated to the children. When teachers answered, this upset the normal allocation of turns and seemed to be avoided wherever possible. Chapter 4 discussed the multiple ways that teachers used to nominate children into answer position.

When children failed to take up a count (and on some other occasions), teachers took it up themselves, sometimes making further attempts to pass the floor to children within the sequence. In the 49 sequence bouts where teachers performed the count alone, they held the role (and position) of both questioner and answerer. The minimal child involvement resulting from this is conventionally undesirable and the 172 joint counts in the data may therefore be a way to keep children involved in the count.

Joint counts pose problems for discussing turn allocation because the count itself becomes split into separate turns. The next sections of this chapter attempt to disentangle this, covered in three ways,

- description/definition of joint sequences,
- turn allocation patterns in joint sequences (i.e. who says which number),
- turn allocation procedures in joint sequences (i.e. when and why speaker changes).

Defining joint sequences

Extract 5.2 is an example of the type of count I am referring to when I use the term 'joint sequence' (lines 6-8).

Extract 5.2. T3F5-B23

	1	L	((rolls dice))
	2	T	oops I can see this dice that's got a
	3		lot of dots on it can you count
	4		those Liam?
	5		(pause)
→	6	L	one two three four
	7	T	four five
	8	L	six
	9	T	brilliant shall we count up six spaces

There were a variety of ways these counts occurred but fundamentally, these were counts where the count sequence was said with number contributions from both teacher and child.

The prosodic design of enumerating sequences may make multi-party counting unsurprising. Individual contours marking each number make the sequence 'permeable' in a way that whole contour utterances are not. Each number is a potentially complete turn and therefore an opportunity for speaker change. The setting up of repetitive, rhythmical units has been noted (in other interactional contexts) as a way of inviting multiple speaker contributions (Auer, Couper-Kuhlen and Muller 1999, Hellermann 2003, Lerner 2002).

In extract 5.2 both teacher and child contributed numbers to the sequence with smooth turn-taking and little evidence of competition or overlap. At first glance there is nothing to explain either the transition from child to teacher at line 7 or the transition back to child at line 8. Patterns of transition make up the next part of this section.

Turn allocation patterns in joint sequences

Three turn distribution patterns were found within the joint sequences in the data, *completion, unison, alternating*. These are described below with illustrative extracts. It is important to note that counts could not be categorised according to these patterns as few conformed to one pattern throughout or to the exclusion of others.

Completion counts

In these counts, one person began the count and another completed. Extract 5.3 shows a common practice whereby the teacher took on the count but 'handed it over' to the child in time for the last number.

Extract 5.3. T3F1-B02

1	T	what comes after number two . one . two: (0.6)
2	C	^three=
3	T	^=three . so now we've got to find the bun
4		(0.5) the bun that needs ↑three smarties

In extract 5.4 (p80) the child began the count and the teacher completed.

Extract 5.4. T4F3-B47

1	T	and how many spaces do you need?
2		(1.0)
3	C	o:ne
4		(1.2)
5	C	two:
6		(1.0)
7	T	^three: you need don't you

In neither count was the child or teacher *interrupting*. They were polite exchanges in the sense that in extract 5.3 the teacher opened up her sequence by pausing and allowing the child to come in. The child's count in extract 5.4 was already open. It may be difficult to argue that she similarly 'invited' the teacher to complete because the rhythm of her first two numbers was already slow. However, she showed no objection to the teacher's completion.

Unison counts

In these counts, teachers and children said numbers at the same time. This may be for the whole or just part of the sequence as in extract 5.5.

Extract 5.5. T2F4-B02

1	T	he's got some <u>spots</u> y'could <u>count</u> the spots
2		(0.6) one=
3	C	=one=
4	T	=t⌈wo three four fi:: ⌉ve
5	C	⌊two three four five⌋
6	T	and he's number fi:ve

The teacher began the sequence and the child joined her, coming in immediately at the end of "one". Rather than letting him take over the count, the teacher continued counting. She did not cede the floor nor treat his "one" as an attempt to take the floor. Equally the child did not treat the teacher's continuation as a 'rejection' of his contribution by dropping out (as a 'failed attempt to take the floor'), nor increasing his volume to try harder to take the count for himself. These would be common 'overlap resolution strategies' (Wells and Corrin 2004). By the time they said "three" they have agreed a 'joint floor' in that their timing of onset for "three", "four" and "five" was identical (synchronised and non-competitive).

Alternating counts

Extract 5.6 contains two alternating counts. Like the unison extract, a rhythm was set up but the child and teacher did not fall into step, instead the teacher apparently waited for the child to say each number, timing her number to begin only as the child finished.

Extract 5.6. T2F1-B02

	1	T	let's make sure we've got the right number of
	2		snowmen
	3		(2.9)
	4	T	y'going to count them with me
	5		(2.7)
	6	T	how many?
→	7	C	one
	8	T	one
	9		(1.2)
	10	C	two=
	11	T	=two->are <u>you</u> counting?<
	12		(1.3)
	13	C	three
	14	T	three::> I think we have to put them in there
	15		don't we<
→	16		(1.5)
	17	C	four=
	18	T	=four (.) a::nd=
	19	C	=↑fi:ve=
→	20	T	=↑fi:ve (0.8) let's just check (0.9)
	21	C	one=
	22	T	=one (0.8)
	23	C	two=
	24	T	=two (0.8)
	25	C	three=
→	26		=three (0.8) four: (0.9) ↑five ↑good

In the first count (lines 7 to 20), the teacher came in quickly after the child said each number. It is almost interrupting, but three things indicate she did not intend to take on the count,

- She joined by saying "one" (rather than "two") so she was not making a potential 'completion' move,
- She paused after "one" and so provided an opportunity for speaker transition,
- Her intonation of "one" was complimentary rather than competitive.

This pattern was maintained through the count, again with neither party treating the exchanges as problematic.

The key feature of alternating counts was the repetition of numbers within the count. It was perhaps surprising that repetition was predominantly teachers copying children. There were only a very small number of counts where children repeated numbers after teachers. When children followed teachers within a count they did so with the *next* number of the sequence. When teachers followed children they did so with a *repetition* of the child's number.

Teacher repetition of the *last* number of a count can be seen as receipt/evaluation (Hellermann 2003) and this is covered in Chapter 6. Where children contributed a complete sequence and teachers repeated just the last number, I have not categorised them as 'joint'. This repetition was more accurately a 'receipt' of the child's complete sequence rather than a contribution to it. Repetition of numbers *within* the count sequence may also be seen as 'receipts', further evidence for the permeability of the sequence, indicating 'right-so-far'.

Mixed counts

Extract 5.6 illustrates that joint counts could contain elements of more than one pattern. The second count in extract 5.6 was alternating in lines 21-25. At line 26 it became a completion count as the teacher completed the sequence and the child played no further part. The pauses suggest that the teacher was providing an opportunity for the child to say the next number, but in the second count she did not pause for as long between "three" and "four" (compare lines 26 and 16), neither did she repeat "and" to prompt the last number.

Summary of turn allocation patterns in joint sequences

The described patterns of turn allocation illustrate the kinds of counts that teachers and children engaged in. It is difficult to see how these counts can be seen as child-only answers to teacher-only questions. They did not present as teacher 'repairs' of children's counts, and appeared collaborative rather than competitive in their treatment of the 'floor'.

Transition in joint sequences can also be described in terms of direction. Completion counts had just one transition, from child to teacher or teacher to child, whereas alternating counts

had transition both ways. Additionally, there was transition to and from unison counting and many unison counts were not unison for the entire count.

Table 5.4 gives the frequencies of five different kinds of mid-sequence speaker transition found in a random sample of 40 joint counts from the data. Teachers were more likely than children to 'lose' their turn *mid-sequence* (in contrast to the end of sequences when teachers never lose their turn, see Chapter 6). Only 18 of the 54 transitions were from child to teacher, reinforcing the difficulty in seeing joint sequences as a consequence of teachers 'intervening' in children's counts.

Table 5.4. Frequencies of transition types in random sample of joint counts

Transition type	Frequency
child to teacher	18
teacher to child	24
child to unison	1
teacher to unison	9
unison to teacher	2

Table 5.4 confirms that joint sequences occurred as a result of both children and teachers 'interrupting' the count space. Taken together with the rest of the discussion of joint sequence patterns, it illustrates the flexibility of speaker transition within count sequences. At least some of this can be attributed to (or is responsible for) the *separation* of each word in conversational terms. The separation produced sequences that were permeable and open to construction by more than one person at once. Both children and teachers appeared to treat sequences this way in their unproblematic acceptance of mid-sequence transition.

Turn allocation procedures in joint sequences

The permeable design of the count sequence may explain the presence of speaker transition and diverse patterns of turn allocation, but it does not on its own explain how and when transition occurred. Two counts to five are shown as extracts 5.7 and 5.8 below. They were both between the same child and teacher, in separate activities but recorded on the same day. In the first example there was speaker transition following the child's saying of "four", but in the second example she went on to say "five".

Extract 5.7. T4F2-B02

1	T	shall we count the spots and see what
2		number it is
3	C	´one ´two ´three `four
4	T	´four and one in the middle makes
5	C	`eight
6	T	`five doesn't it so that's number ((holds up five fingers))
7	C	`five
8	T	`five good girl so you stick that one on the
9		washing line as well

Extract 5.8. T4F1-B10

1	C	((throws dice))
2	T	what did you throw? how many?
3	C	´one ´two ´three ´four `five
4	T	`five there you go you got five didn't you
5		get five get five out then

Listening to (and marking) the pitch movements provides an explanation for the difference in the consequences of the child saying four. In the first extract she produced "four" with a falling pitch movement (FPM – Final Pitch Movement), in the second she produced it with the slow rising pitch movement characteristic of mid-counts (EPM – Enumerating Pitch Movement). The EPM showed "four" to have the same status as the previous numbers she has said, and implied 'more to come'. FPM, in extract 5.7, contrasted "four" with the previous numbers and the teacher took this to indicate the child had finished counting. The teacher repeated "four" and drew the child's attention to another spot to be counted. The teacher used EPM on her "four" and in doing so, she both *contrasted* it with the status that the child had given it, and *aligned* it with the status of the child's previous numbers.

Examples like this, involving the same teacher and the same child in joint and single counts, were difficult to find across the data. However, 15 matches were found, 30 different counts, and analysed in the same way. A second example is shown as extract 5.9.

In the first count, line 3, the child counted uninterrupted to 3. In the second count, line 9-11, the teacher came in after the child said "one". It could be argued that the child was

providing "one" as the answer, yet the teacher did not respond to it as an answer, she responded to it as an incomplete count.

Extract 5.9. T3F4-B19-20

	1	C	(rolls dice again)
	2	T	that's it, how many dots?
→	3	C	´one´two `three
	4	T	`three . can you move your spider three more
	5		spaces please? so start here,
	6		´one´two `three
	7		so, how many spaces has he got to go to reach
	8		the spider's web?
→	9	C	¯one
	10	T	w-´one and
	11	C	^two
	12	T	then he'll be in the web, how many more
	13		spaces has yours to go Amir?

As in the matched counts from extracts 5.7 and 5.8, there was a difference in the pitch movements used on the "one" where the child continued and the "one" where the teacher came in. The first "one" was produced with EPM but the second was shorter and said with level pitch (NPM – Neutral Pitch Movement).

There is no way to deduce from the extracts what the children intended in terms of 'answers' or how teachers interpreted this. In both extracts, when children used EPM they kept their turn. This contrasts with the expectation, set up in the discussion of turn design, that EPM might facilitate turn transition. Table 5.5 gives the pitch movements used in all 15 of the matched count examples.

Table 5.5. Pitch movements used on target numbers in matched counts

Pitch movement on target number	Child to teacher transition	Child continues
Enumerating	2	13
Neutral	8	2
Final	5	0
All	15	15

Although FPM led most consistently to speaker transition (5/5 uses) there was a stronger effect for EPM in preventing transition. There was most variation in numbers that led to transition. Rather than teachers waiting for children to indicate they have finished (by using FPM), the alternative hypothesis, supporting the claim that EPM is a representation of the one-to-one principle, is that teachers allowed children to continue as long as they used EPM.

Schegloff's (1998) caution was well advised. It was premature to suggest a *function* for the prosodic design (in this case, EPM) without observing how it was used and responded to by the participants in the data. Use of EPM by children in these sequences made the sequences less, rather than more, susceptible to speaker transition.

The matched analysis is a small but important source of evidence about the mechanisms and variations in turn allocation. To explore the importance of the three different pitch movements in relation to turn allocation further, an analysis was done of all the numbers in one focus session (T3F1). T3 used the highest proportion of joint counts. Analysing just one session limits how far the results can be extended to other parts of my data, but has the advantage of minimising variation resulting from different children or type of activity.

Every number said in the session was categorised according to pitch movement. Table 5.6 gives the frequencies of pitch movements used according to whether they were followed by speaker transition. The few examples of transition to unison were excluded.

Table 5.6. Patterns of turn transition/maintenance in T3F1 following different pitch movements

Pitch movement	Child turn continues	Child turn transition to adult	Adult turn continues	Adult turn transition to child	All turns
Enumerating	22	7	41	13	83
Neutral	1	16	13	0	30
Final	0	22	21	0	43
All	23	45	75	13	156

There were 68 numbers said by children in the session, of which 23 (33%) were followed by the child continuing to count and 45 (66%) led to transition (not necessarily joint sequences). In contrast, only 13 (15%) of the 88 numbers said by the teacher led to transition.

The type of pitch movement used in children's turns is significantly associated with transition (Chi square = 40.07, df = 2, $p<0.001$). The pattern is consistent with the matched

sample (table 5.4): children were most likely to keep their turn when they used EPM (22/29 uses, 76%) but overwhelmingly **lost** their turn if they did not use EPM (38/39 uses, 97%).

Pitch movement in teacher turns was also significant (Chi square = 9.6, df = 2, $p < 0.01$) but the pattern was different. Whilst children lost their turn when they did not use EPM, the teacher kept her turn when she did not use EPM. All occasions where there was transition from teacher to child occurred mid-sequence when the teacher had used EPM.

The implications of the patterns shown in this analysis are discussed in the next session where the analyses of turn design and turn allocation are integrated.

Interactions between turn design and turn allocation

The examination of turn allocation patterns and procedures illustrates the relationships between turn-taking and the use of intonation. The following points can be made from analysis of the use of pitch movements identified in the section on turn design,

- Children responded to teachers' use of enumerating pitch movement (EPM) as a signal that they could join in the count without being penalised.
- Teachers (mostly) responded to children's use of EPM by allowing them to continue.
- Teachers were most likely to join in children's counts following the use of neutral pitch movement (NPM).
- When children used final pitch movement (FPM), this always led to them losing their turn. If their use was erroneous or premature, teachers came in to extend the count. It their use was appropriate (i.e. the teacher agreed that the count was complete), teachers came in to evaluate the count as a whole.

These points suggest that children and teachers used the different pitch movements as resources in their movement in and out of count sequences.

The second interaction between turn allocation and turn design is found by considering occasions when EPM was *not* used and looking at differences in uses and responses between children and teachers. In teachers' counts,

- FPM was used for the last number only,
- NPM was used only in 'whole contour' counts (often non-enumerating),
- EPM was used in enumerating counts.

Evidence that children were sensitive to these different uses is shown in the pattern that they did not treat FPM or NPM as opportunities for transition. Being sensitive to the different

uses is not the same as attributing particular meanings to the different uses, but it is arguably an element of doing so.

Teachers showed most sensitivity to children's uses of EPM within the sequence in that,

- When children did not use EPM, teachers took a turn. The turn was usually a repetition of the child's number but differed in that the teacher *would* use EPM. The turn acted as an evaluation, confirming the lexical design but 'correcting' the prosodic design of the child's turn.
- When children do use EPM, no attention is drawn to this and it therefore becomes the default design.

This is the strongest argument for seeing EPM as an embodiment of the one-to-one principle because it suggests that teachers were actively promoting EPM use by children. The teachers' sensitivity to the children's use of EPM may be connected to an association with physical enumeration. Further research with video evidence would establish this.

Chapter Summary and Conclusions

The important findings of this chapter are to do with the way that the prosodic design of count sequences can be utilised by children and teachers in order to engage in varying degrees of collaborative counting. There are significant restrictions on turns within the count in terms of lexical design and so 'work' done by the turn must be achieved using intonation. It is useful to illustrate this with reference to extract 5.2 (reproduced as extract 5.10), looking particularly at the options open to the teacher for her turn at line 7, and for the child at line 8.

Extract 5.10. T3F5-B23

	1	L	((rolls dice))
	2	T	oops I can see this dice that's got (0.6) a
	3		<u>lot</u> of dots on it (0.7) can you count
	4		those Liam?
	5		(1.2)
	6	L	´w:o:ne ´two: ´three- (0.7) ↑`fou::r
→	7	T	´four ´five (0.5)
→	8	L	`six
	9	T	brilliant shall we count up six spaces

The child said "four" in a way that contrasted it with his previous production of "one two three". He used final pitch movement suggesting he had come to the end of his turn. The teacher did not agree that the count was finished. She could have said the next number "five" but chose to repeat "four". She did so using pitch movement that both *contrasted* with how the child said it and at the same time *replicated* the pitch movement that the child originally used on the earlier numbers in the sequence.

If she had replicated the pitch movement from the child's production of "four", this would suggest agreement with its status relative to the other numbers. This is the pattern found when counts were closed and is detailed in the next chapter.

In this count however, the teacher went on to produce "five", again with the replicated pitch, thus allocating it a similar status. The child at line 8 could in theory have repeated her "five" but this was a rare occurrence in the data. He produced "six", the next number, using pitch movement that *contrasted* with the teacher's production of "five" and so arguably demonstrated that he knew it to have different status. This is confirmed by the teacher's exclamation of "brilliant!".

This chapter has shown how speakers can use intonation to signal relationships between the different numbers in a count sequence. Appreciation of the last number as different can be shown through the use of contrastive pitch movement. Appreciation of the preceding numbers as similar can be shown through the use of replicated movements. Whilst such uses of intonation do not imply an understanding of *how* the numbers are similar and different, their prevalence in my data suggests that they are arguably a contribution to what it means to do counting in these settings.

The use of individual pitch movements on each number appears to be a manifestation of the one-to-one principle. It may not be essential in that objects can be counted accurately without the use of individual pitch movements. However, its prevalence amongst this age group and promotion by the teachers in this study suggest that it may be a further aid to maintaining one-to-one correspondence.

In the analysis of joint sequences it was found that children showed differing degrees of comfort in entering into teachers' count space. Some of them recognised that teachers used a distinctive "one…." to 'invite them in'. Teachers were comfortable in practice about entering into children's count space (but see Chapter 7 for evidence of their unease about it when they listen/see it written down). They drew on a range of strategies within the

sequence that appeared to enable the count to continue in a way that achieved an accurate (mutually agreeable) count. The use of transition enabled teacher evaluation mid-sequence, slowed down the pace of the count, apparently reducing the possibility of sequence and correspondence errors.

Finally, the analysis illustrated that few children took a turn following a teacher's use of final pitch movement on a number. Final pitch movement conventionally signals an opportunity for speaker transition but it seems that the children in this study were already aware that they should wait for an evaluation and/or another question or explicit nomination before talking again. What happened following a completed count is the focus of the next chapter.

Chapter 6. Data Presentation – Count Closing

Introduction

Chapter 5 included description of how the last number of count sequences was typically emphasised. The last number of a count could not be predicted through lexical or grammatical design, but it was highly distinctive in prosodic design. It was emphasised through the use of falling pitch movement that identified it both as the end of the sequence and as contrastive to preceding numbers in the sequence. It conforms to Goodwin and Heritage's (1990) description of talk as shaped by the talk it follows and simultaneously shaping what comes next. What comes next was almost always a teacher receipt and the shape of these receipts is the focus of this chapter.

The first section discusses speaker transition around the last number. This leads to the main focus of the chapter which is the different kinds of turns that followed the last number, predominantly when there had been speaker transition. As with Chapter 4, there is a strong link initially to the study by Fluck (1995). The extent of my data and use of CA have enabled me to build on his work as well as consider responses to counts that are more characteristic of the educational context.

Speaker transition

The emphasis of the last number identifies it as the potential end of a turn (an opportunity for speaker transition, a TRP (Transition Relevance Place). For children in my data, this was how it functioned. When children said the last number, on all but a handful of occasions, it was followed by teachers taking a turn. Children did not attempt further talk after saying the last number and teachers always took this opportunity to take a turn. In contrast, when teachers said the last number, they always began more talk and children rarely attempted to take a turn at this point. Similarly, if the last number was said in unison, once it was said, children would drop out and teachers would continue.

This is consistent with previous studies of classroom interaction (Hellermann 2003) and suggests that participants in my data were orientating to a 'teacher evaluates' style of discourse. Extract 6.1 is an illustration. The child reached the end of the sequence and used final, contrastive intonation on "five" (line 3). There was no perceptible silence between the child finishing "five" and the teacher's "oh" evaluation. A child wanting to add more talk here would have to do so in overlap with the teacher. Overlap only tended to occur at this point at times when children did *not* use contrastive or final intonation, i.e. they continued counting past what the teacher considers to be the last number.

Extract 6.1. T3F5-B31

1	C	((rolls dice))
2	T	that's it how many've you got (0.7)
3	C	one (0.6) two (0.8) three (0.5) four ^five=
4	T	=oh:: that was brilliant counting as well (.)
5		can you move your little mouse five spaces?

Extract 6.2 gives an example of the lack of an opportunity for speaker transition when the teacher has said the last number of a count. Here the child was taking out counters to put onto her picture, the teacher said each number as the child took each counter but there was no spoken contribution from the child.

Extract 6.2. T3F1-B12

1	T	it's this one you were going to do isn't it
2		you were going to do the one with four
3		Lauren (0.5) w:o:ne >count Lauren< w:o:ne
4		(2.7)
5	T	t:wo::
6		(2.6)
7	T	three::
8		(2.2)
9	T	↑four: clever girl (0.5) Callum which one are
10		you going to do

There were long pauses following each number except for the final number. The teacher's "clever girl" evaluation was incorporated within the pitch movement of "four". The teacher says "four" with a big pitch rise, and the fall from this starts in the middle of "four" and

drops all the way across "clever girl". The potential opportunity for transition shifted from after "four" to after "girl", eliminating the projected TRP at the immediate end of the count. This practice was used by teachers in the data but never by children. It was a way of actively keeping the turn for the teacher. Even when teachers did not do this, when there was a pause following the last number, children still did not take up a turn; showing that they too saw a teacher's turn as the expected consequence of the end of a count.

Such an orientation to teacher follow-up may be unremarkable in classroom dialogue but it is particularly important, in the context of counting, to acknowledge the *placement* of the follow-up. Children's turns rarely extended beyond the end of the count. They therefore had little opportunity to apply the product of their count within the format of these activities.

Following the last number

The examination of speaker transition reveals how teachers secured a follow-up position at the end of counts. The remainder of the chapter describes how teachers used the follow-up.

'Pointers to cardinality'

The phrase 'pointers to cardinality' comes from Fluck's (1995) study. He coined it to describe aspects of follow-up turns used by mothers and how they might support children in the development of cardinal understanding. He identified three types of follow-up,

(i) *'confirming importance of final count word'* – parents did this by echoing the last word of the children's counts. Fluck suggested this contributes to the development of understanding cardinality in its separation of the word from the rest of the sequence.

(ii) *'explicit connection to cardinality'* – this was the parent's use of the child's last word in a phrase (e.g. "there's three lorries").

(iii) *'no pointers to cardinality'* – these follow-up turns did not use the last number, some included a positive assessment/praise.

Teachers' follow-up turns in my data could be aligned with Fluck's three categories. Almost 20% of teachers' responses to children's counts were similar to the example in Extract 6.3 where teachers used both a repetition of the last number and went on to use it in a phrase.

Extract 6.3. T2F2-B16

	1	T	so how many houses've fallen down
			(lines omitted)
	2	C	one two
→	3	T	two two houses've blown down

Table 6.1 shows the proportion of follow-up turns according to Fluck's categories for each teacher in my study. The combined figures for the five teachers are given along with the comparable figures from Fluck's study.

Table 6.1. Proportion of follow-up turns containing pointers to cardinality

Data set	Last word repetition	Last word with plural noun	Neither
T1	29%	62%	9%
T2	54%	34%	12%
T3	42%	20%	38%
T4	64%	8%	28%
T5	77%	3%	21%
All	50% (29%-77%)	25% (3-62%)	25%
Fluck (1995)	10.0% (0-26.3%)	7.5% (0-18.2%)	82.5%

Fluck's pointers to cardinality were therefore more prevalent in these nursery conversations than in his parent-child data. Three of the 13 mothers in his study did not use any pointers to cardinality. Of the 10 who did, they accounted for between 4 and 37% of their follow-up turns. All five of my teachers were regular users, accounting for 62-91% of follow-up turns.

Differences in study design require caution in making direct comparisons. There is an obvious difference between the parents and teachers, but there is also significant variation between the teachers (Chi square 93.7, df 8, $p < 0.001$). There is insufficient evidence to say whether the differences are due to individual style, the age/competence of the children or the importance of cardinality to the task.

It is important to consider the different follow-up types in relation to the previous turn. Fluck (1995) approached this by dividing previous turns into 'correct' or 'incorrect' counts. He found that repetition and plural nouns were more likely following correct counts and that plural nouns were not used following incorrect counts. The higher use of plural nouns in my

data may result from the bias towards 'correct' counts. In this sense, pointers to cardinality occur as the *outcome* of a successful count; they represent an agreement of cardinality.

Whilst Fluck found no use of plural nouns following incorrect counts and it is very rare in my data, it is illustrative to look at the small number of examples when it does occur. Extract 6.4 contains two examples (lines 10 and 13).

Extract 6.4. T2F2-B02

	1	T	right what do we need for the story? (0.8)
	2	C	pigs
	3	T	how many
	4		(2.0)
	5	M	one two three:
	6	R	no there's- I'll count (0.4) one two three four
	7		five six >seven eight nine ten<
	8		(1.4)
	9	R	no
→	10	T	^ten pigs?
	11	R	no one two three (0.8) four
	12		(1.7)
→	13	T	four he thinks we need four pigs
	14	R	no (0.4) we've got one two three f-
	15	T	we've got three:: can you count James cause
	16		he- he keeps getting a different number when
	17		he counts you count and see how many

The teacher's uses of "ten pigs" in line 10 and "four pigs" in line 13 illustrate the consequences of where the child ended his sequences (lines 7 and 11 respectively). Fluck argued that such feedback was still valuable as a pointer to cardinality. This seems to be how T2 is using it and the child does respond with further attempts. Fluck suggested parents avoid it because it meant that children would be *"exposed to erroneous information about the cardinality of the sets"* (1995, p145).

Despite its status as a *"potentially valuable learning opportunity"* (Fluck 1995, p145), three factors mitigate against it being a 'preferred teaching strategy',

(i) Opportunities to use this strategy are minimised by other practices, in particular the placement of teachers' follow-up turns. That is, teachers generally prevented children from continuing their count beyond the 'right' response (extract 6.4 is a notable exception) and if children completed their count prematurely, teachers treated it as incomplete by withholding evaluation (they either prompted children to continue or completed the count themselves).

(ii) The intonation design of the follow-up. This is discussed in more detail below but for now, the way in which the teacher uses "ten" and "four" in extract 6.4. is different from its use in more conventional, agreed sequences.

(iii) Problems with conversational implications.

Overall, the data is supportive of Fluck (1995). The turn design features he identified in parents' turns would seem to be a robust feature of counting in the nursery context as well. His description of characteristics as *pointers to* cardinality, reflects his search for how children learn this aspect of counting but (as he admits) it is not clear how and if children make use of them. From a CA perspective it may be more accurate to view them as *outcomes of* cardinality. The next sections of this chapter explore this further in extension of his categories using the descriptors 'last word repetition' and 'last word incorporation'.

Last word repetition in the count turn

Repetition of the last number in a count has received attention in two ways in the literature: as 'last word repetition' and 'last word responding' (Fluck and Henderson 1996). Both terms refer to repetition of the last word *by the counter* (i.e. child) and have been linked to emerging understanding of cardinality. Fuson (1992) sees the repetition initially as a 'learned response' but Fluck and Henderson (1996) suggest it is a more genuine indication of cardinal understanding.

Neither pattern was found in Fluck's (1995) data. There were only isolated examples in my data and these are discussed in the next examples. Not only did children rarely repeat their last number, but teachers did not repeat the last word of their own counts either. The last word repetition that did occur was in *receipt* of a count. This is discussed in the next section (last word repetition in the follow-up turn).

A rare example of 'last word repetition' in the count turn is shown in extract 6.5. The tendency for teachers to come in at the end of counts minimised the possibility of extracts like this. The dominant pattern in my data would have been for the teacher to come in at the end of line 3.

Extract 6.5. T4F4-B22

	1	T	if I gave you another one how many
	2		would you have?
	3	C	one two three four five six seven eight (0.7)
→	4		eight
	5	T	eight ooh golly

The child used final pitch movement on "*eight*" rather than the enumerating or neutral pitch movement that might be interpreted as intending 'more to come'. There is enough of a pause for the teacher to come in non-competitively. By not doing, she gave the child an opportunity to add more, the child repeated "eight", this time it was louder and with a more prominent pitch movement and the teacher repeated it immediately with the same pitch movement. The pause was not long enough to warrant an interpretation that the child was responding to the pause, i.e. the teacher's *lack* of evaluation, though later on in the exchange it became clear that "eight" was not what the teacher was initially expecting and she may have given some non-verbal indication of this between the child's two sayings of "eight".

Extract 6.6 gives an example of 'last word responding'.

Extract 6.6. T1F2-B10 (also discussed in Chapter 4, p56-57)

	1	C	((rolls dice))
	2	T	d'y'know how many that is?
	3	C	I don't know
	4	T	shall we count them, put your finger
	5		on the spots
	6	C	one two three four ((pointing))
	7	T	oh let's put on every one so you don't
	8		miss any ((holds child's finger))
	9		w:⌈one⌉
→	10	C	⌊one⌋ two three four five
	11	T	so how many?
→	12	C	five
	13	T	five now can you move your spider five spaces

The child has counted using a sequence, but repeated the last word when asked "how many?" (line 11). The practice was very rare in my data, but cannot be attributed to child competence levels. It was more accurately due to limited opportunity. Teachers did not supply the necessary follow-up question for children to respond to. In common with parents in Fluck's (1995) study, we can infer that teachers were satisfied with the sequence response.

Last word repetition in the follow-up turn

In contrast, the last word was repeated in 79% of teacher turns following children's counts. The last word was repeated immediately following 46% counts and repeated in a phrase following 51% counts. The lack of interactive research into counting means follow-up turn repetition has not been examined other than in Fluck (1995). The rest of this section considers the immediate last word repetitions by teachers. Use of the last words in phrases is discussed in the sections on 'last word incorporation' and 'link turns'.

In repetition of the same word, *relationship* to the previous turn is signalled through prosodic design (Couper-Kuhlen 1996). Two conversation analytic studies that have looked systematically at repetition are relevant to my data. The studies (Hellermann 2003 and Tarplee 1996) are taken from different environments but look at repetition in the same conversational context, i.e. the third turn 'follow-up' position common to adult-child dialogue. In both studies, the repetitions signalled and/or achieved different interactional moves according to what Hellermann (2003) calls their "prosodic packaging".

Hellermann's study was in high school classrooms and teacher's repetitions functioned as 'assessments' of students' responses. Repetitions indicative of positive assessment were produced with mid pitch and (or) falling contour (as well as longer duration and rhythmic placement). Negative assessments did not have these characteristics; they were not lengthened, were more likely to have rising pitch and were often produced arhythmically. The high school students were sensitive to these differences and responded accordingly.

Tarplee's (1996) study showed comparable sensitivity in much younger children (aged 12-18 months in a book-sharing activity with parents). The repetitions in this activity also functioned as assessments but, because of the children's immature pronunciation, parents' repetitions were often quite different in their phonetic form. To minimise the contrast between the two productions, parents' repetitions replicated the child's prosody, i.e. parents said the word with similar pitch movement, length and loudness. When parents did not replicate prosody in this way, children responded to the contrasted repetitions (same word, different prosody) by having another go.

The significance of these studies for my data is already apparent from the discussions in Chapter 6. Teachers' repetitions *within* the count sequence constitute the 'alternating' pattern of joint sequences. These repetitions fell in with children's productions and so avoided signalling the 'trouble' that both Hellermann (p100) and Tarplee note as a feature of repetitions in ordinary conversation.

In repetitions of the last number of a sequence, the following patterns are evident,

- if children marked the final number, teachers' repetitions echoed the child's way of marking it – sympathetic repetitions,
- if children did not mark the final number, teachers' repetitions contrasted with the child's marking – contrastive repetitions,
- if children marked the wrong final number, teachers either repeated this contrastively (with EPM) or continued the sequence themselves.

What is clear from this section is that follow-up repetition is a much more prevalent feature of counting in nursery interaction than the count turn repetition described in previous research. The next section looks at what else was done with the last number.

Last word incorporation

Following 33% of children's sequence counts and 30% of joint counts, teachers went on to use the last word in a phrase of some sort. In Fluck's (1995) analysis this was the number together with a plural noun, reflecting what had been counted (e.g. "three lorries"). Teachers incorporated children's last numbers this way but also in other ways, see table 6.2.

Table 6.2. Examples of 'last word incorporations' in follow-up turns

Example	Description	Source
"we've got three pigs"	(plural noun - counted)	T2F2-B02
"can you move your spider three spaces"	(plural noun – effect)	T3F4-B18
"three in the bucket"	(use in phrase without noun)	T5F2-B28
"you got three"	(use as noun phrase on its own)	T4F3-B06

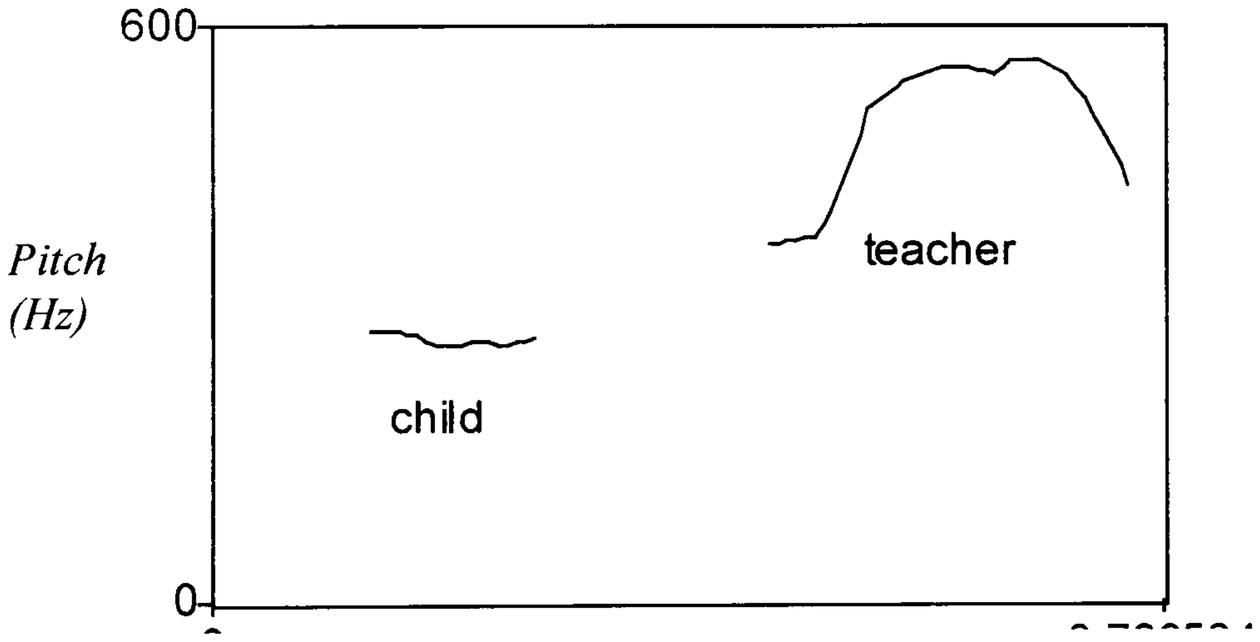
Considered as individual turns these examples illustrate the cardinal use of the last number in the same way that Fluck suggested. However, the potential of these turns as pointers to cardinality is enhanced even further by considering them sequentially; within, not extracted from, the environments where they are produced. This is first illustrated with a rare 'negative' example, returning to extract 6.4 (part of it reproduced as extract 6.7).

Extract 6.7. T2F2-B02

	1	C	no there's- I'll count (0.4) one two three four
	2		five six >seven-eight-nine-ten<
	3		(1.4)
	4	C	no
→	5	T	^ten pigs?
	6	C	no one two three (0.8) four
	7		(1.7)
→	8	T	four he thinks we need four pigs

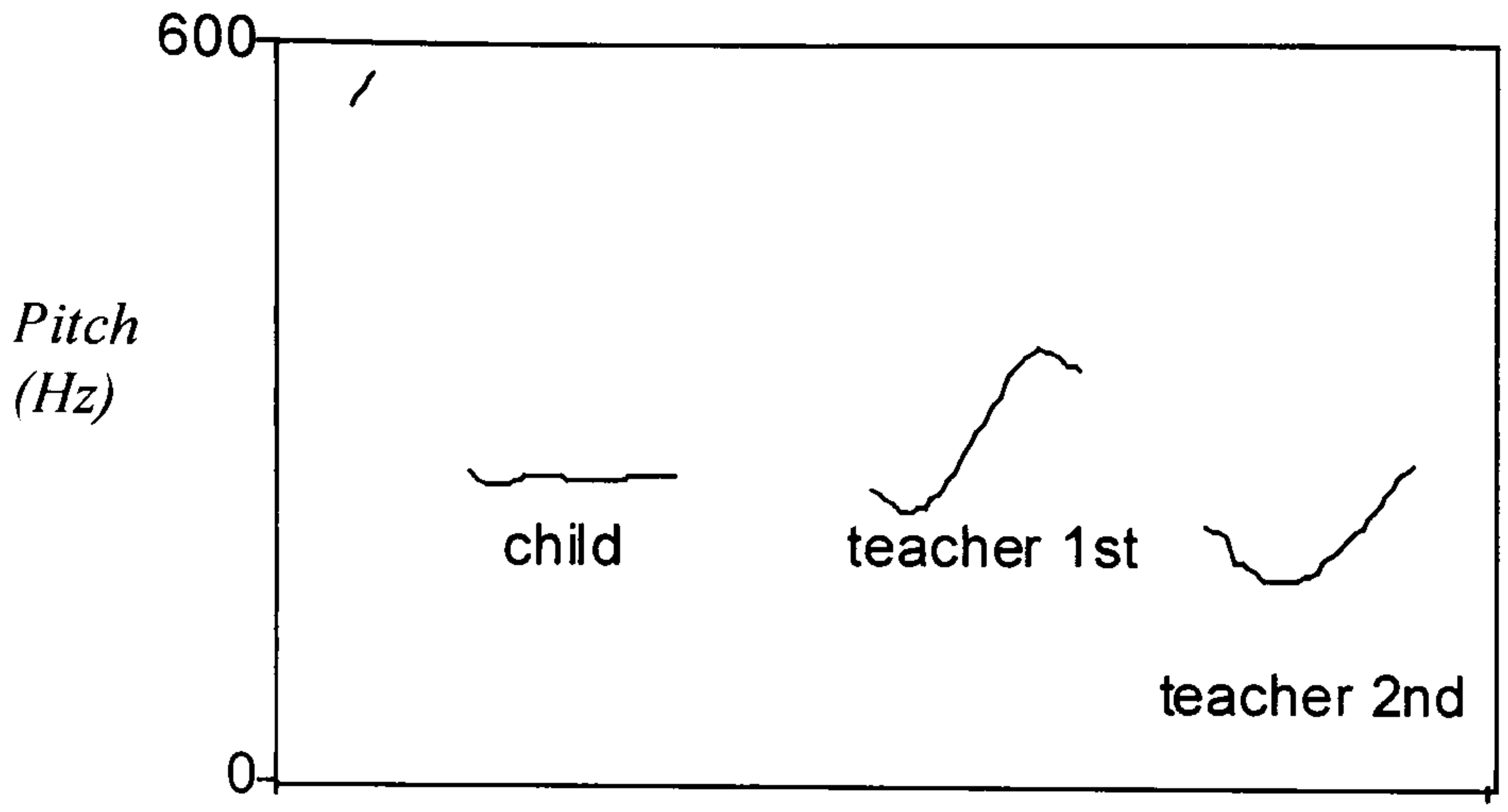
At both lines 5 and 8, the teacher incorporated the child's last numbers into her follow-up turn. Although she incorporated the same word, the way she produced it was heavily contrasted with the child's. Pitch traces of both productions are shown in figure 6.1.

Figure 6.1. Pitch traces for child and teacher's productions of "ten" in extract 6.7



The child's "ten" has been said quickly, quietly and with mid level pitch. The teacher's "ten" is louder, longer and takes a significant rise-fall pitch movement. Figure 6.2 gives the traces for the repetition of "four". This time the teacher stays in the mid pitch area but her productions are still perceived as contrasted because of the fall and rise pitch movement.

Figure 6.2. Pitch traces for child and teacher's productions of "four" in extract 6.7



The earlier discussion of this extract noted how the use of children's last numbers in phrases was rare unless the count was correct. What was also rare was the contrastive production shown in figures 6.1 and 6.2. Far more prevalent in phrases such as these was production that was complementary to the child's. Not only did teachers replicate the *number* that the child has used, they also replicated its prosody.

Extract 6.8 is also from T2 and the same group of children. The teacher's follow-up turn (line 3) has a similar grammatical design as her follow-up turn (line 8) in extract 6.7 ("*four, he thinks we need four pigs*").

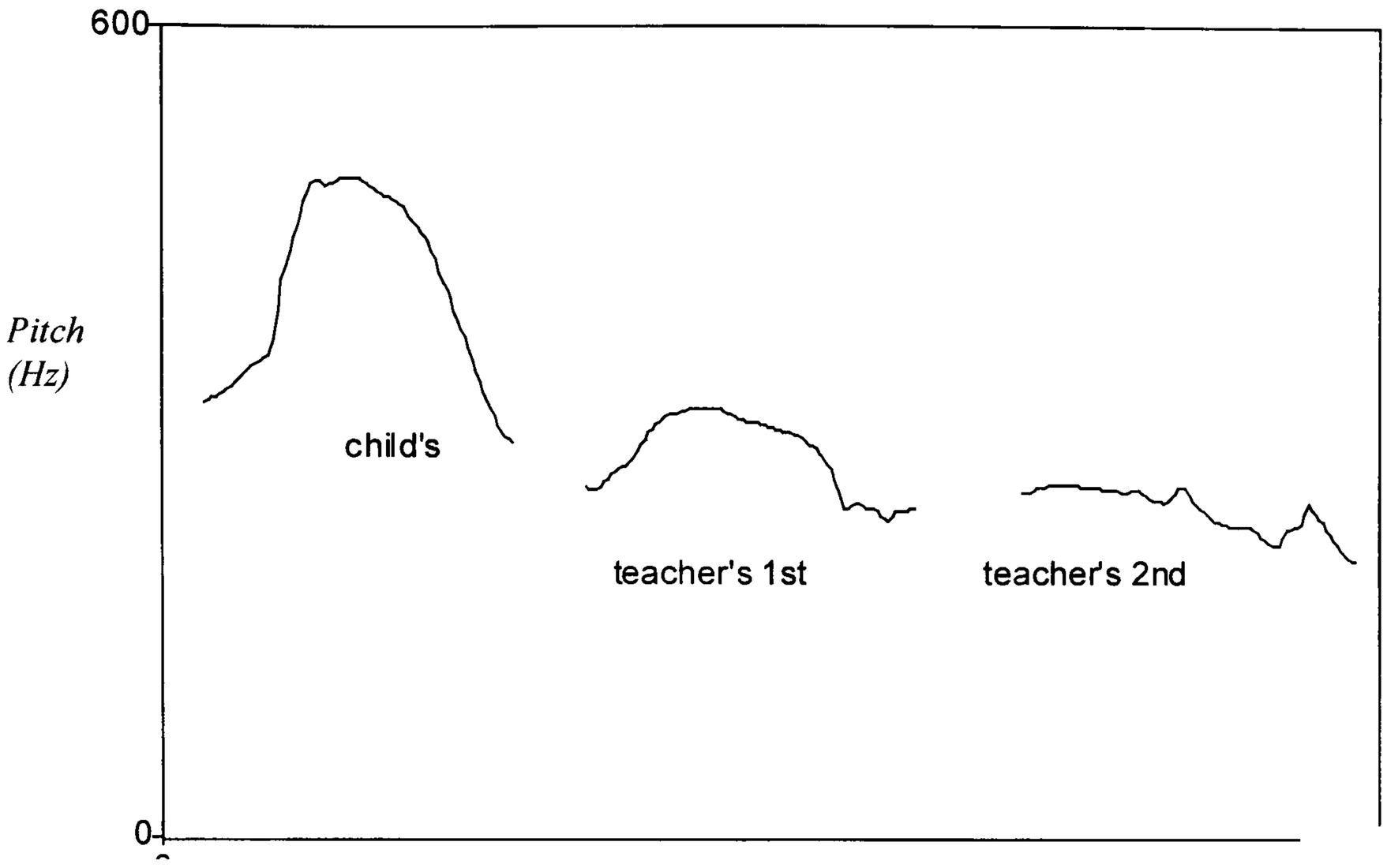
Extract 6.8. T2F2-B21

	1	T	how many houses did we start with
			(lines omitted)
	2	C	three
→	3	T	three we started off with three houses

The pitch traces for the productions of "three" are reproduced in figure 6.3. There is a striking difference between figures 6.2 and 6.3 in the child's pitch movement. It is not the same child, but the point here is to look at the teacher's pitch movements,

- *Comparison across the two extracts.* The pitch movements on the teacher's production of "four" in figure 6.2 both fall then rise, whereas in figure 6.3 they rise then fall.
- *Comparison with child's pitch movements.* The contrast between teacher and child's productions in 6.2 was noted above. In figure 6.3, the teacher's pitch movements replicate the child's rise then fall.

Figure 6.3. Pitch traces for child and teacher's productions of "three" in extract 6.8



The purpose of comparing these two extracts is to demonstrate the greater complexity of the area than revealed by Fluck (1995). The teacher's use of the phrases, *"four, he thinks we need four pigs"* and *"three, we started off with three houses"* are good examples of Fluck's 'pointers to cardinality'. In the way that he suggested, the teacher has made the last number 'separately accessible' by her repetition, and she has modelled its cardinal implications by combining it with a plural noun. However, the analysis of prosody adds two further functions. Firstly as an evaluation, the child's response is replicated and accepted, unlike figure 6.2 where the response is contrasted and 'questioned' (not overtly rejected). Secondly, it extends the child's response along the lines of a suggestion made by Hellermann (2003), that complementary repetitions are,

> *"a resource the teacher has to add salience to the student response by increasing the time that the student's contribution is active in the discourse" (p90).*

Last word incorporation makes children's last numbers 'active' for even longer and in an additional, functional way (i.e. displaying cardinality). In extract 6.8 the teacher links the product of the child's count with what has been counted and to her original question at line 1. The next section shows how some activities took this link even further.

Last word incorporation – 'link turns'

The follow-up turns described by Fluck (1995) were all concerned with what children had already counted. Many of the activities in my data gave children opportunities for two

counts, for example, the roll of the dice and then the use of this count to move spaces or pick up the corresponding number of bricks or counters.

In these activities, the follow-up turn to the first count often functioned simultaneously as an initiating turn for the next count. This contributed to a 'chain' of three-part sequences reported in classroom dialogue (Drew and Heritage 1992, Nassaji and Wells 2000). In these turns, last word incorporation is done differently than the turns discussed by Fluck and in this chapter so far.

Fluck's (1995) description was of the last number being incorporated with a plural noun that refers to what has *been counted.* In contrast, teachers' use of the child's last number in these 'link' turns is with a plural noun that refers to what the child is being directed to *count next*. So in extract 6.9, the teacher used the child's last number not with the spots that he has counted but with the spaces that he should count next.

Extract 6.9. T1F2-B12-13

	1	C	((rolls dice))
	2	T	oh d'y'know how many that is
	3	C	one two three four five
	4	T	well done you've got to move your spider
→	5		five spaces . count in a big loud voice . shout
	6		one
	7	C	one two three ⌈four⌉
	8	C2	⌊four⌋ five
	9	T	one more five five right

The follow-up turn at lines 4-5 links forwards as well as back, displaying the consequences of the child's turn at line 3. The separation of the last number from the child's original string is more distant but distance is reduced through replication of pitch patterns as described in the section on last word incorporation. Further significances of these turns are taken up in my discussion.

Praise

In the discussions of follow-up turns so far I have argued that repetition and incorporation turns also function as evaluations. Hellermann (2003) and Tarplee (1996) both contend that

repetitions (with appropriate 'prosodic packaging') have advantages over more explicit evaluation such as rejections or praise. Hellermann suggests that the implicit evaluation done by repetitions is a means for teachers to 'lessen their authority' in the classroom. For Tarplee, repetitions provide a way to maintain interaction in an activity that could be significantly disrupted if (the very frequent) child 'errors' were highlighted more overtly.

Hellermann and Tarplee's settings were not nurseries but it is clear that the same principles can apply. Teachers' use of repetition and incorporation reduces the need for overt praise and is arguably more effective because of the way it takes the child's contribution further into the joint activity. A paradox is that, whilst there appears to be potential cognitive and interactive value in avoiding the explicit evaluation of praise, three of the four teachers who viewed their transcripts expressed (unprompted) concern about insufficient praise.

Fluck (1995) subsumed praise within his 'no pointers to cardinality' category. In my analysis, this category (essentially referring to those counts where there was no repetition of the last number) was coded according to whether the receipt was positive (praise), negative or neutral. In practice there were only 3 counts received with a 'negative' response. The 'neutral' responses were turns following the count that had neither praise nor use of the last number. The talk in these bouts moved on to something else without reference to the count. Table 6.3 illustrates the percentages of each type of receipt for each teacher.

Table 6.3. Teachers' use of praise and cardinal feedback in follow-up turns

Teacher	Praise alone	Praise with cardinal feedback	Neither	Cardinal feedback alone
T1	4%	7%	18%	71%
T2	0%	8%	14%	78%
T3	20%	8%	34%	38%
T4	12%	9%	25%	54%
T5	13%	0%	13%	74%
All	12%	7%	25%	56%

The variation between teachers is significant (Chi = 76.84, df 12, $p < 0.001$) and the table shows that,

- T2 is both the lowest user of praise and the highest user of cardinal feedback.
- T3 is both the highest user of praise and the lowest user of cardinal feedback.

The exploration of differences in teachers' styles was not a goal of the study but this finding suggests such an exploration would be a useful avenue of further analysis. In the meantime, the patterns point to the possibility of a relationship between count follow-up options.

Chapter Summary and Conclusions

The main findings of this chapter are about the 'consequences' of counts. They contribute to the identification of the conversational context and impact of counting.

An important finding was the pattern of children's contributions terminating at the end of the count sequence and the consistent placement of teacher follow-up turns at this point. This is of significance for wider counting literature because of the lack of opportunity for practices described in the literature such as 'last word repetition'.

In tandem with this is the analysis of how teachers did follow-up children's counts. Whilst 'evaluation' did happen, the variety in the follow-up turn supports studies such as Nassaji and Wells (2000) in identifying the important potential of this turn in teacher-pupil dialogue.

In linking to CA literature, my data gives further support for the relevance of prosodic design as a resource for discrete evaluation (evaluation that provokes least resistance) but also as a resource for dealing with saliency.

Finally, along with Fluck's (1995) work, the analysis provides evidence that the cardinality principle is difficult to pin down in individual counts and may more accurately be part of what counting achieves rather than what counting is.

All of these points link into the findings of Chapters 4 and 5. An integration of the three areas is attempted in the next chapter where the findings are reconciled with the original research questions and the concerns identified in the literature review.

Chapter 7 - Data Summary and Discussion

Introduction

The data presentation chapters provide a detailed description of some of the practices involved in teachers and children doing counting in nursery activities. A sequential approach was taken but overall turns have been discussed fairly separately. The three part presentation enabled comparison with previous research such as Fluck (1995) and confirmed the flexibility of triadic dialogue identified in work such as that by Nassaji and Wells (2000), Radford (2005), and Westgate and Hughes (1997).

Chapter 4 provided analysis of the design and placement of what I describe as QETs (Quantity Engendering Turns). The analysis illustrated the variety of ways that teachers used to elicit counting, and at the same time, the variety of turns that children see as occasions to count. Regularities were found in the way that teachers combined QETs and suggest a preference for prompting counting by providing different purposes rather than directly asking children to count.

Chapter 5 considered the count turn itself. A regular intonation pattern for counting was identified and implications of this design explored. The value of collecting data from interactive activities was reinforced by the discovery of the prevalence of joint count sequences, a practice rarely depicted in previous counting literature where both children and teachers contribute numbers to the sequence. Analysis of joint sequences provided insight into the importance of intonation in co-ordinating turn-taking for counting and in potential representation of counting principles.

Chapter 6 examined the turns that followed counts. Fluck (1995) had noted the value of this turn in his study of counting between children and their parents. The pointers to cardinality he found were evident in my data, with teachers using statements of cardinality much more frequently that the parents in Fluck's study. The chapter identified further potential for this

turn in analysis of the use of intonation and grammar but also found a limitation as a result of the placement of the turn, seemingly preventing children from continuing beyond the count.

In order to integrate the findings from the data presentation chapters, this discussion chapter returns to the CA stance of considering the interactions as 'ordinary conversation', i.e. not necessarily triadically structured. Rather than starting from the initiation of a count and working forward, it means focussing on the counts themselves: when did they happen, why did they happen then, what did they arise from and what did they create?

The approach is influenced by Hopper and LeBaron's (1998) description of a 'noticing series'. As I have picked out counting, Hopper and LeBaron picked out occasions relating to gender. They identified what went before and what followed, describing it as a 'noticing series' to highlight how the series of turns advanced gender from something *potentially* relevant to something *centrally* relevant to an interaction.

With this perspective in mind, the chapter is structured around the research questions for the study. The overarching question was,

> ***What features of conversation do teachers and children recruit during nursery counting activities?***

The phrase 'features of conversation' was necessarily broad but was divided into four narrower questions to complement areas raised about counting in the literature review,

- How do counting conversations unfold? Are there recurrent patterns and where are the conversations embedded?
- How is turn-taking organised in counting conversations?
- What are the features of conversational turns in counting activities (their vocabulary, grammar and intonation features)?
- What asymmetries of knowledge and participation are there?

The questions link to the four CA 'techniques' discussed in Chapter 2 and are numbered 1 to 4 in this chapter for ease of reference. The first question links to attention to sequential analysis and the way that context is indexed and created. Issues and implications of turn-taking organisation and turn design are considered by questions 2 and 3 respectively. The final question, about asymmetries, moves from integrating the conversational features towards implications for teaching and learning. The four areas are summarised together with an acknowledgement of the study's limitations. The final section states my conclusions.

1. Sequential analysis -

How do counting conversations unfold? Are there recurrent patterns and where are the conversations embedded?

The focus of this question is the sequential analysis of talk immediately surrounding counts. The usefulness of such analysis is in its ability to reflect relevant aspects of context. The approach to context taken in CA has been discussed a number of times through the thesis, i.e. context that is created through interaction rather than context as a 'bucket' in which interaction takes place (Goodwin and Heritage 1990). Some attention to the 'bucket' is useful and was the purpose of supplementary data described in Chapter 3. This provided a starting point for locating where counting conversations took place and is reviewed here before turning to the actual unfolding of the conversational context for counting.

The broad placement of counting conversations in nursery activity was found to vary considerably. Brief counts occurred within many areas and materials but in addition to these, teachers could be seen to have some favoured or habitual placement of counts. A good example from the exploratory recordings was where T4 took small groups of children to the school pond. Each trip had a similar overall conversational organisation, with counting a recurrent topic at particular points: counting the number of children before setting off, counting the steps, counting the fish, counting the children when they got back.

For all teachers, the most concentrated placement of counting was in the small group number focus activities used for the main data recordings. In some of these, particularly those involving dice, the conversation consisted almost entirely of counting bouts, nearly all turns could be classified as QETs, counts or feedback to counts. In others, where there were other identifiable learning objectives, the bouts were more spaced out.

The common thread for the occurrence of all counting was attention to quantity or plurality in the environment, often following attention to *changes* in these. The concepts of plurality and quantity, and the attention to them, were 'visible' to me. CA required demonstration of how and where they were visible to the participants. Demonstration is not just a requirement for an exercise in CA; it is crucial for teaching and learning. It is necessary to identify how and where teachers and children make these aspects of context evident to each other; how teachers make quantity an explicit focus of context rather than 'just' plurality; and whether it is possible for teachers or children to count in a way that makes it recognisable to others that they are doing more than just enumerate a set of objects.

Chapter 4 approached this level of context by noting the kinds of turns that participants recognised as opportunities to count or provided a single number response. These 'QETs' could be classified into those that provided a purpose and those that prompted a process based on their linguistic design (discussed further in section 3 of this chapter). I was able to show that teachers orientated to this distinction in their combination of QETs.

However, whilst it was the case that children were more likely to use single numbers in response to the purpose QETs, their usual response to these QETs was still to count. When they count, this could be taken to indicate two possibilities,

- children regard their counting as implicitly quantitative,
- children do not see the 'quantity' implicit in the purpose QETs.

These possibilities require further discussion but the implication for this research question is that, whilst there were recurrent patterns in QET design and combination, these did not lead to recurrent patterns in the way that the rest of the conversations unfolded. It was necessary to start from the counting turns themselves, these are the most distinctive and unequivocal turns in the data and it is these that I set out to capture.

Following Hopper and LeBaron (1998), counting turns can be seen as 'noticing' turns,

> *"noticing places at centre stage matters that already may be present as background but have not previously been explicitly indexed in talk"* (p63)

Hopper and LeBaron used a range of data sources to examine 'gender noticings' (see example below) in a similar manner as I have examined the instances of counting across my data. They sought to determine what conditions led to noticings as well as what was done with the noticings once they were made. A similar process enabled me to identify my unit of counting 'bout', to incorporate not just the counting but its immediate antecedent (QET) and the subsequent 'closing' or agreement type turn that followed the count.

The comparison is extended further below but the question needs to be asked *what is it* that counting is *noticing*? Asking this question feeds the debate raised in Chapter 1 about 'what is counting'. The physical activity of enumerative counting is a highly effective way to notice the plurality of a group of objects. The findings of Fluck, Linnell and Holgate (2005) indicate that parents may not see a distinction between this and counting as a noticing of quantity. Research within carefully designed activities, and children's own reporting, suggest that children do not *notice* quantity with their counting at this age, yet this is arguably one of the reasons for educators involving them in counting activities. The issue at stake is identification of what is required for counting to notice quantity as well as plurality.

The first step is to return to Hopper and LeBaron's (1998) work, where a valuable parallel between gender and quantity can be teased out. Gender has been argued as being something that is omni-relevant in interaction, i.e. an aspect of context is unavoidably significant, even when not explicitly referred to (Billig 1999). The CA perspective is that nothing is relevant without the interaction making it so (Schegloff 1999). Context is made relevant by being 'advanced' into focus from background to foreground. Gender is indexed in conversation in various means, but whether it is contextually relevant depends on speakers' orientation to the indexing. Extract 7.1 is an example.

Extract 7.1. From Hopper and LeBaron (1998, p62)

1	Jill	I've signed up for one of those informal classes about car
2		maintenance and repair
3	Pip	That's a good idea. A lot of women can really learn a lot from
4		these classes
5		((short pause))
6	Pip	Well, I guess there's a lot of guys who can learn from them too

A different view of context might argue that gender is already relevant in line 1. Gender is not verbally 'noticed' until line 3 and it is only at line 6 that gender is explicitly focal in the talk. We can only see the speakers' treatment of gender once it is brought into potential context, then considering what led them notice it and how the noticing is dealt with.

Applied to quantity, it may be that the cardinal meaning of counting remains only a potential aspect of context in activities, even when quantity has been indexed in an initial purpose. The challenge for teachers, in making counting something that children can use productively (as well as enjoy and participate in), is to advance the quantitative aspect into focus.

A group of objects in a game will 'possess' both plurality and quantity. When the objects are played with or talked about in terms of colour, size, personality, the plurality and quantity remain in the background. Plurality is emphatically advanced into focus through counting. In the interactions in my data, children count objects but rarely comment on quantity. The count may make quantity apparent to the teachers but this is not publicly 'noticed' unless the teacher responds with an expression of quantity. Noticing of quantity is achieved by the turns identified by Fluck (1995) as 'pointers to cardinality'.

Interactions between plurality and quantity make it slightly different from gender but the comparison is compatible with the distinction between the three parts of the series, described by Hopper and LeBaron (1998) as follows,

- first there is a *peripheral orientation* where gender can be argued to be present but cannot be considered a relevant part of context,
- this can lead to a *noticing* where gender is explicitly referred to,
- then there is (but again does not have to be) an *extension* where gender becomes the topic of the interaction.

Examining the data for occasions when quantity is noticed, these frequently surround occasions when plurality is noticed. When teachers draw attention to quantity as a relevant feature of the environment, attention to plurality is the frequent precursor to doing so. Attention to plurality is most effectively achieved by counting and in this way counting prepares the conversational ground for quantity.

The value of invoking the idea of a 'noticing series' is in the suggestion that noticing only introduces aspects as *potentially* relevant, they only *achieve* relevance if they are picked up in further talk. Some *extension* is needed in order to make quantity the explicit focus of the interaction, explicit to the participants and explicit to analysis. If quantity is not advanced then, conversationally, it remains in the background. Viewing counting conversations as 'noticing series' therefore provides a candidate, or at least contributory, explanation for the opinions of the children in Munn's (1997) research.

Chapter 6 showed how teacher turns always occurred immediately followed children's counts. This meant it was always teachers who took the position of responding to a noticing of plurality and were therefore responsible for how and whether the noticing was extended. The following three extracts show different implications from the noticing series framework.

Extract 7.2. T3F5-B03

	1	T	how many clocks?
	2		(1.0)
	3	T	shall we count? (0.6) you count=
	4	C	=o:ne two three (0.5) ^fou:r=
→	5	T	=brilliant that's lovely

Extract 7.3. T2F1-B04

	1	T	how many snowmen are left
	2	C	one two three four
→	3	T	four snowmen are left

Extract 7.4. T1F1-B02

	1	C	((rolls dice))
	2	T	what numb- how many spots've y'got
	3	C	one two three four
→	4	T	you have got four . can you move your spider
	5		four spaces

The status of plurality and quantity as a consequence of the children's counts is different in each example,

- in extract 7.2, plurality is noticed by the count but quantity remains peripheral,
- in extract 7.3, plurality is extended into a noticing of quantity, quantity is explicitly referenced by the teacher's turn and becomes a noticed part of context,
- in extract 7.4, quantity is again explicitly referenced in the teacher's turn as an extension of the plurality noticed by the child's count, but in addition to this, quantity is also extended.

Future research is needed to identify the proportions and distributions of the different examples. From my data, examples like 7.4 occur most prevalently in the 'two-stage' activities, usually involving dice. The framing of quantity within a conversational noticing series underpins the rationale for the design of these activities. T1 was emphatic in her expression of the conceptual difficulty contained in these activities, but conversationally they unfold in a similar way to other conversations (that children may or may not take part in).

The final part of this section considers two important considerations for the literature,

1. Fluck, Linnell and Holgate's (2005) study suggests that, for parents, quantity is omni-relevant in counting. Parents did not see that counting needed to be extended in order to become a noticing of quantity, that quantity may need to be explicitly *added*. The finding of relatively limited use of cardinal referencing by parents (Fluck 1995) would therefore reflect an assumption that quantity does not need referring to.

In contrast, the finding that teachers frequently 'notice' quantity in their follow-up to children's counts may indicate they do not think it has already been noticed, that the count on its own did not achieve this. The difference between child and teacher counts is important. The reason that teachers do not follow their own counts with reference to quantity may be that they see quantity as already noticed.

2. There are also implications for the discussions of pedagogical and instrumental styles. The literature review indicated that research located much counting in the least preferred 'pedagogical' style of mathematical teaching. 'Instrumental' was a more desirable style but it was not clear how counting of forks in the home corner was more readily quantitative than counting of buttons on a coat.

What the noticing series offers is that quantity can be noticed in *either* of these contexts but whether it becomes *relevantly* quantitative is dependent on how the noticing is extended in the interaction. It may be that there are more ways to extend remarks about quantity of forks than buttons and that it is this *extension* that researchers have responded to. The distinction between noticing and extension may be of more practical use to teachers than the distinction between pedagogical and instrumental.

In summary, the answer to the research question about where counting is embedded and how counting conversations unfold is that counting occurs in an environment of multiple things. These are noticed in a general sense and then enumerated through a count that is mostly performed by children. Following the count, teachers have an opportunity to evaluate the count explicitly, to extend it or to move on to another activity.

2. Turn-taking organisation -

How is turn-taking organised in counting conversations?

This second question looks within the sequence organisation to see how turns are allocated between the participants and how allocation is achieved. The presence of turn-taking within the count turn itself is particularly interesting and is the main focus of my discussion.

Across the data, turns were exchanged in a largely predictable manner, orientating to the system identified by Sacks, Schegloff and Jefferson (1974). In terms of allocation, there were no instances of children using QETs and only a very small number of instances where children attempted any kind of follow-up to their or others' counts. Overall the second

position, response/counting turn was taken up by children, but could also be shared in ways that are of interest in both conversational and teaching/learning terms.

Analysis of turn-taking reveals the kind of talk that teachers and children treat as units around which to take turns (TCUs, turn construction units), it reveals the points in talk where they see speaker change opportunities (TRPs, transition relevance places). The presence of joint sequences means an unexpected presence of TRPs within the count turn. Before discussing joint sequences in more detail, it is necessary to relate them to previous counting research.

Chapter 5 noted 46% of count sequences in the data included number contributions from both children and teachers. Despite the relatively high proportion of joint counting in these nursery settings, it had not been picked up through my literature review and it required considerable re-examination of the literature to find reference to anything similar.

The first explanation comes from the study design and intentions of many of the researchers involved in counting. The focus of the majority of studies is *children* counting. In one sense, children's counts are treated as variables to be 'isolated' and observed against the manipulation of contextual variables such as age, distribution of objects, different request types. This was not the case in the design of my study where the aim was to capture *children and teachers* counting. My design prevents reliable comparison with many previous studies. At the same time, the design of studies seeking an isolation of children counting prevents the occurrence of joint counting in the data gained.

Two studies that do include reference to some kind of joint counting are two of those reviewed in Chapter 1, designed to investigate behaviour of parents as well as children (Durkin et al 1986, Linnell and Fluck 2001). Both studies describe 'alternating sequences' where mothers and their children supplied the numbers of the sequence one at a time. In terms of design, the parents in Durkin et al's study did not have specific tasks to implement and researchers were not initially collecting data about counting. Linnell and Fluck's study had specific tasks, but they compared children's counting under 'assisted' and 'unassisted' conditions. Their example of an alternating sequence was an assisted count.

Research has focussed predominantly on children's 'unaided' abilities where findings would be ambiguous if children were not left to count on their own. When children did not count on their own, in the two studies mentioned and in my data, joint sequences occurred. This contrast, between the *presence* of joint counting sequences in data collected with

parents/teachers and their *absence* in data collected with researchers, is in itself an important finding. The joint sequences in my data indicate that, at least some of the time, parents and teachers did not interact with an intention of establishing children's 'unaided' ability.

Whilst the two studies support joint sequences as part of supported/interactive counting practices, in neither are they as prevalent as in my study. Two other studies, where supported counting took place (Fluck 1995, Saxe et al 1987), do not refer to joint counting. This aspect of turn-taking organisation in counting is therefore a gap in the literature. The sample of teachers for my study is small and it could be argued that these five teachers just happened to use such sequences. There were a lot more than five children involved in my study. They appeared to take part in the joint sequences unproblematically but again, this could be explained by familiarity with the teachers' particular practices.

Alternatively, joint sequences may be a feature of counting in interactive rather than experimental contexts. That it is a practice that extends beyond this study is supported by the mention of unison counting in the CGFS (QCA 2000), and of "choral counting" in Aubrey (1999). In addition, the teachers in my study did not see the joint counts as remarkable when viewing their transcripts. It seems that joint counting is a familiar practice yet is relatively absent from research.

In the teacher interviews, they expressed comfort with the unison counting (*"we tend to do that quite a lot, where we say it together"*) but were less confident of the virtues of their involvement in counts more widely. They saw this as interruptions, *("I've jumped in too quick", "I probably should have let him finish saying it before I came in", "sometimes I'm not always giving them enough chance to do it on their own"*).

When counting is portrayed in the literature as a child only activity, then it is understandable that teachers see their presence as intrusion. Discomfort can relate to feelings about teachers' role in children's learning more widely: discomfort with 'intervening' as somehow getting in the way of children's learning, something that it is right to do but only minimally (Meade 2000). The teachers' comments support Meade's perception in that their concerns were all about too much, rather than too little, involvement.

It was important for this study to focus not on what the teachers said about their practice, but what their practice (in conjunction with children) revealed. It could be that the joint counts resulted from children's active recruitment of teachers' contributions, in one sense against

the teachers' 'will'. This possibility is returned to in section 4. For now it is important to return to the conversational aspects.

Joint sequences incorporate two features of turn-taking organisation of interest,

(i) turn-taking practices engaged within the counting turn position,

(ii) deliberate overlap/co-production within the counting turn position.

These are of interest because they question the status of count sequences in terms of the concept of TCUs. TCUs do not conform precisely to grammatical units or sentences; they are units of talk that are potentially complete. Ford and Thompson (1996) describe three forms of completion: grammar, intonation and function. As aspects of turn design, these are more thoroughly treated in section 3. In relation to turn-taking organisation, TCUs are important as the units around which turn-taking takes place. They reveal the kind of units that the speakers treat as complete units.

If children and teachers can be seen to be treating the whole count sequence as one TCU, their joint sequences would be seen in the context of *turn sharing* (Lerner 2002), sharing the production of a single TCU. The patterns of turn organisation for turn sharing are discussed next. The alternative explanation is that regular speaker transition around individual numbers indicates children and teachers treat count sequences as made up of several TCUs.

This point links to viewing these conversations as 'noticing series'. Determining the TCU status of count sequences is evidence to the concern about what it is that counting notices. If counting only notices plurality, there is no need to preserve it as one turn. The corollary is that, if speakers do treat it as a single TCU then they may be treating it as *more* than just a noticing of plurality. Unfortunately this still does not instil it with quantity, but may perhaps bring it closer to doing so or influence the step to quantity noticing or extension.

To consider the TCU status being attributed to the count sequence, it is relevant to discuss patterns of joint sequences in relation to conversational literature on turn sharing. This not only provides insight to the ongoing discussion, but also begins to illustrate the variety of conversational practices that are recruited to enrich the activity of counting.

Lerner (1994, 1996, 2002) identifies various ways in which turn sharing is achieved and the circumstances where it happens. Two or more speakers take part in a turn yet it is not treated as problematic. The easiest pattern from my data to incorporate is when children and teachers say some or all of the words of the count together, in unison. This corresponds to a form of turn-sharing that Lerner describes as 'choral co-production',

> *"..participants speak in a fashion that reveals that they are not aiming to produce a separate turn at talk or even a distinct utterance among other simultaneous contributions but are instead aiming to simultaneously co-produce part or all of a ..[TCU] more or less in unison with another participant, by recognisably attempting to do such things as match the words, voicing and tempo to another speaker."* (2002, p226).

In joint counts, children and teachers frequently match the tempo of their number production, not just to each other's production, but also to the physical correspondence with the objects being counted. Viewed as one joint 'noticing' turn, this functions as an extremely powerful creation of enumeration.

A second form of turn-sharing uses the concept of *compound* TCUs (Lerner 1996). Compound TCUs are most recognisable in grammatical examples such as the use of 'if/then' type constructions, as in extract 7.5.

Extract 7.5. From Lerner (1996, p241)

1	Dan	when the group reconvenes in two weeks=
2	Roger	=they're gonna issue strait jackets

Dan's talk is not complete without both parts but the compound TCU is flexible in who provides the second part. The 'completion' count patterns in my data are examples of count sequences being treated this way. The numbers supplied by child or teacher are not complete turns, they are contributions to a whole sequence that is a compound TCU, constructed by more than one speaker without concern.

Lerner (1996) concluded that such turn transitions were evidence for the 'semi-permeable' nature of some kinds of talk. As well as these two-part grammatical units, there are a number of other practices where turns have this permeable character such as lists, word searches (Lerner 1994, 1995) and 'designedly incomplete utterances' (Koshik 2003). In all of these, it is interesting to note the points at which TCUs can be taken over. In alternating sequences there is speaker change between every number. Aside from these sequences, exchanges do occur between all numbers but not all numbers in every joint sequence.

Alternating sequences may initially seem to provide the most support for seeing count turns as a series of separate TCUs. However, this does not seem to be the way they are treated. Whilst mid-sequence repetitions function as evaluations, they are consistently different from end-of-sequence evaluations. By repeating the child's number, the enumerating function of the turn is again emphasised effectively. By delaying explicit evaluation (and extension)

until all objects are referenced this way, the numbers are preserved in one turn and the sense of 'groupness', of unity, is kept intact.

In summary, the way that teachers and children treat the numbers within the count sequence is, for the most part, as a complete unit but a *shareable* complete unit. The design of the unit is discussed further in the next section. The teachers and children's attempts to preserve this structure support the suggestion that although the count turn works first and foremost as a means of noticing plurality, it is also a noticing of unity if not quantity.

The count turn is mostly treated as a single TCU but one that can be permeated without penalty. Individual numbers may be more evidently treated as separate TCUs in counts where enumeration has a stronger focus. TCU status is not fixed, but created on each occasion, jointly negotiated as the count goes along. This can explain lack of coherence between initiation and follow-up.

3. Turn design -

What are the features of conversational turns in counting activities (their vocabulary, grammar and intonation features)?

Turn design was discussed in detail within the data presentation chapters themselves. For this chapter, findings are summarised under the three proposed areas (vocabulary, grammar, intonation) to consider how they contribute to the way that counting conversations unfold. The largest section is features of prosodic design because this is least addressed in previous research and has the most intriguing findings.

Vocabulary features

Vocabulary was identified as significant in two areas of the analysis,

- In the **opening** turn, different vocabulary choices enabled the manipulation of purpose and process,
- In the **counting** turn, the *lack* of vocabulary variation meant that counts in the data only rarely violated the stable order principle.

Chapter 4 identified the variety of vocabulary used in the **opening** turns. It provided a comparison with Fluck (1995) who had noted that children differentiated between "count" and "how many". The differentiation was even stronger for the children in my study, who were much more likely to give single word responses to QETs including "how many"

vocabulary. The children in my study were older than in Fluck's and the increased sensitivity to "count" versus "how many" vocabulary may be a reflection of age.

Fluck's claim that parents used "count" and "how many" interchangeably is intriguing. If the terms are truly used interchangeably, it seems perplexing that children treat them differently. Fluck's explanation was based on a language development perspective whereby children are seen as predisposed to find contrasts in meaning for different vocabulary (Clarke 1987).

There are two alternative explanations to challenge the notion of interchangeability. Firstly, a CA approach to Fluck's (1995) data may reveal that the parents *did* show distinctive use of the terms, in the way that the teachers in my study did. Secondly, the fixed nature of Fluck's tasks may have limited parents' opportunities to use the terms distinctively. What both of these explanations would imply, is that children *are* involved in conversations where these terms are used distinctively but it was not revealed in the design of Fluck's study.

The teachers in my study were unrestricted in selection of activities. It was clear that, as well as placing counting in many different physical and material contexts, they set up a wide range of verbal places for counting. The variety of 'purposes' evident in teachers' QETs was notable, teachers were not just designing turns that would prompt children to count, they were designing them as part of a broader environment for counting. Analysis of the way turns were combined revealed that teachers persisted in creating purposes even when children did not link them automatically to the process of counting.

Vocabulary variation in the **counting** turn was minimal in terms of the order of numbers used. Overwhelmingly, counts adhered to the stable order principle. This adherence may be indicative of the ages of the children involved. Only 9% of counts were of quantities above six. Threlfall and Bruce (in press) found 79 of 93 children in a similar age group were able to say the sequence accurately to at least six. Irrespective of issues of competence, the turn-taking patterns for the joint sequences restrict the possibility of errors in sequence order.

Where sequence order errors did occur they were dealt with in contrasting ways. Chapter 5 (Extract 5.1, p74) gave an example of the treatment of a child started a count with "two". T2 was explicit about these instances and it is interesting that she also allowed exposure of cardinal errors. T3 was the only other teacher who was faced with sequence order errors. In contrast to T2, T3 (e.g. extract 7.6) did not draw attention to the errors.

Extract 7.6. T3F6-B03

	1	T	it's a ladybird . a ladybird with spots on her
	2		body and you're going to make one like this as
	3		well (.) how many y'putting on Liam
	4	L	one
	5	T	o::ne- just watch Liam (..) how many's that
	6	L	(>1.0) ((Liam has now put three on and is reaching for more))
	7	T	let's just count these ones now (.) count them
	8		Liam before you put any m- no don't put any
	9		more glue on just yet Liam (.) you have to
	10		count the spots first
→	11	L	one eight nine
→	12	T	one two three good boy three circles . you
	13		don't need any more glue you can just put
	14		more spots on

By the time the teacher elicits line 11 from Liam, her acceptance of what will pass as counting no longer requires adherence to the stable order principle. She is satisfied with an attempt at enumeration. Her "good boy" at line 12 may be read as praise that Liam has stopped gluing to notice his 'spots-so-far'.

Grammatical features

Grammatical design featured in the chapter on **closing** turns. Its importance had been raised in Fluck's (1995) study, with his concept of 'pointers to cardinality'. In Chapter 6 I argued that teachers' use of the last number with a plural noun, as well as being a pointer to cardinality, marks an *achievement* of cardinality. In the context of the noticing series, this use is clearly a *noticing* of cardinality. Whilst this is works as an explicit extension of the child's count, at the same time, its placement prevents children from extending their own count, maintaining children's contributions as enumeration only.

Counter last word repetition would also be considered an aspect of grammatical design. The significant finding about this from my study is that it is a relatively rare occurrence.

Another grammatical feature is the placement of teachers' own counts. Consider extract 7.7.

Extract 7.7. T3F6-B19-20

	1	T	how many have you given him?
	2	C	((has stuck 4 legs on one side of a ladybird))
	3	T	he only needs three at that- look .
	4		look at this one ((holds up finished model))
→	5		it's got one two three legs here (.) so <u>you've</u>
→	6		got one two three four

The sequences at lines 5 and 6 are used in the grammatical position of a single number. The teacher is equating the whole sequence with the last number. This would benefit from further investigation but 12 of 49 (24%) teacher sequences were in this grammatical position. There were no examples of children placing their counts in this position. In addition, the grammatical design is supported by prosodic design: when sequences are used in this position they receive 'whole contour intonation' (see next section).

In addition to grammatical features that *are* present, it is important to note grammatical options that are *not* used in this data. Chapter 4 (and this discussion) makes a strong claim that teachers wove purpose and process into the counting environment. They did this with separate turns and with single statements. I have argued that this is effective. The question at this point is why teachers did it in this slightly implicit way and did not tend to link process and purpose *grammatically*. Conjunctions such as if/then/when/so were rarely used to link the two aspects of counting. Extract 7.8 below contains a rare explanation of what the link entails (lines 7 and 11-13).

Whilst teachers did, occasionally, use these explicit linking statements, there were no examples of teachers talking about counting itself so specifically. Teachers did not say "if you count them then the last number you say will tell us how many".

It is possible that explanations have been 'wind tunnelled' *out* as being beyond the language understanding of children this age. In their place are the separate QET combinations. Alternatively, the QET combinations may have been 'wind tunnelled' *in*, deliberately posing a gap for children in order that they construct the connection between process and purpose for themselves.

Extract 7.8. T3F4-B06-07

	1	T	Adam can you roll the dice please
	2	A	((rolls dice))
	3	T	what number is on top can you count the dots
	4		(1.0)
	5		how many dots are there?
	6	A	´one´two´three
→	7	T	there are three dots so you're going to move
	8		the spider how many spaces (.)
	9		if there are three dots Adam? this is´o:ne
	10	A	´two´three´four´fi-
	11	T	no no Adam there are just three (.)¯one¯two
→	12		`three so you're going to move the spider
	13		one two three spaces can you do that?
	14	A	((puts spider onto board))
	15	T	count´o:ne [´two `three]
	16	A	[two three]
	17	T	leave it there now that's where your spider's
	18		going to sit and have a little rest until you
	19		throw the dice again

Intonation features

The analysis of intonation features has been a central theme to the data presentation. Its importance was predicted in the light of limitations to vocabulary and grammatical design and it lived up to this prediction. The most exciting finding was the apparent **iconic** use of intonation in count sequences. Previous studies refer to 'emphasis' of the last number but the nature of emphasis and of other numbers in the sequence is not explicitly documented.

Characterisation of prosodic design appeared to reflect one-to-one and cardinal counting principles. The numbers of the sequence received individual (one-to-one) pitch movements replicated from number to number. This apparent display of similar conceptual status is then set dramatically against a contrasting pitch movement for the last number.

Excitement was followed by disappointment as CA principles rejected such an assignment without demonstration of it interactionally. Considering it in conjunction with turn allocation patterns, it appeared that teachers actively encouraged children to use the slow rising 'enumerating pitch movement' (EPM) on each number, thus promoting a display of the one-to-one principle. By not interrupting when children use individual, enumerating pitch movements, the teachers reduce resistance, make interaction smoother and (ultimately) hone children's counts into independent constructions of cognitive use.

The separation of numbers in the sequence through these individual pitch movements is reminiscent of Fuson's (1991) description of the count sequence as a list. The different marking of the last number indicates a different status from the other numbers but may merely indicate that this number is 'end of the list' or 'end of turn' rather than anything more significant. In this interpretation, the rising intonation signals "there's more to come", the final fall signals "I've finished" (Corrin, Tarplee and Wells 2001).

This 'normal list' interpretation compares with arguments about 'last word responding', it is not clear if this reflects what children know or merely what they believe is expected.

In terms of CA and the principle of sequential analysis, what is important here is not the relationship between prosodic design and internal understanding or intention but what the design responds to and leads to. From this perspective, it is significant that the relationship between non-final and final number intonation is often more dramatic than other 'end-of-turn' intonation. As is the way in which the final emphasis is received.

When teachers repeat the child's last number, they can do so with the same emphasis that the child has put onto it. Whilst this cannot be taken as evidence that the child intended to mark the last number as 'the answer' it is evidence that teachers receive it as the answer. It is the only item in the child's 'list' that is given further attention. In this way, the teachers' use and emphasis of the last number again marks it out as different from the rest of the sequence.

Matched repetitions occurred not only at the end of count sequences but also mid-sequence. Their presence and distribution supports work by Hellermann (2003) and Tarplee (1996) referred to in Chapter 6. Where teachers repeat children's numbers and match prosody it is treated as a positive receipt. Contrastive repetitions led to different progression.

Prosodic design is also linked to the discussions in section 2 of this chapter. Enumerative pitch movements made teachers' counts permeable: children join teachers' enumerative

counts with no sanctions but they do not join in teachers' 'whole contour sequences'. These counts are said quickly with no opportunity to join in without being obviously interruptive. Impermeablity is achieved by prosodic and grammatical design and reveals both the teachers' ability to adjust permeability in sequences and children's ability to recognise this.

Summary of turn design features

The examination of turn design illustrates the wide range of vocabulary, grammar and intonation features used in the three core turns of counting bouts. It illustrates different consequences of design over the course of the bout, for the length of the bout and, importantly, for what the bout achieves. Even within the restricted alternatives for count sequence design there are different ways to emphasise the progression and status of the numbers. Both children and teachers make use of the different emphases and, whilst my study has not linked precise meanings with precise designs, there is evidence that recognition of gradations of design forms part of learning to count in these settings.

In Chapter 2, the discussion of turn design included reference to Heritage's (1997) 'wind tunnel metaphor' and I have invoked this a number of times, in Chapter 4 and in this chapter. The essential aspect of the metaphor is that turn design almost becomes standardised through repeated experience. It provides an interesting concept for future research in an expectation that some turn designs would be more characteristic of teachers with limited experience of either counting activities or children in this age group. The metaphor implies that teachers', as well as children's, participation in these conversations is expected to change over time.

4. Interactional Asymmetry -

What asymmetries of knowledge and participation are there?

The issue of interactional asymmetry was raised in Chapter 2 (p33-35) and linked to current concerns of power and equity in early years pedagogy. Both CA and early years writers (such as MacNaughton 2004) take a view of power and equity as not operating externally *on* interaction, but being recreated and produced *in* interaction.

It was important to start from a position of expecting symmetry whilst at the same time recognising that few interactions are strictly symmetrical (Schegloff 1992). It would be naïve to expect anything but asymmetry of knowledge between children and teachers but what is important is whether this was apparent from the interaction. Similarly, asymmetry of participation needs teasing apart to examine not just whether participation is unequal but how opportunities for participation are offered and taken up.

Participation is a key issue in institutional interaction. In a teacher-led focus activity, the teacher is involved in all counts; she leads the questioning, the nominating of who should answer and how children's contributions are dealt with. In some activities the dialogue is constructed almost as monologue with the teacher opening up opportunities for children to participate at specific places.

T2's first comment on her first transcript was, *"there's not much from the children is there"*. T2 was the only teacher to incorporate other aspects of story-telling in her number focus activities and she included more opportunities than the other teachers for children to make contributions about things aside from counting. Clearly, children's contributions were a priority for her. Her dismay was not just with herself for not having facilitated more contributions in the particular transcript, but also with counting for not enabling it, *"with counting, it's either a right or wrong isn't it? It doesn't give them much chance to give their own thoughts. There either is three pigs or there's not"*.

Asymmetry in participation was most strongly reflected in position assignment. Teachers took on the questioning and follow-up positions. The answering position was more flexible, but generally dominated by children. This 'answering' role is often derided, particularly when the answer is seen as already known to the questioner. However, the teacher's 'monologue' cannot move on without children's contributions; children need to roll the dice and count so that the teacher knows how far to tell them to move. This is comparable with doctor-patient dialogue; the doctor needs the patient's version of events in order to proceed with diagnosis and prescription. The teachers in my study were committed to eliciting this participation from children, using repeated QETs and 'one-prompting'.

Teachers dominate participation, but at the same time routinely and methodically create slots for children to participate. In terms of counting, these slots are restricted to enumeration. Once the count has been performed, the child's contribution is treated as complete and teachers consistently take on any extension of the count. Again, this has a parallel with the doctor/patient scenario: it is not for the child to suggest a use for the count, just as it is not for the patient to suggest their own diagnosis or treatment.

Here, asymmetry of participation reflects the asymmetry of knowledge. Children have a small and defined opportunity to contribute. However, starting from the position that the interaction is a variation on 'normal' conversation, the features described above (turn-sharing, co-opting, co-production, designedly incomplete utterances) are features that have been found in conversations where there is *shared* knowledge (Lerner 2002, Szczepek

2000b). Lerner suggests they are used in reminiscing about shared experience. Szczepek describes 'duetting' where two people relay an event or activity for the benefit of others.

The practices are therefore associated with situations where there is an assumed (rough) symmetry of knowledge. For teaching and learning this is closer to Jordan's (2004) claim about co-construction than it is to scaffolding. Chapter 1 found counting to be problematic for the metaphor of co-construction. It is problematic if what is being co-constructed is quantity. The quantities in my data are 'directly knowable' in a way that other areas of the curriculum may not be.

It is rare that a teacher's question about 'how many' can be viewed as a genuine question and teachers do not accept 'wrong' or disputed answers. Using features of conversation such as joint productions, teachers are able to portray a treatment of the knowledge as *shared*, showing respect for the child's saying of the count sequence, for their contribution of enumeration. A jointly produced count sequence may work as a shared reminiscence of other occasions and contexts in which the count sequence has been invoked.

The starting point for the discussion of this research question has so far been one of assuming symmetry in the interaction. Most discussion of teaching and learning starts from assuming asymmetry between participants. For counting, this is evident in the specification of scaffolding by Sacks et al (1987) and then by Linnell and Fluck (2001). Rather than children contributing to a teacher's story, the model is framed as teachers contributing to children's learning. The strategies and levels of support are reproduced as table 7.1 below.

Table 7.1. Levels of parental support for count sequence information (reproduced from Linnell and Fluck, 2001, p220)

Level	Type of support from parent
0	provides no sequence support
1	says count but does not provide any other strategy
2	requests next number without referring to other numbers, e.g. 'what comes next'
3	requests next number by referring to previous number, e.g. 'what comes after 5?'
4	provides a sequence of numbers up to present one, e.g. 'one, two, three …?'
5	provides hints about next number, e.g. 'se…sev …'
6	supplies the number
7	demonstrates the entire count sequence

The strategies were drawn from activities involving children with parents rather than teachers. In my data, teachers did use some of the strategies, but only *rarely*. Teachers seemed to avoid supplying children with the next number and their most frequent means of intervening in children's counts was repetition of the number that the child had just said. This is not identified in table 7.1 but is comparable to level 3.

In terms of scaffolding within the count sequence, it is overwhelmingly children who 'supply the next number' (level 6) and teachers who copy them. In addition, rather than teachers joining in children's counts when children hesitate, it seems that teachers use features of hesitation or uncertainty ('one-prompting' and excessive pausing) to encourage children to join in their counts. Such features again look, conversationally, as though children are supporting teachers rather than the other way around.

The construction of the sequence is more compatible with the metaphor of co-construction than of scaffolding and fits with a grammatical view of co-construction (Helasvuo 2004). However, although the count sequence is open to contributions from both children and teachers, it is children who are predominantly placed in the position of being first to say the last number. This is consistent with claims referred to in Chapter 2 (p34); being first to give an opinion is the weaker power position. The stronger power, and knowledge, position is the least exposed 'opinion receiver' because this is the place for evaluation of the opinion.

My data is consistent with this. Teachers' immediate receipt of the last number often functions as an evaluation, as in the IRF structure. Nassaji and Wells (2000) found that frequent evaluations were associated with reduced contributions from students. There is a further consequence for counting, because not only can the teacher's immediate receipt be seen to constrain children's participation, it also constrains their contribution of knowledge because it prevents them from extending their own count beyond its enumerative function.

The final point to be made in this section is that the data did include a number of attempts by teachers to position children into the role of evaluator. Extract 7.9 is one such attempt but also gives proof that teacher as evaluator is the 'norm'. A great deal of interactional 'resistance' is apparent before the rhyme can resume at line 27. The children seem unable to accept that the teacher is wrong, their evaluations (that the teacher is right, lines 6 and 22) are not accepted. It is still the teacher's evaluation (line 26) that takes precedence.

Extract 7.9. T2F1-B30

	1	T	that's right Callum four ((establishing that there are four snowmen))
	2		are we going to do the rhyme?
	3	Children	yeah
→	4	T	three little snowmen fat (…) was I right
	5		saying three
→	6	C?	yeah
	7	T	was I? was I right Shannon, saying three? (.)
	8		if you look- you haven't looked to see (.)
	9		Kieran, am I right, are there three?
	10	Kieran	you've only got three
	11	Liam	you've got that one that one and that one
	12	T	are you sure
	13	Kieran	that's three
	14	Liam	you've got one
	15	Kieran	one
	16	Liam	and two
	17	Kieran	that's two
	18	T	Callum how many are there? I said three .
	19		w:o:ne
	20	Children	⌈two three ⌉
	21	T	⌊two three: ⌋
	22	Children	four
→	23	T	four . so was I right when I said three?
→	24	Children	yes
	25	T	I don't think so . one two three ((pointing to 3 of 4))
	26	C	there's that on there ((pointing to the one not counted))
	27	T	that one shouldn't have been there if I said
→	28		three . I was wrong . because there's
	29		one two three four . I got it wrong . four ((points to all))
	30		little snowmen fat

The strength of the organisational tide goes against children evaluating and is an example of what Seedhouse (1997) discusses as conflict between pedagogy and interaction. The pedagogic aim of enabling children to evaluate cannot translate directly into interaction because there is an additional layer of organisation being orientated to by those involved. The layer of organisation is 'the way we normally do things', i.e. teachers' knowledge takes precedence. This is not to say that such organisation cannot be overcome, but it requires more subtle manipulation of conversational organisation.

To add to the complexity of the task, pedagogy requires finely balanced challenges or interactional resistance. Too much 'resistance' and interaction breaks down. T2 eventually brought the children back to where they had left off but the children's first strategies were all about making 'interactional sense' out of her behaviour. Too little resistance (perhaps in the example of T3 accepting the child's erroneous sequence) maintains the interaction yet may have less pedagogical value.

Returning to the assumption of symmetry and of children as competent (Hutchby and Moran-Ellis 1997), it cannot be just teachers who *control* this manoeuvring. Children's enthusiasm for counts, resistance to them, agreement to choral production, are equally important in the maintenance or disruption of interaction.

Discussion Summary

The research questions were designed to identify features of counting conversations that might counteract the image of counting that seemed to dominate the literature. The image, of children counting on their own, getting different aspects right or wrong, is unhelpful for teachers seeking to actively support children's counting. The study reveals that, in the settings studied, counting occurs in a way that conforms to the three counting principles. In the majority of conversations, teachers did not 'test' children's knowledge of the principles.

Features of conversation such as choral production and turn-taking within the count turn were helpful to the maintenance and highlighting of one-to-one and stable order principles. The design of the turns leading to and following on from counting had most to offer in drawing attention to the cardinality principle. However, Chapter 1 drew attention to alternative perspectives on counting, not just in terms of the counting principles. The idea of counting as a noticing series offers a way to incorporate the three apparently different perspectives attributed to children, teachers and parents in the literature.

The series finds enumerative counting, particularly when done jointly and/or with enumerating intonation, a powerful way to make plurality salient in interaction. It reinforces the difficulties in making salient the quantitative meaning of counting and suggests that, in CA terms, the only reliable way to make quantity salient is through the concept of extension.

The only previous conversational strategy identified to do this is the use of "how many?" following a count. This was not popular in my study perhaps because it has problematic implications in conversational terms; a repeated question implies that the first answer was incorrect. Additionally, using 'how many?' at this point makes explicit that the questioner treats the count as *not* quantitative. In contrast, extension treats the count as quantitative, reinforces the link between counting and quantification, and accepts the child's answer as something that is actively useful in moving the activity and the conversation forwards.

Research such as Fluck and Henderson (1996) suggests that understanding of cardinality has an 'all or nothing' element. The children in their study were either 'counters' or 'grabbers'. Bruce and Threlfall (2004) may have identified more gradation *for children* in this aspect but there is still an implication that teachers are helpless to 'wait' for cardinality to appear, a position renounced by Meade (2000). The concept of conversational extension contributes three potential interim strategies for teachers,

- extending children's counts to make them actively quantitative
- extending their own counts to make them explicitly quantitative
- delaying evaluation to providing children with opportunities to extend their own counts

My analysis identified examples of the first of these but stopped short of examining the consequences. The second and third strategies were rare occurrences in the data. Further research is warranted to consider how and if this extension contributes to changes in the way children participate in counts. It is important to recall here that my study was not explicit about quantification. Teachers were asked to plan activities involving counting. It may be that more extension of quantity would occur if teachers were asked to provide activities specifying quantitative counting.

Considering counting within the wider arena of teaching and learning in the early years, I suggested in the literature review that counting was problematic for current perspectives (e.g. Dahlberg, Moss and Pence 1999). The nature of counting is such that there *is* a right answer, a right answer that is often known to the teacher before a count is embarked upon. The opportunities for practitioners to genuinely co-construct the 'answer' with children are rare.

However, the examination of counting as conversation has shown that counting is not just about the 'answer' and there are many aspects of counting that are open to a co-constructive approach. The teachers in my study found ways to enlist children in creating possible contexts for counting and involved children in the extension of counts. Most evident was co-construction of the count sequence, with teachers approaching some sequences one number at a time, accepting and inviting children's contributions, but also putting forward their own.

The conversations draw attention effectively to the relevant elements of context. The steady construction and sharing of the count turn enhances the saliency of plurality as participants show each other their shared knowledge of the co-ordination of numbers and objects. The study has not explored the full extent of the variation in sharing counts and this is an area where it would be particularly useful to use video to add in how co-ordination of non-verbal behaviour such as eye contact and the placement of objects and fingers contributed to the timing of counts.

Previous research on shared turns (Lerner 2002, Szczepek 2000b) has linked them to situations where the two speakers have an audience of some kind. My analysis of conversations has mostly treated them as one-to-one conversations without reference to the rest of the group. It is likely that, at least some of the time, the teachers' turns (and some of the children's) were designed with the 'audience' in mind. Again, video recording would be able to identify here where counts were directed.

Exclusion of much of the non-verbal behaviour in the study is a central limitation to the study. Video-recording may have been more intrusive and taken away from the focus on using only what was verbally referenced. However, now that aspects of interactive verbal counting have been identified, it would be useful to link these to the very important non-verbal aspects of counting.

The study provides more detail about what constitutes learning to count but only within the situations studied. It is a picture of counting for five nurseries in the study, during a particular period of time. Whilst this suggests a need to extend the research beyond my data, there is still much that is unexplored within the data. My analysis is limited by not attending in more detail to the differences that emerged between the five teachers. There is also scope for further examination of differences between tasks.

The study benefited from including a large number of children but this is again a limitation in obscuring individuality. The research would be strengthened by closer examination of

specified dyads, i.e. the same teacher and the same child. This would assist in determining how far strategies reflect personal styles as opposed to universals. Using specified dyads would also address the issue of change and learning. Observing over time, changes in the styles and degree of participation could be identified, giving a sense of progress, and of some ways of interacting being more advanced than others. This cannot be determined within the design of the current study.

Study Conclusions

The study set out to capture a picture of counting in interactive contexts. To bridge a gap between literature that focussed on children counting in isolation and children like Harry and George, using number words in conversation with collaborative adults. It took a risk in choosing an approach to data analysis that contrasted explicitly with previous research in its approach to context, rules and interaction.

The study was successful in its identification of conversational features recruited. The description of these features provides a picture of an interactive activity. It is a picture of many different possibilities, proof that counting is not 'just right or wrong'. Practitioners may now be best placed to determine the significance of the different possibilities. Their knowledge and experience of individual children over time is likely to inform them about how changes in the intonation of a child's count or changes in a child's participation in joint sequences link to that child's wider understanding and use of number.

Alongside this, the study gives a much richer picture of teachers' role in counting. The role is not depicted purely in terms of how teachers can support children's counts. It is depicted in terms of how teachers can construct the many and varied contexts for counting and how they can actively extend counting into something productive for a game, a story or a home corner project. Depicting the many possibilities for this role in actual, rather than suggested, conversational designs gives practitioners something tangible to experiment with. They may reflect on their own emphasis of number words in count sequences or on their preferred ways for opening and responding to children's counts. They may then wish to reflect on whether their preferences vary according to aspects of context not revealed in my study: whether they use different designs according to pre-determined beliefs about particular children, or whether variation is linked to the quantity potential of different materials and activities.

The use of Conversation Analysis has illuminated a depth to counting in nursery activities that has not been fully recognised in the literature and that the teachers involved in the study

were not fully aware of. Teaching is a highly interactive profession, and 'quality talk'. for both teachers and learners, is an essential aspect of successful pedagogy. Talk, from both teachers and children, goes by so quickly that it is difficult for professionals to be aware of the relationships between what talk achieves and how talk is (co-)constructed.

Professionals need and desire to develop their own ability to participate in quality conversations, just as strongly as they desire it for the children they work with. Speculation about the different effects of open or closed questions, or about the right response to a correct or incorrect answer is not a sufficient or personal enough way to meet this need. The many, and messy, shades of grey in the talk of teachers and learners are only identifiable (and identifiable with) through engagement with the unpredictable features of real conversations. Using Conversation Analysis, this study has uncovered layers of possibilities in a curriculum area often dismissed through its association with 'rote learning' and 'right or wrong'. The potential of CA in application to other curriculum areas has yet to be explored.

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Appendix I

Transcription conventions

The table below is based on transcription conventions described by Hutchby and Wooffitt (1998, pvi-vii, p77-92). In common with many CA writers I have also added some symbols that work specifically for my data. These are influenced by conventions used in Ochs, Schegloff and Thompson (1996). Not all conventions are used in all extracts. Although this means some inconsistency, it addresses the problem described by Westgate and Hughes (1997, p130) of 'over-cluttering the record'. By this, they mean that too many symbols can reduce the readability of extracts. Specific pause lengths and pitch markings are not essential to every extract and so have only been included when specifically discussed in the accompanying text.

Symbol	**Represents**
1	Lines are numbered so that they can be referred to in the text. Talk is organised in lines purely by the length of the line not by characteristics of the talk (such as phrase or sentence boundaries). Speaker change is indicated by initials.
→	Arrows in the left margin point to specific parts of an extract that are discussed in the text.
T / C	Initials are used to identify speakers. They are used each time speaker changes. 'T' is always used for the teachers. 'C' is used for children. Where more than one child is involved or the teacher uses a name, these are distinguished by fabricated names or initials.
[[	Left-hand brackets around adjacent lines of concurrent talk to indicate the onset of overlapping talk
]]	Right-hand brackets around adjacent lines of concurrent talk to indicate the end of overlapping talk
(0.5)	The number in brackets indicates a pause measured in tenths of a second.
(.)	A single dot in brackets indicates a pause of less than three-tenths of a second.
-	A dash indicates the sharp cut-off of the prior word or sound.
=	An equals sign is used at the end of one turn and the beginning of the next where there is no perceivable silence between the two turns.
:::	Colons indicate that the speaker has lengthened the previous sound. Impressionistically, the more colons, the longer the sound.
> <	More than/less than signs indicate that the talk in between the signs is noticeably quicker than the surrounding talk
° °	Degree signs indicate that the talk in between is noticeably quieter than the surrounding talk.
CAPITALS	Words written in capitals were said noticeably louder than the surrounding talk.

<u>Underline</u>	Words or syllables that receive emphasis are underlined. The nature of the emphasis may be indicated by a pitch movement symbol, see below.
↑↓	Up/down arrows indicate a marked change in pitch. They are placed immediately before the pitch change.
`	A falling mark prior to a word indicates emphasis with a falling pitch movement.
´	A raising mark prior to a word indicates emphasis with a rising pitch movement.
¯	A level mark prior to a word indicates that it is produced with level pitch.
^	A triangle mark prior to a word indicates that it is produced with pitch that rises and then falls
?	Question marks at the end of a line indicate that the talk was fairly unambiguously recognisable as a 'question' type utterance.
/?/	Slashes with a question mark indicate that the talk between them is unclear.
(( ))	Double curved brackets enclose descriptions of non-verbal activity that occurred during the talk that is written on the numbered line above them. They only receive their own line number if the non-verbal activity occurred in the absence of talk.
*	An asterisk is used to separate two potential turns – there is no pause between the two words but they belong to two different intonation contours

Appendix II

Praat Software Description

The Praat software referred to in the text is a computer programme created by Paul Boersma and David Weenink of the Institute of Phonetic Sciences, University of Amsterdam. It is available to download from the internet (www.praat.org). Described as 'doing phonetics by computer', it converts audio-recordings into visual representations. It makes features such as length, loudness and pitch visible based on acoustic analysis of the sound waves. Figures II.1, II.2 and II.3 are examples of its pictorial output. Figures II.1 and II.2 are both of the same count, "one two three four five" said by a child in T2F1. Figure II.3 is by T3 in T3F1.

In all figures, the five words are identifiable. Figure II.1 is composed of vertical lines that represent the sound waves caused by the repeated opening of the vocal cords. The depth of the lines represents loudness; in this count, the loudest numbers are "one", "four" and "five".

Figures II.2 and II.3 are more complex. The shading results from the resonance of the sound waves around the vocal tract: the lower dark patches correspond to the vowels in the numbers, the higher dark patch on the second word is the 'burst' from the 't' sound at the beginning of "two". For this thesis I have made most use of the *pitch trace analyses* and these are the lines drawn on figures II.2 and II.3: as the lines rise, so does the pitch. The enumerating and final pitch movements described in Chapter 5 are recognisable in II.2. The level pitch movements and whole contour sequence is illustrated in II.3. It is important to note the 'time' axis for these two counts: the enumerating sequence (II.2) takes nearly 5 seconds, the whole contour (II.3) less than 2.

Human beings do not 'hear' speech in exactly the same way as the software and background noise can sometimes distort how the software interprets the sound. It is therefore important to use impressionistic judgements alongside computer analysis (Cruttenden 1997, Schegloff 1998). Sections of the pictures can be selected, played separately and extracted if necessary. This 'cut and pasting' enabled me to produce the figures in Chapter 6, to compare the same number said by different speakers. Measurements can be taken of selections and by selecting periods of silence, I was able to measure the pauses between QETs in Chapter 4.

Figure II.1. Waveform of count sequence 1-5

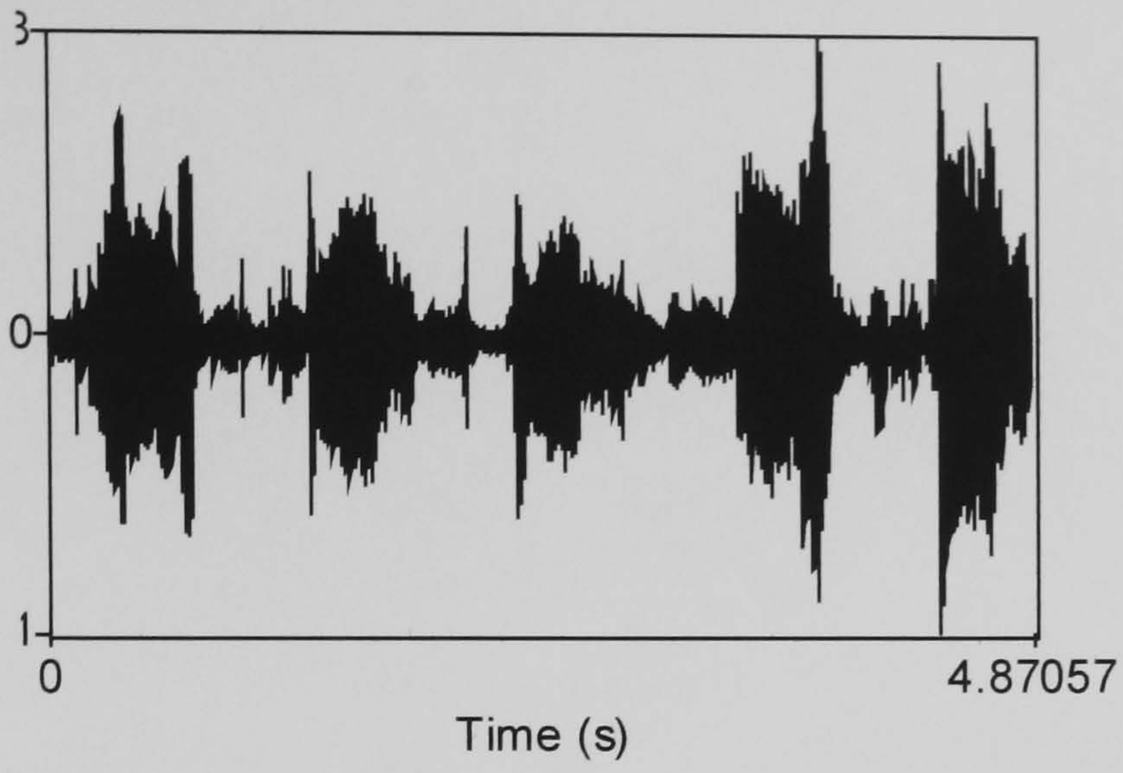

Figure II.2. Pitch trace and spectrogram of an enumerating count sequence 1-5

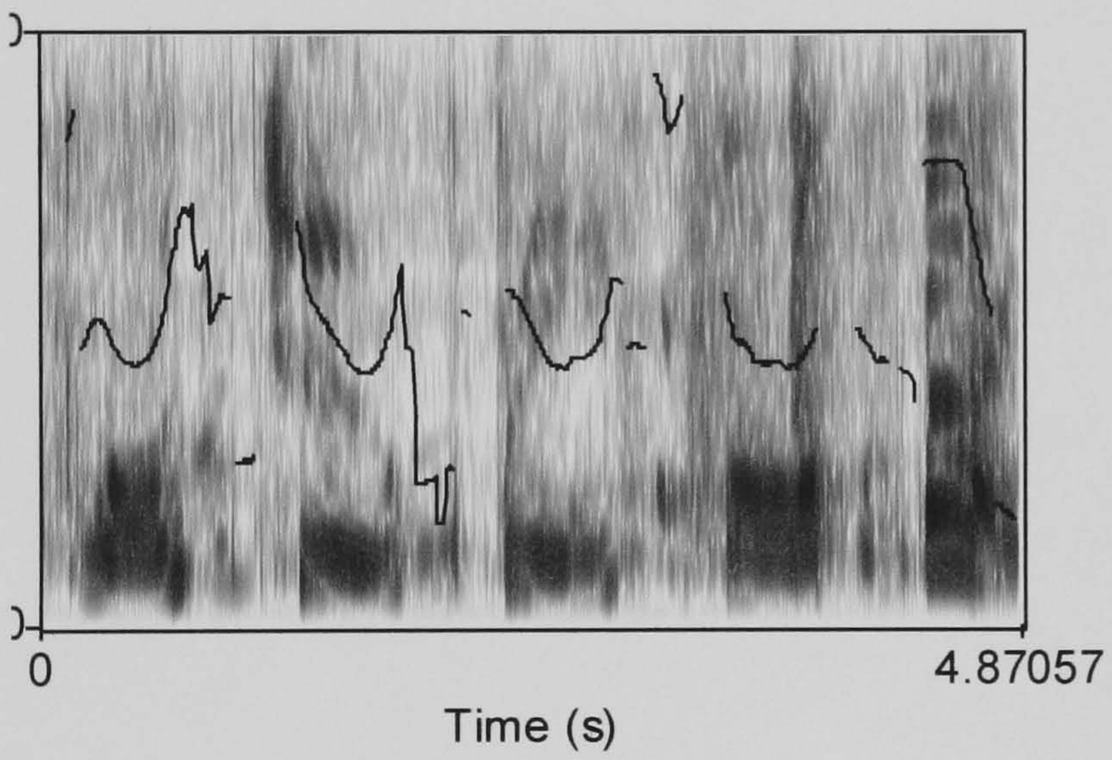

Figure II.3. Pitch trace and spectrogram of a whole contour count sequence 1-5