

**Exploring the Role of Maternal Ostensive Communication in Infant Learning**

Shruti Jamnadass

D.Clin.Psy. Thesis (Volume 1), 2020

University College London

**UCL Doctorate in Clinical Psychology**

**Thesis declaration form**

I confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

Signature



Name: Shruti Jamnadass

Date: 24<sup>th</sup> July 2020

## Overview

This three-part thesis explores the relationship between infant learning and maternal ostensive communication. It also considers the relationship between these constructs, maternal mentalisation, IQ and stress.

**Part One: Conceptual Introduction** – This conceptual introduction considers key conceptual and methodological concepts for the empirical paper by reviewing studies related to maternal communication and infant learning. The theory of natural pedagogy is applied to the understanding of ostensive cues. A critique of existing literature is provided before setting the scene for the empirical paper.

**Part Two: Empirical Paper** – The application of an ostensive cues coding tool in order to measure maternal ostensive communication in an infant learning study is detailed. The relationship between infant learning outcomes, maternal ostensive communication, mentalisation, IQ and stress are explored. This was a joint project with Jeffy Chun Yu Ho (DClinPsy, 2020). The contributions of the authors are summarised in Appendix A.

**Part Three: Critical Appraisal** – The critical appraisal uses a reflective stance to discuss the research process, including the study design and data analysis.

## **Impact Statement**

The present study replicated existing infant learning paradigms and successfully demonstrated the application of an ostensive cues coding tool in order to capture maternal ostensive communication. The study used a qualitative approach to explore the relationship between infant learning outcomes and factors related to the mother, including use of ostensive cues, mentalisation, IQ, psychological distress and parental stress. Currently, there is no agreed measure to record ostensive cues therefore the current study paved the way for future studies to use this tool to replicate learning paradigms, allowing for comparisons across studies.

Future research is recommended to explore the intended aims, using a larger, more diverse sample. As the present study did not have the opportunity to manipulate ostensive cues, studies would be enhanced by including two conditions; one where mothers can use spontaneous ostensive cues to demonstrate a task, and one where only restricted ostensive cues are permitted in order to demonstrate a task. This would help develop knowledge on the role of ostensive cues on infant learning. While the current study used a small sample to provide preliminary evidence, future research may highlight consistent patterns that can increase knowledge in the field of maternal communication, mentalisation and infant learning.

When replicated with a larger sample, this research has the potential to increase knowledge and awareness of factors involved in infant learning. Furthermore, the relationship on infant learning outcomes, ostensive cues, mentalisation, IQ and parental stress could inform manualised parent-infant programmes in a clinical setting. Future research may also benefit from exploring ostensive communication among non-clinical and clinical populations to broaden this field of research.

## Table of Contents

Appendices.....	8
List of Tables and Figures .....	9
Acknowledgements .....	10
Part One: Conceptual Introduction: Exploring the Theory of Natural Pedagogy in Order to Understand Ostensive Communication and Infant Social Learning .....	11
Abstract .....	12
Introduction .....	13
An Introduction to Social Learning .....	13
Observational Learning .....	15
Criticisms of Social Learning Theory .....	16
The Theory of Natural Pedagogy .....	16
Epistemic Trust .....	17
Applying the Theory of Natural Pedagogy to Ostensive Cues .....	18
Ostensive Communication and Mentalisation .....	19
A Proposed Definition of Ostensive Cues .....	22
Criticisms of Applying Natural Pedagogy to Understanding Infant Learning .....	24
Summary of Theoretical Concepts .....	26
What Can we Learn from Research on Infant Learning? .....	26
Imitation and Emulation .....	26
Research on Ostensive Cues .....	29
Critique of Existing Literature .....	39
Lack of Standardisation Across Experimental Studies .....	39
Use of an ‘Experimenter’ rather than a Primary Caregiver .....	41

Proposal for Future Research .....	41
References .....	44
Part Two: Empirical Paper: Exploring the Role of Maternal Ostensive	
Communication in Infant Learning .....	57
Abstract .....	58
Introduction .....	59
Natural Pedagogy and the Transmission of Knowledge .....	59
Imitative Learning .....	60
A Caregiver’s Response and Infant Learning .....	62
Maternal Stress .....	63
Ostensive Cues .....	63
Current Study .....	65
Aims .....	67
Method .....	68
Joint Project .....	68
Ethics .....	68
Participants .....	68
Setting .....	70
Design .....	71
Procedure .....	73
Coding Tool .....	77
Measures Administrated .....	77
Re-Developed Design due to Covid-19 .....	79
Method of Data Analysis .....	80
Results .....	81

Infant Learning Outcomes .....	82
Summary .....	99
Discussion .....	103
Infant Imitation .....	104
Infant Learning Outcomes and Ostensive Cues .....	104
Maternal Mentalisation, Intelligence and Stress .....	106
Additional Findings .....	107
Experimental Paradigm Design coupled with the Ostensive Cues Tool ....	108
Strength and Limitations .....	109
Clinical and Theoretical Implications .....	111
Conclusions .....	112
References .....	113
Part Three: Critical Appraisal .....	118
Introduction .....	119
Researcher Background .....	119
Recruitment .....	119
Study Design .....	120
Data Collection .....	121
Covid-19.....	123
Data Analysis .....	125
Working as a Scientist-Practitioner .....	126
Conclusion .....	127
References .....	128

## Appendices

<b>Appendix A:</b> <i>Contributions to the Joint Research Project</i> .....	129
<b>Appendix B:</b> <i>Ethical Approval</i> .....	130
<b>Appendix C:</b> <i>Participant Information Sheet</i> .....	131
<b>Appendix D:</b> <i>Participant Consent Form</i> .....	134
<b>Appendix E:</b> <i>Participant Debrief Form</i> .....	135
<b>Appendix F:</b> <i>Recruitment Poster</i> .....	136
<b>Appendix G:</b> <i>Appointment Letter to Participants</i> .....	137
<b>Appendix H:</b> <i>Instruction Sheet for Participants</i> .....	138
<b>Appendix I:</b> <i>Demographics Questionnaire</i> .....	140



## List of Tables and Figures

<b>Figure 1:</b> <i>Diagram of the two groups</i> .....	72
<b>Table 1:</b> <i>Procedure of the Study</i> .....	75
<b>Table 2:</b> <i>Demographic Characteristics</i> .....	83
<b>Table 3:</b> <i>Participant Scores in Task A</i> .....	85
<b>Table 4:</b> <i>Participant Scores in Task B</i> .....	86
<b>Table 5:</b> <i>Participant Responses to BSI, PRFQ and PSI</i> .....	87

## **Acknowledgements**

Firstly, I would like to thank my two supervisors, Professor Peter Fonagy and Dr Tobias Nolte for their knowledge and guidance. Thank you also to the North London libraries and the team at the Anna Freud Centre who supported our recruitment and data collection. To Jeffy, I'm thankful to have experienced this long thesis journey with you.

Thank you to my mum, Anita, as none of this would be possible without your praise and kindness. To all of my family and friends; the zoom chats, impromptu cards and motivational messages helped me through and kept me going.

Finally, thank you to my fiancé, Rishi. Your patience, humour, encouragement and gourmet meals have played a huge part in my thesis journey and for that, I am eternally grateful.

**Part One: Conceptual Introduction**

**Exploring the Theory of Natural Pedagogy in Order to Understand  
Ostensive Communication and Infant Social Learning**

## **Abstract**

It is undeniable that understanding the wide range of factors that influence infant learning is highly complex. Using the theory of natural pedagogy to understand how humans pass knowledge through generations, allows for the consideration of concepts such as the role of ostensive communication and mentalisation when understanding infant learning.

This Conceptual Introduction is intended to review theoretical concepts applied to understand ostensive communication and increase knowledge of studies demonstrating how ostensive cues facilitates learning in infants. From reviewing experimental studies, it is apparent that there is a lack of an agreed definition of which social cues would be classed as ostensive cues. Furthermore, studies lack a comprehensive tool to reliably capture ostensive cues, resulting in a challenge when attempting to compare the results of learning tasks across studies. This work is intended to inform the further development of experimental studies in this field, and to pave the way for a paradigm using a newly developed tool to measure ostensive cues.

## **Introduction**

This conceptual introduction firstly provides an overview of social cognitive theory in order to understand infant learning. Criticisms of this theory are provided before introducing the application of the theory of natural pedagogy to ostensive cues. Concepts such as epistemic trust and mentalisation are also discussed. A detailed definition of ostensive cues is provided, and the theoretical section of the conceptual introduction is concluded with criticisms of the theory of natural pedagogy and a summary of theoretical concepts. Empirical support for the relationship between ostensive cues and infant learning is critically examined. A clear need for future research which replicates existing infant learning paradigms whilst using a validated, reliable tool to measure ostensive cues is highlighted; this paves the way for the empirical paper.

### **An Introduction to Social Learning**

Human communication has allowed us to impressively transmit knowledge through generations, meaning that through social learning, we can learn and retain useful information within our social group (Tomasello, 1999). More specifically, ostensive cues such as eye contact, smiling and addressing the listener by their name, may signal a caregiver's intent to communicate relevant information to their infant (Russell, 1940).

The process of infant learning is complex and has attracted a range of theoretical explanations to explain how and why people learn. By developing our knowledge in this field, and in particular ostensive cues, this has the potential to inform clinical psychology. For example, a better understanding of infant learning could inform psychological support offered to parents to improve parent-infant relationships. Furthermore, by exploring the relationship between ostensive cues,

parental distress and infant learning, it is possible that this knowledge could be applied to a range of clinical groups such as individuals experiencing a history or trauma or borderline personality disorder.

Behavioural theories proposed learning occurred through conditioning and cognitive theories focused on influences such as attention and memory. However, Bandura's (1977) social learning theory suggested that observation and modelling play a key role in learning. This idea was developed further by Bandura in 1986 when he introduced social cognitive theory. This posits that learning occurs in a social context with a dynamic and reciprocal interaction of behaviour, cognition, personal factors and environmental influences (Bandura, 1989). In other words, it is the idea that individuals are not reinforced solely by their environment or by internal forces but instead, by a network of influences which are reciprocally interacting with each other (Bandura, 1989).

As well as Bandura's contribution to the field of social learning, many others also investigated the evolution of social cognition (Caporael, 1997; Daniel et al., 2012; Dean, Kendal, Schapiro, Thierry, & Laland, 2012; Herrmann, Call, Hernández-Lloreda, Hare, & Tomasello, 2007; Van Schaik & Burkart, 2011). Within the social cognitive perspective, it is believed that social and cognitive development occurs through the transmission of valuable knowledge which is imparted socially through guided instruction and modelling. Social cognition allows for infant learning as humans have the capacity to be aware of others' intentions and motivations, thus leading to the remarkable human skill of being able to tolerate and benefit from meaningful interactions within social groups (Fonagy, Luyten, & Allison, 2015)

Infants are also able to gain an understanding of objects through direct and vicarious experience and studies of infants learning to use objects by observing

others has broadened our understanding of human development (Nielson, 2006). Research on imitation shows that infants aged approximately 6 to 12 months can copy what others do with objects (Meltzoff, 1988; Barr, Rovee-Collier & Campanella, 2005). From 12 months onwards, infants can copy an increasing number of actions in a range of circumstances (Nielson, 2006).

Language development is also an important concept because from a young age, by learning the names of objects and about the relationship between them, humans can perceive, organise, and interpret events. Thus, language development serves as a tool of thought as well as communication skills (Bandura, 1989).

### **Observational Learning**

For observational learning to occur, four rules must be met; attention, retention, reproduction and motivation. Firstly, attentional processes relate to infants attending to the model and extracting information from what they notice. Given the limits of attentional processes that infants possess, adults can alter the behaviour they model to compensate for this in observational learning. Parents gain the attention of their infants and tend to give salience to specific behaviours by performing them in an exaggerated fashion to increase the likelihood of the infant attending to the behaviour (Papousek & Papousek, 1977).

Secondly, for observed events to have an impact, individuals need to remember what they have seen; thus retention processes are important in observational learning. Infants can model single acts and research has shown that at 18 months, infants are able to enact behaviour learned from televised models after some time has elapsed. This type of delayed learning requires symbolic memory which means that infants have the capacity to extract rules from modelled performances and organise it into easily remembered structures (Bandura, 1989).

Thirdly, infants must have the capacity to reproduce the behaviour that was observed and retained. That is, they must be able to perform the action themselves (Bandura, 1989).

Finally, social cognitive theory states that individuals are motivated to imitate behaviour, which is rewarded, therefore; direct, vicarious and self-produced reinforcement influences the likelihood that observationally learned behaviours will be reproduced (Bandura, 1989).

In summary, learning can occur by observing the behaviour of others. There are four specific steps which are required for observational learning to occur. These steps include attention, retention, reproduction and motivation.

### **Criticisms of Social Learning Theory**

Social learning theory recognises behavioural and cognitive factors involved in learning, thus, provides models for integrating with genetic influences that may be involved in the process, i.e. nature and nurture as influencers of infant learning.

Although the theory explains how infant learning can occur through observation, it doesn't go further to explain how learning occurs across cultures and culturally important knowledge is transmitted across generations. For example if an infant were to observe an adult performing a range of behaviours, it would be helpful for the infant to know which of these actions were going to be important for them in achieving their goals and whether this is knowledge that is shared across the culture. This brings us to the theory of 'Natural Pedagogy' (Csibra & Gergely, 2009) which proposes a social learning mechanism that supports the hypothesis of evolutionary adaptation among humans (Csibra & Gergely, 2011).

### **The Theory of Natural Pedagogy**



The Theory of Natural Pedagogy (Csibra & Gergely, 2009) explains that humans use cue-driven communication to ensure the most effective and efficient transfer of culturally relevant knowledge. The transmission of knowledge between members of a social group is necessary for human survival and adaptive functioning.

Humans have evolved to transmit both cognitively opaque cultural knowledge and generic knowledge through the use of communication. This cognitively opaque cultural knowledge which is both generalisable and robust to interference becomes experienced as shared as it generates an expectation that this knowledge is common to others within the same social group (Fonagy & Allison, 2014). This shared knowledge means that young children assume that their mental states are not separate or unique; and this sense of uniqueness is gradually developed over time (Fonagy & Campbell, 2016).

### **Epistemic Trust**

When a listener is noticed as an agent; someone with intentionality, an attitude of epistemic trust is established. This means that the listener is ready to receive personally relevant new knowledge about the social world from a trustworthy source (Csibra & Gergely 2009; Fonagy & Allison, 2014). Epistemic trust can be defined as the amount of trust we place in the personal relevance of information being communicated to us and can be achieved through mentalisation (Fonagy & Allison, 2014). Epistemic trust is crucial in early attachment relationships as it can facilitate communication between a caregiver and an infant and helps the child learn and develop.

Culturally transmitted beliefs are accepted by individuals either because of the content or because of the source (Sperber et al., 2010; Wilson, 2012). This is likely to be a largely unconscious process, particularly when the content is within an

infant's expectations based on existing beliefs they hold about the world. However, there may be more effort involved in testing the content of the culturally transmitted beliefs compared to accepting the information based on the source. We are in an advantageous situation when the source of the information is someone who is familiar, reliable and trustworthy as we may be more likely to accept the information rather than having to use an inductive or deductive process examining the content (Fonagy, Luyten, & Allison, 2015)

### **Applying the Theory of Natural Pedagogy to Ostensive Cues**

The idea that an individual uses certain signals to prepare another for the intent of communication was first discussed by Bertrand Russell (1940) and also used by Sperber and Wilson (1995). Russell suggested that individuals signal their intent to communicate via ostension, which triggers an attentional state in the addressee and this idea has also been supported more recently by Csibra and Gergely (2009). They propose that infants have a special sensitivity to ostensive cues which trigger a pedagogical stance where an infant anticipates being taught new, culturally relevant knowledge. Csibra (2010) proposes that a source uses ostensive signals to inform an observer of their intentionality and to also indicate the addressee of this information.

Ostensive cues can include eye contact, addressing the listener by their name, smiling, turn-taking, contingent reactivity, infant-directed language and tone and pointing or gesturing (Csibra & Gergely, 2011; Király, Csibra & Gergely, 2013). “Marked mirroring interactions” (Fonagy, Gergely, Jurist, & Target, 2002) have also been claimed to serve as ostensive cues. This involves a caregiver using exaggerated expressions (both facial and vocal) to mimic an infant's expressions of emotion to reflect an acknowledgement and awareness of how the infant is feeling.

There are three important elements of natural pedagogy; knowledge acquired is *generalised* or shared, knowledge gained via ostensive communication is *relevant* to the context and that *reference* occurs in the presence of ostensive cues. Here, reference means that infants follow an adult's gaze which makes it more likely that they will learn about the object that the adult is intending to teach them about (Csibra & Gergely, 2009).

“Epistemic vigilance” (Sperber & Wilson, 1995) is also important in terms of development of knowledge, as it is necessary for humans to trust information of personal relevance rather than all information that is communicated to them. The use of ostensive cues leads to epistemic vigilance being momentarily suspended and the addressee is thus prepared to receive information. By suspending the biological protection of epistemic vigilance, ostensive cues trigger epistemic trust to allow for information to be exchanged about the social world. Ostensive cues signal that we will receive generalisable, relevant knowledge and epistemic trust enables an infant to be ready to acquire this knowledge (Fonagy & Allison, 2014). It is thought that the epistemic channel should only be opened when an infant feels reassured and receives all of the necessary signals (Recanati, 1997; Sperber et al., 2010). Research demonstrates infants seem to anticipate that relevant, generalisable knowledge will be communicated (Futó, Teglas, Csibra, & Gergely, 2010; Egyed, & Király, & Gergely, 2007; Yoon, Johnson, & Csibra, 2008).

### **Ostensive Communication and Mentalisation**

The point mentioned earlier about the occurrence of ostensive cues triggering ostensive trust may be slightly more complex than Sperber and Wilson's (1995) proposal. Would we expect that epistemic trust is triggered in all infants who observe ostensive cues? Fonagy & Allison (2014) go beyond epistemic trust to highlight that

parental mentalisation is key to the formation of epistemic trust and therefore may be involved in the mediation of transmission of knowledge through the use of ostensive cues.

Mentalising relates to an individual's capacity of imagining what others are thinking and feeling and more specifically, allows individuals to perceive and understand their own and others' behaviours by taking into account their mental states such as their thoughts, feelings, wishes and desires (Bateman & Fonagy, 2012; Fonagy et al., 2002; Fonagy & Target, 2006; Fonagy, Luyten, & Allison, 2015). The capacity to mentalise is understood to develop during the early years of life, based on our attachment relationships and is an extremely powerful human characteristic (Fonagy & Campbell, 2016).

The capacity to hold in mind the mental states of another can be linked with the concept of an individual's use of ostensive cues when communicating an action. Research suggests that 'ostensive cues are based on both an affect- and cognition-focused non-conscious, automatic indicators to the recipient that the communicator has adopted a mentalising stance towards them' (Fonagy, Luyten, & Allison, 2015).

Developmental research focusing on the growth of understanding of mental states in the self and other helped pave the way for the theory of mentalising. Fonagy, Steele, Steele, Moran, and Higgitt (1991) introduced the mentalising model in relation to infant attachment. They found that infant attachment with each parent was strongly predicted by both parent's attachment during the pregnancy but even more by the parents' capacity to make sense of their childhood relationships with their own parents (Fonagy & Campbell, 2016). It appears that there is an overlap between attachment and mentalisation as studies have suggested that secure children are better at mentalising when compared to insecure children (Rosnay & Harris,

2002). This is also supported by neuroscientific research (A. Bartz & Hollander, 2006; Fonagy, Luyten, & Strathearn, 2011; Simeon et al., 2011).

Research has also found that insightfulness and reflective function in a caregiver is associated with both secure attachment and mentalising (Meins, Fernyhough, Fradley, & Tuckey, 2001; Oppenheim & Koren-Karie, 2002; Slade, Grienenberger, Bernbach, Levy, & Locker, 2005). Overall, there may be an overlap with attachment and mentalising however the main point to take away from this research is the suggestion that parents who demonstrate a capacity to mentalise, might lead to a facilitation of the development of mentalising in their infant.

The concept of maternal mentalising helps us consider Ainsworth's concept of sensitivity (Fonagy & Allison, 2014) between a caregiver and child and this can be understood as "appropriate responsiveness" when transmitting relevant cultural knowledge. The concept of sensitivity relates to the infant's sense of being recognised as an intentional agent and thus, promotes social development. These concepts can help to develop an operationalised understanding of ostensive cues, such as maternal responsivity to the child's actions or intentions, imitation of the infant and using infant-directed language (Fonagy, Luyten, & Allison, 2015)

Meins posited 'mind-mindedness' (Meins et al., 2003) which may predispose caregivers' with traits that encourage communication which is rich in ostensive cues and helps to establish a receptive communication to allow for new information to be shared with an infant, helping to pass down relevant cultural knowledge that can be generalised to other settings.

It is important not to overlook the body of research which explores parent-child interactions that lack ostensive cues, contingency and other capacities which suggest that mentalising may not be sufficiently established. This leads to the idea

that a lack of mentalisation may lead to early aggression and conduct problems as an adaptive response to limited resources. Thus, the concept of mentalising is highly important when considering clinical practice and has led to the development of mentalising based therapy (MBT) which is primarily used for individuals with borderline personality disorder. MBT aims to improve mentalisation to stabilise relationships, sense of self and increase affect regulation skills (Fonagy and Campbell, 2016).

Overall, the experience of having our mental states understood triggers social learning as it enables us to develop our knowledge and thus, generates a possibility of having an impact on the way that we view ourselves and our social world. In sum, the pathway to learning new information about our social world is opened up when we experience the feeling of being thought about (Fonagy & Allison, 2014). Could this therefore mean that parents who score higher in a mentalisation measure may teach their child a task in a more effective way compared to parents who score lower in a mentalisation measure? Is there a link between mentalisation and ostensive communication? This concept appears to have not been considered in experimental studies of ostensive cues.

### **A Proposed Definition of Ostensive Cues**

Although there is variability in how studies define and discuss ostensive cues, Csibra's (2010) proposals on ostensive cues may help specify which situations truly are ostensively communicated. These signals should; be distinguishable by newborns, should clearly identify that the infant is the addressee of the communicative act and finally, should encourage attention towards their source. Csibra (2010) highlighted at three types of stimuli which fulfil these guidelines;

direct gaze which initiates eye contact, infant-directed speech (or ‘motherese’) and contingent reactivity to the infant’s behaviour.

### ***Eye Contact***

There is robust evidence that infants, including newborns, demonstrate a preference for eye contact (Farroni, Csibra, Simion and Johnson, 2002; Farroni et al., 2004a; Farroni et al., 2006) including a preference for direct eye gaze compared to averted gaze (Hood et al., 2003; Farroni et al., 2007; Blass & Camp, 2001).

### ***Infant-Directed Speech (IDS)***

Infant-directed speech (IDS) includes a higher pitch, a broad variation of pitch and amplitude and a slower pace to provide infants with cues that they are being addressed (Csibra 2010). Early research shows that infants prefer when their mother interacts with them using IDS (Mehler, Bertoncini, Barriere and Jassik-Gerschenfeld, 1978).

### ***Contingent Responsivity***

The very nature of dialogue includes mutual contingent responsivity; a ‘back-and-forth’ interaction between two individuals where we take turns in our communication. Csibra (2010) stated that contingent responsivity can be a highly effective ostensive cue, and this is evidenced in studies focusing on mother-infant interactions. Mothers and infants coordinate their behaviours such as smiling, gesturing and touching which appears to mimic conversational turn-taking (Bateson, 1979). Infants from 6 weeks old are shown to be sensitive to contingent interactions (Bigelow, 2001; Nadel et al., 1999; Stormark and Braarud, 2004).

In sum, ostensive cues trigger learning in infants by helping to establish epistemic trust and relaxing the need for epistemic vigilance. This not only allows the transmission of knowledge, but also develops an understanding of who is

trustworthy, knowledgeable, and provides relevant information that is culturally significant to the self (Fonagy, Luyten, Allison & Campbell, 2017). Eye contact, IDS and contingent responsivity are believed to fulfil the criteria of ostensive cues (Csibra, 2010). Although human infants appear to be sensitive to particular ostensive cues (Csibra & Gergely, 2009; 2011), there has been a lack of research comparing whether specific ostensive cues are more successful in triggering learning in infants.

### **Criticisms of Applying Natural Pedagogy to Understanding Infant Learning**

Csibra's (2010) perspective on ostensive cues and infant learning varies from other theoretical perspectives which propose attention (Moore & Meltzoff, 2008; Mundy, Sullivan & Mastergeorge, 2009) and reinforcement learning (Deak et al., 2014; Triesch, Teuscher, Deak, & Carlson, 2006) to be responsible for facilitating gaze following, rather than ostensive cues (Gredebäck, Astor, & Fawcett, 2018). It appears that one of the main criticisms of ostensive cues is that they are attention-grabbing and controls for differences in attention have not been employed in experimental studies (Gredeback, Astor, & Fawcett, 2018). Gredeback, Astor, & Fawcett, (2018) tested this idea with a between-subjects design with 6-month-old infants. The study included actors shifting their gaze towards an object and there were three conditions; direct gaze (social and ostensive cue), shivering (social and non-ostensive cue), and no cue. The study did not support natural pedagogy as it illustrated that 6-month-olds followed an adult's gaze, irrespective of which condition they were in. In other words, infants reliably followed gaze no matter what cues were present. The authors reject the claim that natural pedagogy facilitates gaze following in 6-month-old infants and instead, propose that infants may learn from what we do and not from what we intend to communicate. However, Csibra (2010) states that attention is not an alternative explanation but instead, is a fundamental



component of the theory. To be clear, ostensive cues do indeed grab the attention of the addressee to perceive an adult's intentions, but increased attention alone does not satisfy all components of an infant's responses to ostensive cues, such as smiling.

Although I have discussed Csibra's (2010) proposal on ostensive stimuli, it is unclear whether infants learn better when stimuli are presented simultaneously, or in a specific order. Most communication is multisensory as we frequently use facial expressions, gestures as well as speech. Research has shown that mothers simultaneously use verbal and non-verbal communication when teaching infants objects (Gogate, Bahrick, & Watson, 2000). For example, Zukow (1991) found that Mexican and American mothers simultaneously used gestures such as pointing when they were teaching their infants names of objects. Gogate, Bahrick and Watson (2000) investigated how maternal multimodal communication is coordinated when teaching infants labels for novel objects and found that 99.99% of mothers' utterances were multimodal. Thus, a question arises when applying the theory of natural pedagogy when investigating whether ostensive communication leads to effective and efficient learning. Will an infant who observes object naming and non-verbal gestures such as pointing to the object learn more effectively than an infant who just observes the object being labelled?

The integration of Sperber's ideas with the theory of natural pedagogy is not without controversy. Nakao (2014) points out that by applying the concept of epistemic trust to the theory of natural pedagogy we make the implicit assumption that ostensive cues require interpretation rather than acting as automatic triggers. Nakao (2014) explains that if ostensive cues are limited to signals which also indicate trustworthiness, then the theory of natural pedagogy is not simply about cue-driven communication from any model but is instead a more intellectually active

role based on trustworthiness. Is it possible that ostensive cues do serve as natural triggers which are linked to another natural process of socially moderated cultural knowledge acquisition? So there is no incompatibility between the models as long as we make the assumption that infant learning is a highly complex process, where the relationship between an infant and an instructor may be important to consider. Here, I argue that introducing epistemic trust does not dilute the theory of natural pedagogy but instead highlights the complexities involved in infant learning.

### **Summary of Theoretical Concepts**

In sum, when we think about infant social learning, ostensive cues are signals that a caregiver uses to communicate to their infant that relevant, important information is going to be shown. A caregiver's ability to use ostensive signals may be linked with their capacity to 'hold their infant in mind', that is, an ability to mentalise their child's intentions and thoughts to ensure that their communication is applicable and adjusted to be within their child's learning repertoire. This process of using ostensive cues and recognising the listener as an intentional agent triggers epistemic trust, which in turn triggers a special kind of attention. As a result, these processes increase the likelihood of the communication being coded as relevant, generalisable and being coded in memory to allow it to be applied to other settings and help develop cultural knowledge and beliefs.

### **What Can We Learn from Research on Infant Learning?**

#### **Imitation and Emulation**

Infants are sensitive to communicative cues when they are just months' old (Butler & Markman, 2012; Farroni, Csibra, Simion, & Johnson, 2002; Grossmann & Johnson, 2010; Grossman et al., 2008).

Several paradigms have been introduced to investigate social learning between infants and adults such as the "imitation" paradigm where an adult performs an action and the child has the opportunity to reproduce the observed action. Imitation is thought to have both a cognitive and social basis (Meltzoff and Williamson, 2013).

It is important to note the difference between studies demonstrating that infants have *imitated* an action compared to *copied* an action as imitation may refer to instances where infants understand the goal of the model's actions. To make this clearer, Tomasello (1990) referred to the term emulation for situations when an observer learns about the causal relations between objects. Here, emulation will be discussed when it is believed that infants understand the goal of the model's actions and thus, attempt to reproduce the modelled result but by using their own behavioural strategies or actions. Imitation will be used to describe situations when an infant copies an action without understanding the end goal.

Studies have attempted to establish whether infants of a certain age will imitate or emulate a model's actions. Carpenter, Nagell and Tomasello (1998) found that infants around the age of 12 months indicate an understanding of the goal of an experimenter's actions. By the age of two years, infants will often imitate an action, even when they are in situations in which it would be possible to engage in emulation. We, therefore, understand that by the age of two years, child-directed interactions are not necessary to support action imitation (Shneidman, Todd & Woodward, 2014).

Nielson's (2006) study focused on infants between 12 months and 24 months of age. The infants were presented with three opaque boxes which contained a desirable toy. In the object condition, the infants watched as a model used a target

object to activate a switch to open the box and retrieve the toy hidden inside. The two control conditions consisted of a hand condition where the model showed how to activate the switch with her hand, and a no model condition where the box and the accompanying object was placed in front of the child to assess whether children would spontaneously open the box and if so, by using their hand or the object. Results showed that age played a large factor in whether the child imitated or not. The children who were 24 months copied the model's object use, even if it was unsuccessful. However, those who were 18 months old both imitated and emulated, as they did not always copy the model's object use. Interestingly, 12-month-olds rarely activated the switch with the object and instead used their hands. Thus, it appears that the 12-month-old infants engaged in emulation. However, this raises the question of why the younger subjects emulated and the older subjects imitated. Previous research has suggested that the younger subjects did not use the object, simply because they were unable to (Meltzoff, 1995; Visalberghi & Limongelli, 1996). Nielson (2006) explored this with further experiments and disproved the idea that infants of this age cannot use objects as tools as the study found that when given an appropriate reason, 12-month-old infants used an object in an attempt to open boxes.

In contrast, other studies have shown that when directly addressed, infants between 15 and 18 months may faithfully imitate an adult's actions (Shneidman, Todd and Woodward, 2014).

The phenomenon of "over-imitation" can occur in early development when infants imitate irrelevant and unnecessary any novel actions to achieve a simple goal (Horner & Whiten, 2005; Butler, Schmidt, Burgel & Tomasello, 2015). One social theory proposal for the mechanism that underlies over-imitation is that infants over-

imitate to affiliate with others as they assume their actions are culturally relevant (Over & Carpenter, 2012). Another proposal is that it is an automatic assumption that the action is causally necessary to achieve a broader goal (Butler, Schmidt, Burgel & Tomasello, 2015; Lyons, Damrosch, Lin, Macris, & Keil, 2011). Research suggests that a live demonstration, with ostensive cues and a demonstrator who is familiar to the infant, may lead to over-imitation (Marsh, Ropar, & Hamilton, 2014; Nielson, 2006).

So far, we have learnt that younger infants (12-month-olds) will copy an action (such as by using a tool) when given a justifiable reason to do this action. In contrast, older infants (18 to 24-month-olds) copy a model's actions, but for what reason? Promoting learning by satisfying social cognitive motivations could be a potential reason. Older toddlers may copy models to promote a shared experience with another (Nielson, 2006). The intricacies of when infants imitate compared to emulate thus appears to be dependent on not only their age but other factors. For example, child-directed situations may facilitate learning as it is possible that the information is explicitly marked as being for the child or because they are generally marked as information of notable importance (Shneidman, Todd and Woodward, 2014). This brings us back to the topic of natural pedagogy and ultimately, the use of an adult's cues to promote infant learning.

### **Research on Ostensive Cues**

There is a range of research investigating the use of ostensive cues in infant learning tasks. To help make sense of research on ostensive cues, the concepts will be organised based on different methods that studies have employed.

Taking into account the theory of natural pedagogy, we would expect that children learn more robustly from interactions where information is marked as

intended for them and when they carry informational value (Shneidman, Todd and Woodward, 2014).

### ***Category and Concept Formation***

Studies looking at the use of cues in category and concept formation offer an understanding of the transmission of knowledge that refers to novel objects (Butler & Markman, 2012). Research with infants aged two to four years old have shown that pedagogical teaching facilitates infant learning in this field (Butler & Markman, 2012; 2014; 2016; Butler & Tomasello, 2016; Futó et al., 2010; Butler, Schmidt, Bürgel, & Tomasello, 2015) when compared with a condition that lacks ostensive cues. At this developmental stage, children may be more attune in interpreting ostensive communication when it is part of a pedagogical demonstration rather than when cues are used in an overarching or accidental context (Butler & Markman 2016; Csibra & Gergely 2009). For example, 3-year-olds being taught about a novel category appear to assume that an experimenter's deliberate choice to exclude potentially relevant information means that it is of no importance. Further research investigating the interaction of ostensive cues and labelling of novel objects is needed among infants in this age range to clarify the developmental differences between younger and older child learning (Butler & Tomasello, 2016).

### ***Learning Novel Objects or Actions***

A key study by Meltzoff (1988) served to develop our knowledge on imitation of novel actions in infants. 14-month-old infants observed novel actions with objects such as an experimenter turning on a light by touching a box with their head. Interestingly, 8 of the 12 infants who observed this behaviour imitated it themselves. The big question is why did the infants re-enact the new head-action when they could have simply touched the box with their hands? In other words, they

could have emulated the goal by using a familiar and efficient action but instead, appeared to separate the goal from the means. Csibra and Gergely propose that infants may have noticed that the model did not use her hands, even though this would have been possible. Instead, the model ostensibly demonstrated for the infant to use an apparently less efficient novel action. Thus, based on the natural pedagogy hypothesis, the novel head action may have been seen as culturally relevant which explains why infants learned this action, despite its cognitive opacity (Csibra & Gergely, 2009).

In an interesting development, Gergely, Bekkering and Kiraly's (2002) study was based on Meltzoff's (1988) study however there were two conditions; one where the model's hands were visibly occupied and one where the model's hands were visibly free. A key finding is that the majority of infants in the hands occupied condition did not imitate the novel head action, therefore emulating the goal of turning on the lamp by using their hands. However, in support of Meltzoff's study, infants in the hands-free condition imitated the novel head action because the model ostensibly communicated manifestation of the cognitively opaque head action. The authors conclude that at 14 months, infants' imitation of goal-directed actions involves a selective mechanism whereby the rationality of the method is evaluated in relation to the restrictions of the situation. This finding was replicated by Schwier, van Maanen, Carpenter, and Tomasello (2006) who found that at 12 months, infants imitated novel, unusual demonstrations when the demonstrator had no physical constraints compared to when she was not able to freely choose an action. This is further support that infants are capable of rational imitation and understand intentions as well as goals.

In sum, research supports Csibra and Gergely's' (2006) proposal that ostensive cues play a key role in triggering inferences as to what is novel and relevant in the environment. Cultural learning can occur in two types of context; via an observer demonstrating an action using ostensive cues, or via a non-communicative context where an individual's actions are observed (such as incidental observation or over-hearing). In certain situations, infants may be able to emulate a goal by the age of 12 months.

Other studies have been shown how ostensive cues facilitate the selection of actions that infants imitate. In a study with 14 to 16-month-olds, an experimenter used a range of cues such as making eye contact, speaking directly to the infant about their actions and leaning towards the infant whilst demonstrating actions with objects. As well as non-verbal cues, "motherese" was shown to facilitate learning of novel actions. Both social cues and the infant's understanding of the appropriateness of the action influenced imitation (Seehagen & Herbert, 2010).

Ostensive cues have been shown to facilitate learning regarding tool use as it appears that they go beyond being an attention-grabbing mechanism to being partly responsible for how infants process and utilise information they have observed regarding tool use (Sage & Baldwin, 2011).

Williamson and Brand (2014) investigated whether 'motionese' or 'infant-directed action' (Brand, Baldwin, & Ashburn, 2002) facilitated infant learning when observing demonstrations of novel objects. Motionese or infant-directed action include cues that have been proposed to establish a pedagogical context. The study compared an infant-directed condition, an adult-directed condition and a baseline when teaching 2-year-olds demonstrations of four novel objects. The infant-directed condition included an experimenter who was emotionally engaged, used a large



range of motion for specific acts and used eye contact, pointing and drew attention to body parts before using them. The study found that the infants in the infant-directed demonstration showed higher levels of imitation than those in the baseline or adult-directed conditions. The authors consider the mechanism underlying these cues and propose that there may be more occurring than the pedagogical stance being triggered as this would have been possible in the adult-directed condition too. It is suggested that using cues to draw infants' attention to specific actions in the demonstration may have been key, such as the timing of cues such as eye gaze and a large amount of motion to draw attention to a body part. Furthermore, some of these exaggerated behaviours may make acts appear more intentional, and we know from previous research that intentionality influences imitation (Carpenter, Akhtar, & Tomasello, 1998; Meltzoff, 1995; Hopper, 2010). This study helps to develop our understanding of research demonstrating how social cues can trigger a pedagogical stance, increase imitation and thus promote children's observational learning to allow a quick and efficient mastery of tools and toys in their everyday lives.

Other studies have also demonstrated that ostensive cues facilitate infant imitation in a task (Lauricella, Barr, & Calvert, 2016). Research lacks information on specifying which social cues may be responsible for infants' selective imitation however in this study, the authors hypothesise that whilst infants mostly looked at the toy, the fact that they could see the experimenter's non-verbal cues "from the corner of their eyes" (i.e. leaning in and looking towards them) may have been key however it is important to note that this is a tentative suggestion. Overall, the imitation of goal-directed actions is a complex process which is likely to be due to several factors including ostensive cues and an infant's cognitive appraisals (Lauricella, Barr, & Calvert, 2016; Bauer & Kleinknecht, 2002).

### ***Word-learning***

Infant-directed speech (IDS), or motherese can be defined as “rhythmic speech including high-pitched, short phrases, and positive affect” (Foursha-Stevenson, Schembri, Nicoladis, & Erikson, 2017). This method of interacting with infants is common in languages around the world, including English, Russian, Swedish and Japanese (Foursha-Stevenson, Schembri, Nicoladis, & Erikson, 2017; Kuhl et al., 1997; Andruski et al., 1999) and infants have shown to have a preference for infant-directed speech compared to adult-directed speech (Fernald, 1985; Cooper et al., 1997).

From 18 months of age, infants can learn novel words (Shimpi, Akhtar, & Moore, 2013; Floor & Akhtar, 2006; Gampe, Liebal, & Tomasello, 2012). IDS has been found to facilitate infant word learning in 21-month-olds (Ma et al., 2011) and 19-month-olds however 13-month-olds were unable to use both infant and adult-directed speech to learn novel words (Foursha-Stevenson, Schembri, Nicoladis, & Erikson, 2017). IDS has also been found to increase retention of words compared to adult-directed speech (Singh et al., 2009). Overall, research suggests that IDS can increase attention and word learning. Future research could investigate which characteristics of IDS (such as pitch) are most responsible for language acquisition (Foursha-Stevenson, Schembri, Nicoladis, & Erikson, 2017).

### ***Actions directly addressed to an infant***

One reason that children may learn is when they are in a child-directed context as learning may occur as a response to ostensive cues. These studies broaden our knowledge of how infants use the knowledge of others to learn about the world. By an adult using ostensive cues to initially communicate that an action is being

carried out for the infant, infants may recognise the importance of attending to this action (Butler and Tomasello, 2016).

In Matheson, Moore and Akhtar's (2013) study, younger children showed highest levels of imitation in an interactive condition (direct communication between the experimenter and child, including the use of ostensive cues when demonstrating an action) compared to when they merely observed another person act on objects.

Shneidman, Todd and Woodward (2014) aimed to explore whether infants imitate as a response to information marked as intended to them compared to information that held broader communicative value. In their study, the baseline phase consisted of an experimenter presenting 18-month-old infants with three test items and saying, "what does this do?" In the demonstration phase, there was either a child-directed condition (where eye contact and speech were directed to the child) where they were shown how to use the object or an observed condition (instead of addressing the child, the adults only spoke to each other, but still used 'child-directed speech register). During the test phase, the experimenter re-entered the room and asked the child what the object does. This process was repeated for another set of test items. This study found that although children similarly directed their attention in both conditions, infants in the child-directed condition were more likely to imitate the actor's actions. This suggests that although child-directed interactions may increase infants' attention to a situation, direct cueing is essential for effective infant learning at the age of 18 months.

### ***Presence of a demonstrator during re-enactment***

Some studies have investigated the potential effects of the presence of a demonstrator during behaviour re-enactment. Kupan et al. (2017) explored factors such as the presence of communicative cues during demonstration and the presence

of the demonstrator during re-enactment. It appears that infants' behaviour was impacted more so by the presence of communicative cues than whether the demonstrator was present during the re-enactment. This adds to the already growing research that ostensive communication may lead infants to imitate an observed action in a "socially prescribed" way, as the non-communicative condition failed to promote any one of the particular strategies in the study. Of note, is that when infants were in the non-communicative context, having a demonstrator present during re-enactment had an impact on infants' behaviour. This furthers our understanding of cues impacting infant learning as the results showed that the non-communicative demonstration did not effectively evoke a particular learning mechanism as when there was no demonstrator present in the re-enactment, infants only imitated after the communicative context, but not in the non-communicative context.

### ***Third Party Contexts***

Research that appears to focus more on third party or observational contexts (where a behaviour or action that is directed to someone other than the infant is observed by the infant) is limited (Matheson, Moore, & Akhtar, 2013). As would be expected, infants ability to imitate an action in a third-party context appears to be age dependent. It has been shown that 18-month-olds can imitate whilst in third-party contexts (Herold & Akhtar, 2008). Furthermore, between the age of 18 to 25 months, it appears that the reliance on child-directed information reduces (Shneidman, Todd and Woodward, 2014).

Overall, research suggests that ostensive cues in interactive situations are highly important for eliciting imitation. However, by the end of the second year, children's heightened awareness of their self and others as psychological agents may

result in an ability to imitate situations that do not necessarily include direct interaction, however, further research is required.

### *Characteristics of the listener*

From birth, infants prefer to look at their mother's face than a stranger's (Pascalis, de Schonen, Morton, Deruelle, & Fabre-Grenet, 1995; Sai, 2005) which may result in a difference in learning from their mother compared to a stranger however this effect does not appear to be true when watching their mother via video rather than 'live' demonstrations (Seehagen & Herbert, 2010). Research on epistemic trust tells us that older children (approximately three years old) appear to have a preference to learn from reliable, confident, knowledgeable models (Schmidt, Rakoczy, Tomasello, 2011) and in some studies, infants were more likely to imitate a familiar model (such as their mother) compared to an unfamiliar model (Shimpi, Akhtar, & Moore, 2013; Krcmar, 2010; Seehagen & Herbert, 2012).

### *Differences in social cues*

Broadening the idea of infants imitating in child-directed contexts, some studies have compared conditions where a demonstrator appears more aloof or where ostensive cues are restricted.

Nielson (2006) suggested that at the age of 18 months, infants may imitate an adult's actions because they are motivated to sustain an interaction, but this may differ when presented with a socially aloof model. Again, this idea is age dependent as it has been found that at the age of two years, children can imitate a socially disengaged model. The authors propose that this may be because, by the age of two years, children imitate cognitively opaque actions, without the need for ostensive cues. However, the authors suggest that it is surprising that the reliance on social cueing drastically reduces in just six months and propose the idea that instead, a

shared focus of attention with another facilitates child learning as it communicates the adult's intention. This theory would explain why younger infants are less likely to learn where there is no direct interaction as it is more challenging to understand the intentions of others when there is no shared focus (Shneidman, Todd and Woodward, 2014).

### ***Cultural contexts***

It is important to bear in mind that much of the research discussed has been conducted in Western countries, where children usually grow up in contexts where child-directed communication is common (Shneidman, Todd and Woodward, 2014).

Two rare studies carried out by Shneidman, Gaskins and Woodward (2016) investigated whether imitative learning is a universal phenomenon by comparing a study which included a community where direct teaching is not the norm (a Yucatec Mayan village) with a study with participants from a community where infant interaction is frequently direct (a US city). The within-subjects design included 18-month-old infants being directly shown how to use novel objects (condition 1) and on the following day, they observed an actor using different objects (condition 2). The different conditions did not appear to have an impact on infant learning in both communities. For the Yucatec Mayan infants, direct communication did not appear to increase the likelihood of imitation. Surprisingly, this was also the same for the US infants as they did not show a difference in imitation in the child-directed versus the observed condition. Instead, infants who were directly addressed on the first day scored higher in imitation than infants who observed on their first visit.

The authors suggest that the results of this study go against much of the research which state that directed cues are a critical factor in infant learning. However, there is a possibility that there was a degree of learned behaviour, due to

the within-subjects design. It may also mean that US infants used the information gathered from the first interaction to inform their behaviour and learning the next day. In other words, by being directly addressed on the first visit which communicated that the information was relevant, infants may have continued to imitate in the second visit, despite no longer being directly addressed. The authors, therefore, suggest that child-directed communication may not necessarily be an automatic cue but may depend on how infants make sense of what counts as relevant information by basing this on their everyday experience of social cues.

### **Critique of Existing Literature**

#### **Lack of Standardisation Across Experimental Studies**

##### ***Age***

It appears to be unclear how the impact of ostensive cues on learning may be moderated by an infant's age. From Fillingham's (2018) meta-analysis, age of infants was not a significant predictor of ostensive cueing as some studies appeared to show a significant difference in an older comparison group and vice versa. Fillingham (2018) suggests that there is not a simple direct linear relationship between age and ostensive cues and that ostensive communication is most relevant when the competence being assessed is almost within the developmental reach of an infant. In order to have more clarity on ostensive communication and infant development, it would be important for research to replicate comparable learning paradigms across different age groups. As mentioned earlier, infants may be able to copy a range of actions from 12 months old but by 24 months, they may copy actions even if they were unsuccessful (Nielson, 2006). Further research between this age range would be useful in investigating when infants imitate and emulate an adult's actions.

##### ***Replicability of learning paradigms***

Although experimental paradigms such as the one used in Meltzoff's (1988) study have been replicated, learning paradigms explored in the literature lack standardisation. This raises problems when comparing the relevance of parameters such as ostensive cues. It is unclear if variation in the observed importance of cues is due to the nature of the cues being tested or are the result of differences in learning paradigms used to investigate them or the range of comparison conditions being used. Standardisation is of course most relevant differences in experimental manipulations that could be considered as ostensive cues.

### ***Definition of Ostensive Communication***

From reviewing experimental studies, it appears that there is a variation in how researchers define 'ostensive cues'. Furthermore, studies differ in their language when describing cues, using terms such as 'pedagogical cues'. Despite Csibra's (2010) definition of ostensive communication including eye contact, IDS and contingent responsivity it is apparent that a clear definition of ostensive cues is needed to ensure reliable experimental research.

The research on maternal multimodal communication mentioned earlier from Gogate, Bahrick and Watson (2000) raises an important question of whether the co-occurrence of ostensive cues could be more effective than simply one ostensive cue being used at a time. Therefore, both a clear definition of ostensive cues and an acknowledgment of co-occurrence of ostensive cues is needed.

As well as considering standardisation across studies, it would also be useful to use a developed, reliable measure of ostensive cues, which effectively covers the parameters described in Csibra's (2010) definition. As highlighted in Fillingham's (2018) meta-analysis, there is a lack of ostensive cueing protocols, which leads to a



lack of meta-analyses focusing on the degree of ostensive cueing as a moderator variable.

### **Use of an Experimenter rather than a Primary Caregiver**

Experimental studies investigating the impact of ostensive cues on infant learning mostly include experimenters or 'models' who demonstrate an action to the infant. Understandably, studies use this design to ensure that all interactions are consistent across participants. However, including an infant's mother in an experimental paradigm would allow for a more 'natural' interaction, thus increasing ecological validity.

There is limited research on social cues studies that include an adult that has an existing relationship with an infant. Some studies, however, have found that observing these individuals may increase imitation (Buttleman, Zymj, Daum & Carpenter, 2013; Howard, Henderson, Carrazza & Woodward, 2014; Shimpi, Ahktar & Moore, 2013, as cited in Shneidman, Gaskins & Woodward, 2016).

Although experimental studies have provided valuable information on the relationship between social cues and infant learning, it is important to consider how previous experience may impact on how infants make sense of actions they observe (Shneidman, Gaskins & Woodward, 2016). This interesting point is highlighted in studies considering different cultures, but it may also apply within cultures and thus, measures exploring infant's existing relationships with their caregivers may be valuable data.

### **Proposal for Future Research**

Overall, I have described two theories that can be used to understand infant learning, social learning theory and the theory of natural pedagogy. This conceptual review suggests that cultural learning is a complex socially supported process where

from early infancy the learner evaluates knowledge in the context of other social cues that serve to highlight the cultural relevance of the information being transmitted. This social contextualisation may be helpfully considered using the concept of ostensive cues embedded in the theory of natural pedagogy. Ostensive cues serve to signal the appropriateness of information to be generalised across setting and thus potentially passed on to others in the same community ultimately also to future generations. By using Csibra's (2010) definition of ostensive cues, we are able to understand that factors such as eye contact, infant-directed speech and contingent response may be key in infant learning. In this review we have considered conceptual criticisms of the model along with reviewing existing experimental research for the use of ostensive cues in infant learning. Overall, there seems to be a strong conceptual and some empirical support for the role of ostensive cues in mother-infant interactions involving learning however the learning process appears complex, and the studies are not without flaws.

Taking into account the criticisms discussed, future research investigating ostensive cues in mother-infant interactions would be valuable. There is no doubt that investigating social learning is highly complex however standardisation of factors such as a definition of what is included in ostensive communication may help to increase replication of paradigms across studies. Furthermore, in order to increase the ecological validity of experimental research in this area, studies should strive to protect the real-life relationship between a mother and her infant by allowing for natural interactions to occur. Alongside retaining natural interactions, a validated, reliable tool to measure ostensive cues would be valuable. This would help clarify a behavioural operational definition of ostensive communication that could be applied in future studies. In sum, an ostensive cues tool would encourage replication of

studies and existing experimental paradigms to develop our knowledge on factors such as individual differences and developmental differences in infant learning.

The factors discussed for future research have strong clinical implications for the field of psychology. The area of attachment and concept of mentalisation have served to inform a new type of therapy, MBT (Fonagy and Campbell, 2016). Thus, the topic of infant learning, ostensive cues and parental distress has the potential to inform clinical practice when working to improve social development and support parent-infant relationships. Further research may also highlight differences in the use of ostensive cues between non-clinical and clinical groups of parents which may pave the way for the development of specific support for parent-infant relationships.

## References

- Andruski, J. E., Kuhl, P. K., & Hayashi, A. (1999). Point vowels in Japanese mothers' speech to infants and adults. *The Journal of the Acoustical Society of America*, *105*(2), 1095–1096.
- A. Bartz, J., & Hollander, E. (2006). The neuroscience of affiliation: Forging links between basic and clinical research on neuropeptides and social behavior. *Hormones and Behavior*, *50*(4), 518-528.
- Bandura, A. (1977). *Social Learning Theory*, Englewood Cliffs, NJ: Prentice Hall.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall, Inc.
- Bandura, A. (1989). Social cognitive theory. In R. Vasta (Ed.), *Annals of child development. Vol. 6. Six theories of child development* (pp. 1-60). Greenwich, CT: JAI Press.
- Barr, R., Rovee-Collier, C., & Campanella, J. (2005). Retrieval protracts deferred imitation by 6-month-olds. *Infancy*, *7*, 263–283.
- Bateman, A. W., & Fonagy, P. (Eds.). (2012). *Handbook of mentalizing in mental health practice*. Washington, DC: American Psychiatric Publishing.
- Bateson, M. C. (1979). The epigenesis of conversational interaction: a personal account of research and development. In M. Bullowa (ed.), *Before Speech: The Beginnings of Human Communication*. Cambridge: Cambridge University Press, 63–77.
- Bauer, P. J., & Kleinknecht, E. E. (2002). To 'ape' or to emulate? Young children's use of both strategies in a single study. *Developmental Science*, *5*(1), 18-20.

- Bigelow, A. E. (2001). Discovering self through other: infants' preference for social contingency. *Bulletin of the Menninger Clinic*, 65, 335–46.
- Blass, E. M., & Camp, C. A. (2001). The ontogeny of face recognition: eye contact and sweet taste induce face preference in 9- and 12-week-old human infants. *Developmental Psychology*, 37, 762–74.
- Brand, R. J., Baldwin, D. A., & Ashburn, L. A. (2002). Evidence for 'motionese': Modifications in mothers' infant- directed action. *Developmental Science*, 5, 72-83.
- Butler, L. P., & Markman, E. M. (2012). Preschoolers Use Intentional and Pedagogical Cues to Guide Inductive Inferences and Exploration. *Child Development*, 83(4), 1416-1428.
- Butler, L. P., & Markman, E. M. (2014). Preschoolers use pedagogical cues to guide radical reorganization of category knowledge. *Cognition*, 130(1), 116-127.
- Butler, L. P., & Markman, E. M. (2016). Navigating pedagogy: Children's developing capacities for learning from pedagogical interactions. *Cognitive Development*, 38, 27-35.
- Butler, L. P., Schmidt, M. F. H., Bürgel, J., & Tomasello, M. (2015). Young children use pedagogical cues to modulate the strength of normative inferences. *British Journal of Developmental Psychology*, 33(4), 476-488.
- Butler, L. P., & Tomasello, M. (2016). Two- and 3-year-olds integrate linguistic and pedagogical cues in guiding inductive generalization and exploration. *Journal of Experimental Child Psychology*, 145, 64-78.
- Buttelmann, D., Zmyj, N., Daum, M., & Carpenter, M. (2013). Selective imitation of in- versus out-group members in 14-month-old infants. *Child Development*, 84(4), 422-428

- Caporael, L. R. (1997). The evolution of truly social cognition: The core configurations model. *Personality and Social Psychology Review*, *1*(4), 276-298.
- Carpenter, M., Akhtar, N., & Tomasello, M. (1998). Fourteen- through eighteen-month-old infants differentially imitate intentional and accidental actions. *Infant Behavior and Development*, *21*, 315-330.
- Cooper, R. P., Abraham, J., Berman, S., & Staska, M. (1997). The development of infants' preference for motherese. *Infant Behavior and Development*, *20*(4), 477-488.
- Csibra, G. (2010). Recognizing Communicative Intentions in Infancy. *Mind & Language*, *25*(2), 141-168.
- Csibra, G., & Gergely, G. (2009). Natural pedagogy. *Trends in Cognitive Sciences*, *13*, 148-153.
- Csibra, G., & Gergely, G. (2011). Natural pedagogy as evolutionary adaptation. *Philosophical Transactions of the Royal Society B*, *366*(1567), 1149-1157.
- Daniel, J. M., Tetyana, D., Cheryl, D. S., Steven, J. S., Wallace, B. B., Mark, J. M., . . . Chet, C. S. (2012). Prolonged myelination in human neocortical evolution. *Proceedings of the National Academy of Sciences*, *109*(41), 16480.
- Deak, G. O., Krasno, A. M., Triesch, J., Lewis, J., & Sepeta, L. (2014). Watch the hands: Infants can learn to follow gaze by seeing adults manipulate objects. *Developmental Science*, *17*, 270-281.
- Dean, L. G., Kendal, R. L., Schapiro, S. J., Thierry, B., & Laland, K. N. (2012). Identification of the social and cognitive processes underlying human cumulative culture. *Science (New York, N.Y.)*, *335*(6072), 1114.

- Egyed, K., Király, I., & Gergely, G. (2013). Communicating Shared Knowledge in Infancy. *Psychological Science, 24*(7), 1348-1353.
- Farroni, T., Csibra, G., Simion, F., & Johnson, M. H. (2002). Eye contact detection in humans from birth. *Proceedings of the National Academy of Sciences of the USA, 99*, 9602–9605.
- Farroni, T., Massaccesi, S., Menon, E. and Johnson, M. H. (2007). Direct gaze modulates face recognition in young infants. *Cognition, 102*, 396–404.
- Farroni, T., Massaccesi, S., Pivotori, D., Simion, F. and Johnson, M. H. (2004a). Gaze following in newborns. *Infancy, 5*, 39–60.
- Farroni, T., Menon, E. and Johnson, M. H. (2006). Factors influencing newborns' preference for faces with eye contact. *Journal of Experimental Child Psychology, 95*, 298–308.
- Fernald, A. (1985). Four-month-old infants prefer to listen to motherese. *Infant Behavior and Development, 8*(2), 181–195.
- Fillingham, K. (2018). *Measuring epistemic trust* (Unpublished doctoral dissertation). University College London, London.
- Floor, P., & Akhtar, N. (2006), Can 18-Month-Old Infants Learn Words by Listening In on Conversations? *Infancy, 9*, 327-339.
- Fonagy, P., & Allison, E. (2014). The Role of Mentalizing and Epistemic Trust in the Therapeutic Relationship. *Psychotherapy, 51*(3), 372-380.
- Fonagy, P., & Campbell, C. (2016). Attachment theory and mentalization. In *The Routledge handbook of psychoanalysis in the social sciences and humanities*. (pp. 115-131). New York, NY, US: Routledge/Taylor & Francis Group.
- Fonagy, P., Gergely, G., Jurist, E., & Target, M. (2002). *Affect regulation, mentalization, and the development of the self*. New York, NY: Other Press.

- Fonagy, P., Luyten, P., & Allison, E. (2015). Epistemic Petrification and the Restoration of Epistemic Trust: A New Conceptualization of Borderline Personality Disorder and Its Psychosocial Treatment. *Journal of personality disorders, 29*(5), 575.
- Fonagy, P., Luyten, P., Allison, E., & Campbell, C. (2017). What we have changed our minds about: Part 2. Borderline personality disorder, epistemic trust and the developmental significance of social communication. *Borderline Personality Disorder and Emotion Dysregulation, 4*, Article 9.
- Fonagy, P., Luyten, P., & Strathearn, L. (2011). Borderline personality disorder, mentalization, and the neurobiology of attachment. *Infant Mental Health Journal, 32*(1), 47.
- Fonagy, P., Steele, M., Steele, H., Moran, G. S., & Higgitt, A. C. (1991). The capacity for understanding mental states: The reflective self in parent and child and its significance for security of attachment. *Infant Mental Health Journal, 12*(3), 201-218.
- Fonagy, P., & Target, M. (2006). The mentalization-focused approach to self-pathology. *Journal of Personality Disorders, 20*, 544-576.
- Foursha-Stevenson, C., Schembri, T., Nicoladis, E., & Eriksen, C. (2017). The Influence of Child-Directed Speech on Word Learning and Comprehension. *J Psycholinguist Res, 46*(2), 329-343.
- Futó, J., Téglás, E., Csibra, G., & Gergely, G. (2010). Communicative Function Demonstration induces kind-based artifact representation in preverbal infants. *Cognition, 117*(1), 1-8.
- Gampe, A., Liebal, K., & Tomasello, M. (2012). Eighteen-month-olds learn novel words through overhearing. *First Language, 32*(3), 385–397.



- Gergely, G., Bekkering, H., & Kiraly, I. (2002). Rational imitation in preverbal infants. *Nature*, *415*, 755.
- Gogate, L. J., Bahrick, L. E., & Watson, J. D. (2000). A Study of Multimodal Motherese: The Role of Temporal Synchrony between Verbal Labels and Gestures. *Child Development*, *71*(4), 878-894.
- Gredebäck, G., Astor, K., & Fawcett, C. (2018). Gaze Following Is Not Dependent on Ostensive Cues: A Critical Test of Natural Pedagogy. *Child Development*, *89*(6), 2091-2098.
- Grossmann, T., & Johnson, M. H. (2010). Selective prefrontal cortex responses to joint attention in early infancy. *Biology Letters*, *6*, 540–543.
- Grossmann, T., Johnson, M. H., Lloyd-Fox, S., Blasi, A., Deligianni, F., Elwell, C., et al. (2008). Early cortical specialization for face-to-face communication in human infants. *Proceedings of the Royal Society of London, B: Biological Sciences*, *275*, 2803–2811.
- Herold, K. H., & Akhtar, N. (2008). Imitative learning from a third-party interaction: Relations with self-recognition and perspective taking. *Journal of Experimental Child Psychology*, *101*, 114–123.
- Herrmann, E., Call, J., Hernández-Lloreda, M. V., Hare, B., & Tomasello, M. (2007). Humans have evolved specialized skills of social cognition: the cultural intelligence hypothesis. *Science (New York, N.Y.)*, *317*(5843), 1360.
- Hood, B. M., Macrae, C. N., Cole-Davies, V. and Dias, M. (2003). Eye remember you! The effects of gaze direction on face recognition in children and adults. *Developmental Science*, *6*, 69–73.
- Hopper, L. M. (2010). “Ghost” experiments and the dissection of social learning in humans and animals. *Biological Reviews*, *85*(4), 685–701.

- Horner, V., & Whiten, A. (2005). Causal knowledge and imitation/emulation switching in chimpanzees (*Pan troglodytes*) and children (*Homo sapiens*). *Animal Cognition*, 8, 164–181.
- Howard, L. H., Carrazza, C., & Woodward, A. L. (2014). Neighbourhood linguistic diversity predicts infants' social learning. *Cognition*, 133(2), 474–479.
- Király, I., Csibra, G., & Gergely, G. (2013). Beyond rational imitation: learning arbitrary means actions from communicative demonstrations. *Journal of experimental child psychology*, 116(2), 471–486.
- Krcmar, M. (2010). Can social meaningfulness and repeat exposure help infants and toddlers overcome the video deficit? *Media Psychology*, 13, 31–53.
- Kuhl, P. K., Andruski, J. E., Chistovich, I. A., Chistovich, L. A., Kozhevnikova, E. V., Ryskina, V. L., et al. (1997). Cross-language analysis of phonetic units in language addressed to infants. *Science*, 277(5326), 684–686.
- Kupan, K., Kiraly, I., Kupan, K., Kreko, K., Miklosi, A., & Topal, J. (2017). Interacting effect of two social factors on 18-month-old infants' imitative behaviour: Communicative cues and demonstrator presence. *Journal of Experimental Child Psychology*, 161, 186-194.
- Lauricella, A. R., Barr, R., & Calvert, S. L. (2016). Toddler learning from video: Effect of matched pedagogical cues. *Infant Behavior and Development*, 45(Pt A), 22-30.
- Lyons, D. E., Damrosch, D. H., Lin, J. K., Macris, D. M., & Keil, F. C. (2011). The scope and limits of overimitation in the transmission of artefact culture. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, 366, 1158–1167.

- Ma, W., Golinkoff, R. M., Houston, D. M., & Hirsh-Pasek, K. (2011). Word learning in infant-and adult- directed speech. *Language Learning and Development*, 7(3), 185–201.
- Marsh, L. E., Ropar, D., Hamilton, A. F. d. C., & Senju, A. (2014). The Social Modulation of Imitation Fidelity in School-Age Children. *PLoS ONE*, 9(1).
- Matheson, H., Moore, C., & Akhtar, N. (2013). The development of social learning in interactive and observational contexts. *Journal of Experimental Child Psychology*, 114, 161-172.
- Mehler, J., Bertoncini, J., Barriere, M., & Jassik-Gerschenfeld, D. (1978). Infant recognition of mother's voice, *Perception*, 7, 491–97.
- Meins, E., Fernyhough, C., Fradley, E., & Tuckey, M. (2001). Rethinking Maternal Sensitivity: Mothers' Comments on Infants' Mental Processes Predict Security of Attachment at 12 Months. *Journal of Child Psychology and Psychiatry*, 42(5), 637-648.
- Meins, E., Fernyhough, C., Wainwright, R., Clark-Carter, D., Das Gupta, M., Fradley, E., & Tuckey, M. (2003). Pathways to Understanding Mind: Construct Validity and Predictive Validity of Maternal Mind-Mindedness. *Child Development*, 74(4), 1194-1211.
- Meltzoff, A.N. (1988). Infant imitation after a 1-week delay: Long-Term Memory for Novel Acts and Multiple Stimuli. *Developmental Psychology*, 24(4), 470–476.
- Meltzoff, A. N. (1995). Understanding the intentions of others: Re-enactment of intended acts by 18-month-old children. *Developmental Psychology*, 31, 838–850.

- Meltzoff, A. N., & Williamson, R. A. (2013). Imitation: Social, cognitive, and theoretical perspectives. In P. R. Zelazo (ed.), *The Oxford handbook of developmental psychology: Vol. 1. Mind and body* (pp. 651-682). New York, NY: Oxford University Press.
- Moore, M. K., & Meltzoff, A. N. (2008). Factors affecting infants' manual search for occluded objects and the genesis of object permanence. *Infant Behavior & Development, 31*, 168–180.
- Mundy, P., Sullivan, L., & Mastergeorge, A. M. (2009). A parallel and distributed-processing model of joint attention, social cognition and autism. *Autism Research, 2*(1), 2–21.
- Nadel, J., Carchob, I., Kervella, C., Marcelli, D., & Re ´serbat-Plantey, D. (1999). Expectancies for social contingency in 2-month-olds. *Developmental Science, 2*, 164–73.
- Nakao, H., & Andrews, K. (2014). Ready to Teach or Ready to Learn: A Critique of the Natural Pedagogy Theory. *Review of Philosophy and Psychology, 5*, 465-483.
- Nielson, M. (2006). Copying actions and copying outcomes: Social learning through the second year. *Developmental Psychology, 42*, 555-565.
- Oppenheim, D., & Koren-Karie, N. (2002). Mothers' insightfulness regarding their children's internal worlds: The capacity underlying secure child–mother relationships. *Infant Mental Health Journal, 23*(6), 593-605.
- Over, H., & Carpenter, M. (2012). Putting the social into social learning: Explaining both selectivity and fidelity in children's copying behavior. *Journal of Comparative Psychology, 126*, 182–192.

- Papousek, H., & Papousek, M. (1979). Early ontogeny of human social interaction: Its biological roots and social dimensions. In M. von Cranach, K. Foppa, W. LePenies, & D. Ploog (Eds.), *Human ethology: Claims and limits of a new discipline* (pp. 456-478). Cambridge, England: Cambridge University Press.
- Pascalis, O., de Schonen, S., Morton, J., Deruelle, C., & Fabre-Grenet, M. (1995). Mother's face recognition by neonates: A replication and an extension. *Infant Behavior and Development, 18*, 79–85.
- Recanati, F. (1997). Can We Believe What We Do Not Understand? *Mind & Language, 12*(1), 84-100.
- Rosnay, M. D., & Harris, P. L. (2002). Individual differences in children's understanding of emotion: The roles of attachment and language. *Attachment & Human Development, 4*(1), 39-54.
- Russell, B. (1940). *An inquiry into meaning and truth*. London, UK: Allen & Unwin.
- Sage, K. D., & Baldwin, D. (2011). Disentangling the Social and the Pedagogical in Infants' Learning about Tool-Use. *Social Development, 20*(4), 825-844.
- Sai, F. (2005). The role of the mother's voice in developing mother's face preference: Evidence for intermodal perception at birth. *Infant and Child Development, 14*, 29–50.
- Schmidt, M. F. H., Rakoczy, H., & Tomasello, M. (2011). Young children attribute normativity to novel actions without pedagogy or normative language. *Developmental Science, 14*(3), 530.
- Schwier, C., van Maanen, C., Carpenter, M., & Tomasello, M. (2006). Rational Imitation in 12-Month-Old Infants. *Infancy, 10*(3), 303.

- Seehagen, S., & Herbert, J. S. (2010). The role of demonstrator familiarity and language cues on infant imitation from television. *Infant Behavior and Development, 33*(2), 168-175.
- Seehagen, S., & Herbert, J. S. (2012). Selective imitation in 6-month-olds: The role of the social and physical context. *Infant Behavior & Development, 35*, 509–512.
- Shimpi, P. M., Akhtar, N., & Moore, C. (2013). Toddlers' imitative learning in interactive and observational contexts: The role of age and familiarity of the model. *Journal of Experimental Child Psychology, 116*(2), 309-323.
- Shneidman, L., Gaskins, S., & Woodward, A. (2016). Child-directed teaching and social learning at 18 months evidence from Yucatec Mayan and US infants. *Developmental Science, 19*, 372-381.
- Shneidman, L., Todd, R., & Woodward, A. (2014). Why do child-directed interactions support imitative learning in young children? *PloS one, 9*(10), e110891.
- Simeon, D., Bartz, J., Hamilton, H., Crystal, S., Braun, A., Ketay, S., & Hollander, E. (2011). Oxytocin administration attenuates stress reactivity in borderline personality disorder: A pilot study. *Psychoneuroendocrinology, 36*(9), 1418-1421.
- Singh, L., Nestor, S., Parikh, C., & Yull, A. (2009). Influences of infant-directed speech on early word recognition. *Infancy, 14*(6), 654–666.
- Slade, A., Grienenberger, J., Bernbach, E., Levy, D., & Locker, A. (2005). Maternal reflective functioning, attachment, and the transmission gap: A preliminary study. *Attachment & Human Development, 7*(3), 283-298.

- Sperber, D., Clement, F., Heintz, C., Mascaro, O., Mercier, H., Origgi, G., & Wilson, D. (2010). Epistemic Vigilance. *Mind & Language*, 25 (4) 359 - 393. (2010).
- Sperber, D., & Wilson, D. (1995). *Relevance: Communication and cognition*. Malden, MA: Blackwell.
- Stormark, K. J., & Braarud, H. C. (2004). Infants' sensitivity to social contingency: a 'double video' study of face-to-face communication between 2- and 4-month-olds and their mothers. *Infant Behavior and Development*, 27, 195–203.
- Tomasello, M. (1999). *The cultural origins of human cognition*. Cambridge, Mass. London: Cambridge, Mass. London : Harvard UP.
- Triesch, J., Teuscher, C., Deak, G. O., & Carlson, E. (2006). Gaze following: Why (not) learn it? *Developmental Science*, 9, 125–147.
- Van Schaik, C. P., & Burkart, J. M. (2011). Social learning and evolution: the cultural intelligence hypothesis. *Philosophical Transactions of the Royal Society B*, 366(1567), 1008-1016.
- Visalberghi, E., & Limongelli, L. (1996). Acting and understanding: Tool use revisited through the minds of capuchin monkeys. In A. Russon, K. A. Bard & S. T. Parker (Eds.), *Reaching into thought: The minds of the great apes* (pp. 57–79). Cambridge, UK: Cambridge University Press.
- Williamson, R. A., & Brand, R. J. (2014). Child-directed action promotes 2-year-olds' imitation. *Journal of Experimental Child Psychology*, 118(1), 119-126.
- Wilson, D., & Sperber, D. (2012). *Meaning and relevance*. Cambridge, UK: Cambridge University Press.
- Yoon, J. M. D., Johnson, M. H., & Csibra, G. (2008). Communication-Induced Memory Biases in Preverbal Infants. *Proceedings of the National Academy of Sciences of the United States of America*, 105(36), 13690-13695.

Zukow, P. G. (1991). A socio-perceptual/ecological approach to lexical development: Affordances of the communication context. *Anales de Psicología*, 7(2), 151– 163.



## **Part Two: Empirical Paper**

### **Exploring the Role of Maternal Ostensive Communication in Infant Learning**

## **Abstract**

*Aims:* (1) To replicate existing infant learning paradigms in order to capture maternal use of ostensive cues by using a newly developed ostensive cues coding tool, (2) to explore whether infants in the ‘ostensive cues’ condition imitate a novel action and have higher learning outcomes than infants in the ‘restricted cues’ condition, (3) to investigate whether infant imitation and learning are related to constructs such as maternal IQ, maternal stress, and evidence of maternal mentalisation.

*Method:* Two infant learning paradigms were replicated, and mothers acted as demonstrators in the tasks. Due to the occurrence of Covid-19, data collection ended prematurely. The second aim of the study could not be investigated due to the small sample size. 14 infants aged 16 to 20 months took part in the study with their mothers. An ostensive cues coding tool was used to measure maternal ostensive communication during the task. Mothers also completed measures to assess IQ, mentalisation, psychological stress and parental stress.

*Results:* A total of six participants with the highest and lowest learning outcome scores were selected for qualitative analysis. Results demonstrated some evidence for the role of maternal ostensive communication in infant learning outcomes, as well as some evidence for the roles of mentalisation, stress and IQ. However, due to the small sample size, tentative patterns are described, and caution should be taken when drawing conclusions from patterns displayed in the results.

*Conclusion:* The ostensive cues coding tool can be applied to infant-learning paradigms to develop knowledge on the role of ostensive communication in infant learning. Further research with a larger sample may offer insight into the relationships between maternal ostensive communication, mentalisation, IQ, stress and infant learning outcomes

## **Introduction**

### **Natural Pedagogy and the Transmission of Knowledge**

The way in which humans learn is thought to be unique to our species due to the transmission of culturally opaque knowledge; generic knowledge and shared cultural knowledge (Csibra & Gergely, 2011). If an infant were to observe their mother using a key to open a door, the goal of opening the door is clear. However, this method of observational learning would only be effective for simple tool use, because determining the goal of behaviours which produce many outcomes calls for a need of pre-existing knowledge about the action, the object, or the individual's intended goal. When the goal of a behaviour is opaque, infants may use blind imitation (Want & Harris, 2002 cited in Csibra & Gergely, 2009) which means that they imitate actions in the hope of learning about the function of the tool later. In terms of the transmission of generic knowledge, if a mother were to point to a key and tell their infant "keys open doors" this would allow the infant to develop general knowledge about the function of keys, providing knowledge that could be applied to other contexts. The theory of natural pedagogy states that when a mother is explicitly teaching her infant about an action, this communication demonstrates to the infant that this act is important and shared knowledge within their culture (Csibra & Gergely, 2011). Overall, the term "cultural learning" supports cultural evolution and refers to a type of social learning where teaching is key to our social and cognitive development (Heyes, 2016).

Adults use a specifically adapted form of communication called ostensive communication, to convey their intentions when teaching infants. Ostensive communication includes cues such as eye contact, smiling and addressing the listener by their name, which are understood to signal a caregiver's intent to communicate

relevant information to their infant (Russell, 1940). By using the theory of Natural Pedagogy, we are able to understand the role of ostensive cues in the facilitation of cognitively opaque cultural knowledge in aiding infants' receptivity to information communicated to them. This theory expands our knowledge of infant social learning as it posits that when ostensively communicated information is observed, it is encoded differently compared to when that same action is demonstrated in a non-communicative context (Csibra & Gergely, 2009). This means that it is understood to be relevant knowledge and is more likely to be encoded in memory and applied to different contexts in future. In brief, when we are thinking about the concept of ostensive communication and learning, there are a few important points of natural pedagogy to consider. Csibra and Gergely (2009) propose that knowledge acquired is generalised or shared; information communicated via ostensive communication is relevant to the context and finally, ostensive cues facilitate reference. This means that ostensive communication encourages an infant to follow an adult's gaze which makes it more likely that they will learn about the object. Thus, Csibra and Gergely (2006; 2009) propose that ostensive communication is the mechanism of natural pedagogy which allows for the transmission of generic, culturally relevant knowledge through generations. Although studies vary in how they define ostensive cues, eye contact, infant-directed speech (IDS), contingent reactivity to the infant's behaviour and addressing the listener by their name are cues which are frequently referred to as ostensive (Csibra & Gergely, 2011; Király, Csibra & Gergely, 2013).

### **Imitative Learning**

As previously discussed, infants learn from adults by observation and imitation. This differs from other proposals of learning such as 'trial and error learning' which is both time consuming and would no doubt involve risks to infants

making dangerous errors in order to learn (Meltzoff, 1999). There is a wide range of literature to show that infants imitate adults (Carpenter, Nagell, & Tomasello, 1998; Nielson, 2006; Shneidman, Todd, & Woodward, 2014). Meltzoff's (1988) study on infant imitation involved 14-month-old infants who were shown actions using novel objects by a demonstrator. One unusual novel action involved the demonstrator touching the top of a box with their forehead, causing the box to light up. Meltzoff aimed to investigate whether infants would imitate this meaningless forehead action and the results demonstrated imitation after the week delay. Specifically, 67% of infants in the imitation group touched the panel with their forehead compared with none of the control group infants spontaneously touching the panel with the top of their head. Furthermore, in another study by Meltzoff (1995) infants aged 14 and 18 months imitated an action up to 4 months after observing it, demonstrating memory for imitative learning. There was evidence of some forgetting as the delay from the time of the experiment increased. The finding from Meltzoff's (1988) lightbulb study is extremely interesting as it raises the question of why infants re-enact a meaningless action when they could have used their hands to touch the box instead. Csibra and Gergely (2009) use the natural pedagogy hypothesis to propose that the novel head action may have been ostensively communicated by the adult and so infants may have imitated the action as it was seen as culturally relevant.

Gergely, Bekkering and Király (2002) replicated Meltzoff's (1988) study but included two conditions; one where the model's hands were visibly occupied and one where the model's hands were visibly free. Results showed that most infants in the 'hands-occupied' condition did not imitate the head action but instead emulated the goal of turning on the lamp by using their hands. This means that infants recognised the end goal and used a different means (i.e., their hands) in order to achieve the goal

of turning on the light. In the ‘hands-free’ condition findings of Meltzoff’s (1988) study were replicated as they imitated the novel head action. The authors concluded that the 14-month-old infants imitated the novel head action however emulated when they could see that the demonstrator was physically unable to use their hands to turn on the light. This interesting finding was replicated in another study (Schwier, van Maanen, Carpenter and Tomasello, 2006) with 12-month infants. We can conclude that from 12 months, infants can understand the intentions of others and are able to utilise this knowledge to decide which components of a demonstration they should imitate.

The likelihood that an infant will imitate and learn has also been studied in the area of ostensive communication. Our knowledge of the theory of natural pedagogy leads us to assume that when adults mark information for infants as important and intended for them, infants may learn more robustly (Shneidman, Todd and Woodward, 2014).

### **A Caregiver’s Response and Infant Learning**

An overlap appears to exist between some ostensive cues and the concepts of mentalisation, reflective functioning and epistemic trust. Fonagy, Gergely, Jurist and Target (2002) define mentalising as the implicit and automatic perception of behaviour in relation to mental states such as needs, feelings and goals. When a mother adopts a mentalising stance, their infant is seen as an individual who possesses their own thoughts, feelings, needs and desires. The overlap between this concept and ostensive cues exist when we consider how mentalising-in-the-moment is operationalised as Fonagy and colleagues (2002) state that the interaction may include the use of ostensive cueing as well as “affect focus” and contingent interaction. This refers to “affect mirroring”, when a caregiver responds with cues to

display their own experience in response to their infant's experience which in turn encourages the infant's development of self-awareness and self-regulation (Sharp et al., 2018).

When a child trusts an adult, they may be more willing to consider the knowledge being communicated to them as it is coming from a trustworthy and reliable source (Sharp et al., 2018). The mentalising stance is understood to facilitate epistemic trust in others (Fonagy & Allison, 2014). Attachment research has demonstrated that infants are more likely to learn and accept information from an adult that has an existing relationship with them (Buttelmann, Zymj, Daum & Carpenter, 2013; Howard, Henderson, Carrazza & Woodward, 2014; Shimpi, Akhtar & Moore, 2013, as cited in Shneidman, Gaskins & Woodward, 2016). Sharp and colleagues (2018) suggest that sensitive caregiving in the form of mentalising and epistemic trust can encourage infants to be open to social learning.

### **Maternal Stress**

Research in the field of mentalisation suggests parental reflective functioning may be linked to higher tolerance of infant distress. This increased tolerance is believed to also act as a coping mechanism in relation to parenting stress (Rutherford, Goldberg, Luyten, Bridgett, & Mayes, 2013). The importance of supporting parents in managing stress is therefore crucial in terms of the parent-child relationship (Adkins, Luyten & Fonagy, 2018).

### **Ostensive Cues**

Fillingham's (2018) meta-analysis usefully aims to unite ostensive cueing research, with a focus on the quantitative effect of ostensive cueing on learning. From the thirty-four papers that were reviewed, a small to medium (Cohen, 1977) significant positive effect of ostensive cueing was found. This means that overall,

most studies reported better learning outcomes for participants in the ostensive cueing condition than those in the comparison condition.

Research on ostensive cues have covered a range of learning paradigms. For example, studies have investigated the use of cues in learning; category and concept formation (Butler & Markman, 2012; 2014; 2016; Butler & Tomasello, 2016; Futó et al., 2010; Butler, Schmidt, Bürgel, & Tomasello, 2015), novel objects or actions (Meltzoff, 1988; Gergely, Bekkering and Király, 2002; Schwier, van Maanen, Carpenter, and Tomasello, 2006) and word learning (Floor & Akhtar, 2006). Methods used for demonstrating actions have also differed in terms of who the demonstrator is. It appears that most studies involve actors or researchers, and this may be to ensure consistency of demonstrations.

Despite the large amount of research on ostensive cues, Fillingham (2018) raises a number of important criticisms regarding existing research. Firstly, there are a lack of ostensive cueing protocols therefore, developing well defined protocols would allow for better comparisons of ostensive cueing effects between studies. Secondly, although there is evidence for the role of ostensive cues in learning, no studies have considered whether a difference exists between specific cues. For example, would a demonstration communicated using IDS yield better learning outcomes than a demonstration using eye contact alone? This also raises the question of whether multiple ostensive cues used in a short amount of time produces better learning outcomes compared to when only one ostensive cue is used. Another important point to consider is the use of actors in experimental studies. Although this allows for consistency of demonstrations, it results in low ecological validity as the effect of a primary caregiver's 'real-life' ostensive cueing when teaching their infant cannot be explored.



## **Current Study**

Considering the existing research on ostensive cues and infant learning, the present study will aim to add to this field of research but hopes to address some of the criticisms offered above.

### ***Using an Ostensive Cues Tool on Existing Learning Paradigms***

As discussed, there is a lack of standardisation of learning paradigms across studies. In order to address this, the current study will be based on existing paradigms but will use an ostensive cues coding tool. This will aim to improve standardisation of factors such as a definition of ostensive cues and therefore will aim to increase standardisation across studies. Task A of the study will be based on Meltzoff's (1988) imitation paradigm and Task B will be based on a word-object learning study by Floor and Akhtar (2006). This study was chosen as it involves a different type of learning compared to the imitation paradigm. Furthermore, parents frequently teach their infants names of objects during early development in order to lay the foundation for lexical development. Floor and Akhtar's study was designed to investigate whether 16 to 20-month-old infants can learn new words from overheard speech rather than being directly addressed. The within-subjects design involved infants being randomly assigned to either an 'over-hearing' or 'addressed' condition. The study included two sets of training rounds, each followed by a comprehension trial and a preference control trial. Results demonstrated that infants as young as 18 months can learn words through overhearing, when memory demands are not too high. The present study replicated this design to investigate whether two different conditions of ostensive cueing would impact word-learning.

### ***Use of Primary Caregiver rather than an Experimenter***

There is an absence in the literature of research considering the use of mothers' ostensive communication as most research involves an infant and an experimenter or demonstrator. It is important to include interactions between mothers and infants that are as natural as possible when investigating ostensive communication and infant learning to develop our knowledge in the complex field of social learning. This in turn could extend to clinical purposes.

### ***Comparing Ostensive Communication with Restricted Ostensive Communication***

Considering the literature on ostensive communication and infant learning, the present study will include two conditions; (1) Semi-naturalistic ostensive communication, and (2) restricted ostensive communication. By instructing mothers to restrict certain cues in one condition, knowledge can be further developed by comparing infant learning outcomes in these two conditions. Furthermore, insight can be gained into whether there are one or two particular ostensive cues which have a significantly larger role to play in infant learning.

### ***Reflective Functioning, Parental Stress and IQ***

The proposal that a caregiver who indicates to their infant, through the use of ostensive cues, that they are about to teach them something relevant is also engaging in mentalisation suggests that the teaching and learning process is complex. The concept of mentalisation is operationalised in research through reflective functioning. In order to explore mentalisation further, the present study will use a self-report measure of reflective function to explore the relationship between this concept, the use of ostensive cues and infant learning. In a validation study of the Parental Reflective Functioning Questionnaire (PRFQ), pre-mentalising (PM) was a feature of the questionnaire which was related to a non-mentalising stance. Mothers' PM was significantly negatively related to level of education and significantly positively

correlated with parenting stress (Luyten, Mayes, Nijssens, & Fonagy, 2017). As we anticipate a relationship between learning outcomes and the use of ostensive cues, we may also anticipate evidence of mentalisation and low self-reported parental distress.

When considering infant learning and social development, the contribution of maternal IQ could be worth considering. Research has suggested that although there are a wide range of factors that influence intelligence, IQ is approximately 50% heritable (DiLalla, 2000). Thus, the present study will administer a test of IQ for the mother to complete in order to explore whether there is a relationship between maternal IQ and use of ostensive communication. In sum, it would be interesting to observe if any patterns exist between higher maternal IQ and higher infant learning outcomes.

Using a measure of ostensive cues in infant learning research, replicating existing paradigms and exploring the relationship between ostensive cues, parental distress and infant learning has a number of clinical implications. This work could help to inform clinical practice with the aim of improving infant social development. Furthermore, an exploration of parental distress on infant learning could encourage future studies to compare non-clinical and clinical groups of parents which would have strong clinical implications for psychological practice.

**Aims:**

The study has 3 aims:

1. To replicate existing infant learning paradigms in order to capture maternal use of ostensive cues by using a newly developed ostensive cues coding tool.

2. (Primary aim) To explore whether infants in the ‘ostensive cues’ condition imitate a novel action and have higher learning outcomes than infants in the ‘restricted cues’ condition.
3. To investigate whether infant imitation and learning are related to constructs such as high maternal IQ, low maternal stress, and evidence of maternal mentalisation.

## **Method**

### **Joint Project**

This was a joint project with Jeffy Chun Yu Ho, Trainee Clinical Psychologist. Ho (2020) developed and validated the ostensive cues coding tool (see Appendix A for a detailed summary of researcher involvement).

### **Ethics**

Ethical approval was granted by the University College London (UCL) Ethics Committee (Reference 16673/001; Appendix B). The study was also issued UCL Data Protection Registration (Z6364106/2019/10/66).

In order to inform participants about the study before they arrived, an information sheet was either posted or emailed to them at least 24 hours prior to their visit. The researcher also read through the information sheet with the participant on the day of the study (Appendix C). All participants provided informed consent (Appendix D) and no risks for taking part in the study were anticipated. A debrief was provided at the end of the study (Appendix E) and participants were given the opportunity to ask questions.

### **Participants**

#### ***Recruitment***

Volunteer and opportunity sampling procedures were employed to recruit mothers with infants aged 14-22 months. As part of the experiment was based on Floor and Akhtar's (2006) study, the current study aimed to replicate their age range of 16 to 20 months. However, due to requiring an adequate sample size, we included infants aged 16-22 months and advertised for infants aged 14-22 months with the view that near the end of data collection, the 14-month infants would have turned 16 months and would therefore be eligible. A poster was made which advertised the study (Appendix F). It briefly explained that the study is looking at mother-infant learning and also stated incentives of taking part which included receiving an 'Anna Freud Centre Bib' which was designed by the researchers, as well as £17. The manager of North London libraries was contacted and with their permission, mother and baby classes were attended (such as Baby Bounce and Under 5s class). At the beginning of the class, the researcher showed their flyer and briefly explained the purpose of the study. At the end of the class, interested mums approached the researcher to give their contact details. Flyers advertising our study were also left in children's libraries in North London. Other infant organisations in North London were also contacted (such as Baby Barre, etc). Flyers advertising our study were distributed on social media platforms (Twitter, Facebook and Instagram). Influencers with a high number of followers with mother-infant content were also contacted to request they share our flyer via Instagram stories.

Once mothers provided their contact details, an email was sent to them requesting basic information necessary for the study (such as their baby's date of birth). Mothers were then contacted nearer the time of the study to organise booking in their experiment visit to the centre. Over 65 mother-infant pairs were recruited for the study.

### ***Inclusion and exclusion criteria***

Only mothers and their infants were required to take part in the study. Infant participants who took part in our study were 16 to 22 months old. Mothers were not excluded if their first language was not English and were encouraged to speak English if they also speak the language with their baby at home.

### ***Power Calculation***

Meins, Faernyhough, Fradley and Tuckey (2001) investigated predictors of attachment security using a sample of mothers and their 6-month-old infants. They found that the two variables that were most strongly related to maternal sensitivity were ‘maternal responsiveness to change in infant’s direction of gaze’ and ‘appropriate mind-related comments’. Each of these variables accounted for 16% ( $r^2 = .16$ ) of the variance in sensitivity. A power calculation was carried out using G Power (Faul, Erdfelber, Lang, & Buchner, 2007), giving an estimated sample size of 52 to provide 80% power with an alpha level of 0.05.

### **Setting**

The study took place in the same room at the Anna Freud National Centre for Children and Families (AFC). The room included 4 in-built cameras and a laptop which was used to record the study and the content of all cameras were visible. The room was set up with a low, round table and a chair for the mother on one end, and a baby chair for the infant to sit opposite their mothers. The lamp was attached to the table with a clip and blue tack so that it was not able to be easily removed by the infant. In the middle of the room, there was a brightly coloured rug. The objects for the study were kept on the high stand next to the laptop, outside of the infant’s gaze. Toys were kept behind cushions near the experimenter.

## **Design**

The experiment used a 2x2 mixed experimental design. Participants were randomly allocated into two groups; semi-naturalistic ostensive communication (SNOC), and restricted ostensive communication (ROC). The two learning paradigms were replications of previous studies. Task A investigated imitation of a novel action of switching on a lamp with their head (modified from Meltzoff, 1988) and Task B investigated novel word-object learning by modifying a previous study (Floor & Akhtar, 2006).

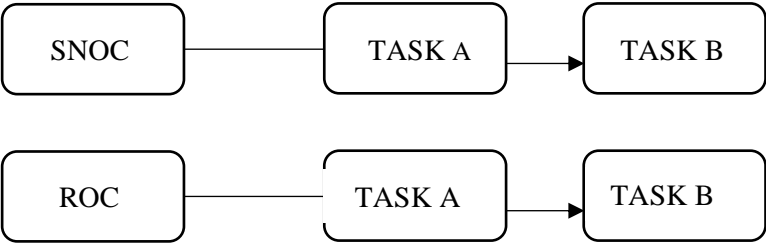
### *Semi-Naturalistic Ostensive Communication (SNOC)*

This group aimed to allow for natural mother-infant interactions whilst standardising the experimental procedure in order to complete the two learning paradigms. Mothers were given instructions on how to complete the learning tasks (through watching a video instruction and being provided with prompt sheets to help them remember what they needed to do during the study) and were encouraged to try to interact as naturally as possible with their infant.

### *Restricted Ostensive Communication (ROC)*

Ostensive communication was manipulated in the ROC group in order to allow for comparisons of the role of ostensive communication in infant learning between the two groups. Mothers were clearly instructed to not address their infant by their name and to not use infant-directed speech (IDS). These cues were chosen by running a pilot study with two participants who had already taken part in the SNOC group. The possibility of restricting eye contact was deemed to be too challenging as the mothers stated it felt unnatural and other cues such as contingent responses involved limiting a high number of cues and thus, was again too challenging. Mothers in the ROC group were given an opportunity to practise limited

name addressing and IDS with the experimenter. As with the SNOC group, the ROC group had an opportunity to watch a video demonstrating the task and were provided with prompt sheets during the experiment to help them remember the tasks and which cues they needed to restrict.



**Figure 1.** Diagram of the two groups

*Task A: Novel Action Imitation Paradigm (switching on the lamp by using their forehead)*

The present study was based on Meltzoff’s (1988) experiment (see introduction). Mothers demonstrated turning on a lamp by touching a box with their forehead. Infants took part in Task B which also served as deferred imitation as they were asked by their mother to turn on the lamp after the completion of Task B.

*Task B: Novel Word-Object Learning*

The design of Task B replicated Floor and Akhtar’s’ (2006) word learning study (see introduction). The aim of the task was for the mother to teach her infant the names of the objects, using any method she liked. She was instructed to name the object up to five times during the teaching phase in order to reduce the likelihood of a ceiling effect. As with Floor and Akhtar’s study, the present task consisted of a ‘familiar items comprehension’ round in order to familiarise them with the procedure. This was followed by two sets of ‘novel items ‘training’ rounds. To assess comprehension, infants were asked by their mothers to select the target object



immediately after the mother had named the object and also at the end of the round once all objects had been taught.

### **Procedure**

Mothers were contacted via phone or email to organise a date to visit the AFC for the study and an appointment letter was sent to confirm the study date (Appendix G). Prior to their visit, they were posted an information sheet, consent form and self-report questionnaires to complete and we requested they bring the measures with them on the day of the study. Participants were also informed that upon arriving at the centre, the experimenter will avoid eye contact and interaction with the infant and therefore may appear 'cold'. This was to prevent the experimenter and infant building a relationship as it may impact the experiment. Participants who had not received the questionnaires or who did not bring them, were asked to complete them upon arrival to the AFC. Study date reminders were texted or emailed the day before the study and mothers were also told that due to the purpose of the study, the experimenter would avoid any interaction including eye contact with their infant until after the study has taken place.

### *Briefing Phase*

The experimenter met with the mother and their infant in the reception area and written consent was obtained (Appendix D). The experimenter briefly explained the study and mothers were shown a video on a laptop or iPad with earphones, which included the two experimenters acting as a mother and infant. The purpose of this video was to demonstrate the tasks. The mother had an opportunity to ask questions after watching the video. The experimenter encouraged mothers to try and be as natural as possible when interacting with their infant, despite being in an unfamiliar environment with cameras. Before the mother and infant were taken into the study

room, the experimenter went back to the room to ensure that the cameras were recording.

### *The Experiment*

The experimenter led the mother and infant to the study room. The room was set up with the aim of appearing ‘welcoming’ and ‘homely’ to help both the mother and infant feel at ease. This room consisted of a table with a small lamp attached to it. The experimenter had the remote for the lamp and so was the only person who could control turning it on and off. At either end of the table was a chair; one for an adult and one for an infant. In the middle of the room lay a colourful rug with cartoon ducks on it. There were also large cushions in the room. Four cameras, one on each wall, were wired in and connected to a laptop which was out of reach of the infant in the corner of the room. This corner is where the experimenter stood during the study and attempted to be both neutral-faced and silent during the study. It was important that the experimenter was in the room to guide the mother through the study and transitions however the experimenter tried to remain as ‘invisible’ as possible in order to for the interactions between the mother and infant to be as natural as possible.

Once all tasks are complete, the experimenter stopped the recording and was allowed to interact naturally with the infant. The infant was given toys to play with whilst the cognitive assessment was administered to the mother.

Upon completion of the cognitive assessment, the experimenter thanked the mother and infant for taking part in the study and gave the mother a debrief form. Mothers were also thanked for the participation with £17 and the infant was given a bib designed by the experimenters.

**Table 1***Procedure of the Study*

<b>Task</b>	<b>Aim and Details of Task</b>
<b>Free play without toys</b>	Familiarisation to the room for 3 minutes.
<b>Free play with toys (3 minutes)</b>	Experimenter placed a toy in the middle of the room for the mother and infant to play with for 3 minutes.
<b>Task A Transition</b>	The experimenter showed the instruction video of Task A. The toy was taken away, and the mother and infant instructed to sit at the table. The experimenter placed an instruction sheet (Appendix H) and a small box on the table in front of the mother.
<b>Task A (3 demonstrations)</b>	Mother demonstrated turning on the lamp by touching her head to the box (lamp is switched on by experimenter using a remote behind their back). This action of turning on the light was repeated two more times.
<b>Task B Transition 1</b>	The experimenter removed the box. The mother was shown the instruction video of Task B and the mother and infant moved from the table to the floor. The experimenter placed an instruction sheet and a small, shallow box in front of the mother and infant which contained 4 plastic objects (ball, banana, car, toy). The mother gave her infant a small amount of time to look at the objects and asked which object was their favourite. The infant's favourite toy was handed to the experimenter who put it on the shelf out of sight.
<b>Task B Familiar Objects</b>	The mother presented each object, one at a time. After teaching one object, the mother asked the infant to show her the object,

<b>(3 demonstrations)</b>	e.g., “which one is the car?” After teaching the names of all 3 objects, the mother asked her infant to show each object, e.g., “which one is the car? Which one is the banana?” and so on. The mother was instructed to ask her infant up to two times to show the object and not to worry if they do not give the correct answer.
<b>Task B Transition 2</b>	The ‘familiar toys’ were removed and replaced with 4 novel toys. These toys were novel as it was expected that the infant may not have encountered them before. The novel toys had labels on them with their name on (sifa, biku, viko and lopot). The transition was the same as Task B Transition 1 as the infant’s favourite toy was selected and removed.
<b>Task B Novel Objects Part 1 (3 demonstrations)</b>	The procedure was identical to ‘Task B Familiar Objects’ as the names of the novel objects are taught and the infant was asked to select each object.
<b>Task B Transition 3</b>	The ‘Novel Objects Part 1’ were removed and replaced with 4 new novel toys (saka, toma, yossi and modi). The transition was the same as Task B Transition 1 and 2.
<b>Task B Novel Objects Part 2 (3 demonstrations)</b>	The procedure was identical to ‘Task B Novel Objects Part 1’. Once the task was complete, the experimenter removed the objects.
<b>Transition</b>	The mother watched the instruction video of ‘test of task A’ and guided her infant to the same set up of Task A where they sat at the table with the lamp attached. The experimenter placed the box (which acted as the lamp switch) in front of the mum.
<b>Test of Task A</b>	The mother moved the box in front of her infant and asked them to switch on the light.

### **Coding Tool (Ho, 2020)**

A newly developed coding tool was developed by Ho (2020) with the aim of providing a scale and operational definition of ostensive communication. Part of this joint project consisted of the two authors testing the tool for inter-rater reliability. All items in the coding system demonstrated an “excellent” agreement between the two coders, as the interclass correlation coefficients (ICCs; Shrout & Fleiss, 1979) ranged from 0.82 to 0.98. The tool was used in this study by watching the recording of the experiment and rating the mother-infant pairs on a range of factors related to their communication. If you would like further details about the coding tool, please contact the researchers; Shruti Jamnadass (Shruti.Jamnadass.17@ucl.ac.uk) or Jeffy Chun Ho (Chun.Ho.10@ucl.ac.uk).

### **Measures Administered**

#### ***Demographics (Appendix I)***

Characteristics such as age, ethnicity, years of education and household income were collected.

#### ***Test of Non-Verbal Intelligence Fourth Edition (TONI-4)***

The TONI is a language-free test which measures intelligence, aptitude, abstract reasoning, and problem solving. It is suitable to be administered to individuals between the age of 6 to 89 years.

#### ***The Brief Symptom Inventory (BSI) (Derogatis & Spencer, 1982)***

The BSI is a 53-item self-report measure that can serve as a brief psychological screening instrument. It was originally developed to rapidly identify levels of distress among cancer patients to ensure early identification and intervention. Participants rate their level of distress during the past week using a 5-point Likert scale ranging from 0 (not at all) to 4 (extremely). The BSI measures

three primary dimensions; somatisation, depression and anxiety. A global severity index (GSI) is calculated from the total mean and is used as a measure of overall psychological distress. The BSI takes approximately 10 minutes to complete.

Cochran and Hale (1985) report norms for females from a non-patient sample.

***The Parental Reflective Functioning Questionnaire (PRFQ) (Luyten, Mayes, Nijssens, & Fonagy, 2017)***

The PRFQ is an 18-item assessment of parental reflective functioning. The self-report measure was primarily developed for parents with children aged 0-5 years as it focuses on a parent's ability to be sensitive and responsive to their child's needs (Luyten, Mayes, Nijssens, & Fonagy, 2017). Items relate to three subscales which represent different aspects of mentalising; interest and curiosity in mental states, certainty of mental states and pre-mentalising. Firstly, 'Interest and curiosity' (IC) in an infant's mental state represents motivation in understanding behaviour through how an infant thinks and feels. Adopting some uncertainty of mental states allows for openness to alternative perspectives. Extremely low scores may be related to a lack of interest in regard to the infant's mental state however extremely high scores may indicate intrusive hypermentalisation. Secondly, a high level of 'certainty of mental states' (CM) may appear to be a trait of mentalisation but in fact, can be inaccurate, intrusive or self-serving. Finally, 'pre-mentalising' (PM) is a lack of mentalising and can lead to difficulties in later childhood and adulthood (Cooke, Priddis, Luyten, Kendall, & Cavanagh, 2017). According to the author, there is no published normative data for the PRFQ.

***Parenting Stress Index, Fourth Edition Short Form (PSI-4-SF)***

The PSI-4-SF is a 36-item self-report screening tool which aims to assess the level of stress parents experience due to their parenting role. It comprises of three

subscales; Parental Distress (PD) (relates to personal factors related to parenting), Difficult Child (DC) (assesses the extent to which the parent-child relationship is influenced by the temperament and behaviour of the child) and Parent-Child Dysfunction Interactions (P-CDI) (explores a parent's perception of their child such as whether expectations are being met). Administration of the PSI-4-SF takes approximately ten minutes and scoring takes around five minutes. The PSI-4-SF is suitable for adults aged 18 to 64 years old. Cut-off scores from a non-specific patient population (Abidin, 2012) are as follows; PD 40 and 60, P-CDI 36 and 60, DC 40 and 60, Total Stress 114 and 180 and Defensive responding would be scores that are less than 10. Test-retest coefficients of the PSI-SF subscales range from good to acceptable (0.68 to 0.85) and internal consistency of the subscales range from good to excellent (Cronbach's  $\alpha = 0.88$  to 0.95).

### **Re-developed Design due to Covid-19**

Due to the occurrence of Covid-19, the Anna Freud Centre closed in March 2020. Upon its closure, 30 participants had been tested (14 in group 1, 5 in group 2, 5 pilots and 6 whose data could not be used due to factors such as the mother not administering the task correctly or the infant not wanting to complete the tasks). Given the low sample size and power, the study was re-designed in order to utilise the results collected in the most effective way. Discussions were held with the experimenter's two research supervisors with an aim of re-thinking data analysis whilst being aware of the research questions.

It was agreed that only participants from condition 1 would be used in the data analysis as this condition consisted of the majority of the collected data. Unfortunately, as it was not possible to use data from group 2 (ROC), the aims of the study were re-developed:

1. To investigate whether imitation of a novel action and learning novel words are related to a mother's use of ostensive communication as measured by a newly developed coding tool. Based on literature, it is hypothesised that infants who learn the highest number of novel words and imitate the lightbulb task will be exposed to more ostensive cueing during the task compared to those who learnt the least number of novel words.
2. To investigate whether infant imitation and learning are related to constructs such as mother's level of IQ, mother's stress levels, and mother's reflective functioning. Based on literature, it is hypothesised that infants who learn more tasks will have mothers who scored higher on the TONI, scored lower on the BSI and PSI, and showed evidence of mentalisation on the PRFQ than those infants who learnt fewer tasks.

### **Method of Data Analysis**

The original study intended to use logistic regression in order to analyse whether infant learning was predicted by the range of variables (maternal ostensive communication, IQ, psychological distress, parental stress and mentalisation). However, due to the low sample, the quantitative study was re-developed to be a qualitative study. The data from the 14 participants in group 1 (SNOC) was used to calculate means and standard deviations of the sample. From these 14 participants, 3 participants who learnt the highest number of tasks, along with 3 participants who learnt the least number of tasks were selected for an in-depth analysis. Totals were calculated from both task A and B which also included scores calculated for the transitions between tasks. Total frequencies and Likert scales were divided by the time taken to teach the task to enable comparisons between participants. For



example, it may have been possible that participants who took longest to teach a task would have had more opportunity for eye contact, resulting in it appearing that they made more eye contact.

## Results

From the six mother-infant pairs that were selected for in-depth analysis; three infants learnt the most tasks (Group A), and three learnt the least number of tasks (Group B). The means presented in the tables are derived from the sample of 14 participants.

**Table 2**

*Demographic Characteristics*

Demographic Variables	<i>M</i> (SD) or N (%)
Infant's Age	19.38 (2.14)
Infant's Gender	
Male	6 (43%)
Female	8 (57%)
Infant's Ethnicity	
White - British	4 (29%)
White – Any other White Background	8 (57%)
Mixed – White and Asian	1 (7%)
Chinese	1 (7%)
Mother's Age	34.08 (2.78)
Mother's Ethnicity	
White - British	5 (36%)
White – Any other White Background	8 (57%)
Chinese	1 (7%)
Mother's Level of Education	

A Level, Vocational level 3 or equivalent	1 (7%)
Higher Education or professional/vocational equivalent	3 (21%)
Post-graduate education or Professional/vocational equivalent	10 (71%)
Household Income (£)	
10,000 – 20,000	2 (14%)
20,000 – 35,000	2 (14%)
35,000 – 50,000	1 (7%)
50,000 – 75,000	4 (29%)
75,000 – 100,000	1 (7%)
100,000+	3 (21%)
No response	1 (7%)
Use of Mental Health Services	
Yes	4 (29%)
No	10 (71%)

---

*Note: M = Mean; SD = Standard Deviation*

Out of the six participants selected for analysis, participant 47's age was highest as both the infant's (22 months old) ( $M = 19.14, SD = 2.25, z = 1.27$ ) and the mother's (39 years old) ( $M = 34.21, SD = 2.72, z = 1.02$ ) age differed when compared to the mean of the full sample. In contrast, participant 35's age was lowest out of the total six participants for both infant age (16 months old) ( $M = 19.14, SD = 2.25, z = -1.40$ ) and mother's age (30 years old) ( $M = 34.21, SD = 2.72, z = -1.55$ ).

### **Infant Learning Outcomes**

Out of the 14 participants, 9 infants imitated Task 1, which demonstrated that 64.3% of the sample imitated the novel head action. From these 14 participants, three infants who scored the highest learning outcomes and three who scores the lowest

were selected to provide an in-depth analysis. Six participants were chosen as the researchers felt that it was an appropriate sample size to carry out an in-depth qualitative analysis. Thus, the aim was to have 3 mother-infant pairs whose infant scored very low in the tasks and 3 who scored very high in the task. In terms of the method used to select the six participants from the full 14 participant sample, the researcher placed more weight on the infant’s performance in Task A, as it was clear whether infants had imitated the head action and this study had already been replicated a number of times in other studies. In order to make the selection the researcher first noted which participants correctly performed Task A. Next, the researcher ranked the participants in order of their performance in Task B. There was one participant who did not perform Task A correctly, however gained a high score in Task B, therefore the researcher chose to include this participant in Group A (the high scoring group) as opposed to an infant who performed Task A correctly but demonstrated a low score for Task B. The in-depth participant descriptions offered in the results section often describes the performance of the participant in relation to the mean. Here, the mean relates to the sample of 14 participants.

**Table 3**

*Participant Scores in Task A*

	Group A					Group B					Total (Full Sample)	
	Ppt.	Ppt.	Ppt.	M	SD	Ppt.	Ppt.	Ppt.	M	SD	M	SD
	20	34	47			15	35	55				
Time (seconds)	96	74	108	92.67	17.24	159	69	52	93.33	57.50	78.50	31.86
Attention	1.50	1.50	1.75	1.58	0.14	1.75	1.75	1.25	1.58	0.29	1.64	0.29
No. of Eye Contact/ Time	0.09	0.07	0.05	0.07	0.02	0.07	0.06	0.02	0.05	0.03	0.08	0.03

No. of Name Addressing/ Time	0.01	0.01	0.04	0.02	0.02	0.01	0.06	0.10	0.06	0.05	0.04	0.03
Quality of IDS	1.06	0.81	1.81	1.23	0.52	0.75	1.31	1.06	1.04	0.28	1.18	0.37
Sum of IDS/Time	0.18	0.18	0.27	0.21	0.05	0.08	0.30	0.33	0.24	0.14	0.27	0.09
Sum of Scaffolding/ Time	0.27	0.20	0.30	0.26	0.06	0.11	0.30	0.31	0.24	0.11	0.26	0.09
Quality of CB	0.25	0.25	0.92	0.47	0.39	0.58	0.25	0.17	0.33	0.22	0.54	0.38
Sum of Quality of CB/Time	0.03	0.04	0.10	0.06	0.04	0.04	0.04	0.04	0.04	0	0.09	0.07
Warmth	1.00	0.25	1.50	0.92	0.63	1.50	0.75	1.00	1.08	0.38	0.91	0.39
Regulating Behaviours	0	0	0	0	0	0.25	0	0	0.08	0.14	0	0
Overall Emotional Support	0	0	1.25	0.42	0.72	0.88	0	0.63	0.50	0.45	0.38	0.51
Co-occurrence Sum	5.50	4.25	8.50	6.08	2.18	8.50	6.75	4.00	6.42	2.27	6.11	2.00

*Note:* CB: Contingent behaviours.

**Table 4**

*Participant scores in Task B*

	Group A					Group B					Total (Full Sample)	
	Ppt.	Ppt.	Ppt.	M	SD	Ppt.	Ppt.	Ppt.	M	SD	M	SD
	20	34	47			15	35	55				
Time (seconds)	706	676	596	659.3	56.86	420	511	892	607.6	250.4	491	190.94
				3					7	1		
Attention	1.92	1.75	1.92	1.86	0.10	2	1.33	1	1.44	0.51	1.63	0.39
No. of Eye Contact/Time	0.03	0.05	0.03	0.04	0.01	0.05	0.01	0.01	0.02	0.02	0.03	0.02

No. of Name Addressing/ Time	0.03	0.02	0.02	0.02	0.01	0.01	0.02	0.04	0.02	0.02	0.02	0.01
Quality of IDS	1.40	1.38	1.63	1.47	0.14	1.44	1.29	1.71	1.48	0.21	1.43	0.26
Sum of IDS/ Time	0.10	0.10	0.13	0.11	0.02	0.16	0.12	0.09	0.12	0.04	0.16	0.07
Sum of Scaffolding/ Time	0.16	0.14	0.13	0.14	0.02	0.21	0.19	0.15	0.18	0.03	0.19	0.05
Quality of CB	1.53	0.75	1.28	1.19	0.40	1.25	1.11	0.92	1.09	0.17	1.04	0.36
Sum of Quality of CB/ Time	0.08	0.04	0.08	0.07	0.02	0.11	0.08	0.04	0.08	0.04	0.08	0.04
Warmth	1.75	1.08	1.83	1.55	0.41	1.50	1.08	1.50	1.36	0.24	1.28	0.53
Regulating Behaviours	0.17	0.25	0.17	0.20	0.05	0.17	0.58	0.42	0.39	0.21	0.25	0.17
Overall Emotional Support	1.46	0.75	1.71	1.31	0.50	0.92	0.67	1.13	0.91	0.23	0.92	0.62
Co-occurrence	14.7	11.6	11.3	12.58	1.88	9	10	14	11	2.65	9.87	3.04
Sum	5	7	3									

**Table 5**

*Participant responses to the BSI, PRFQ and PSI*

	Group A					Group B					Total (Full Sample)	
	Ppt.	Ppt.	Ppt.	M	SD	Ppt.	Ppt.	Ppt.	M	SD	M	SD
	20	34	47			15	35	55				
BSI												
Somatisation	0.14	0	0	0.05	0.08	0	0	0.14	0.05	0.08	0.14	0.33
Obsession	0.33	0	0	0.11	0.19	0.50	0	0	0.17	0.29	0.61	0.86
Compulsion												
Interpersonal Sensitivity	0.50	0.50	0	0.33	0.29	0	0	0.50	0.17	0.29	0.80	1.02
Depression	0.17	0.33	0	0.17	0.17	0	0	0.67	0.22	0.39	0.29	0.32

Anxiety	0.50	0	0	0.17	0.29	0	0	0	0	0	0.45	0.67
Hostility	0.40	0.20	0	0.20	0.20	0	0	0.80	0.27	0.46	0.60	0.53
Phobic Anxiety	0	0	0	0	0	0	0	0	0	0	0.07	0.19
Paranoid Ideation	0	0	0	0	0	0	0	0	0	0	0.41	0.60
Psychoticism	0	0.20	0	0.07	0.12	0	0.20	0	0.07	0.12	0.09	0.15
GSI	0.21	0.11	0	0.11	0.11	0.09	0.08	0.25	0.14	0.10	0.38	0.40
PRFQ												
Pre-mentalising	2.17	1.67	1	1.61	0.59	1.33	1	1.50	1.28	0.25	1.61	0.57
Certainty about mental states	4.33	5.67	3.83	4.61	0.95	4	3.83	3.83	3.89	0.10	4.07	0.84
Interest and curiosity in mental states	6.83	6.17	5.67	6.22	0.58	7	6.33	5.50	6.28	0.75	6.08	0.65
PSI												
Parental distress	27	29	15	23.67	7.57	18	18	35	23.67	9.81	26.79	8.89
Parent-child dysfunctional interaction	17	13	13	14.33	2.31	19	12	20	17	4.36	17.07	7.30
Difficult child	22	13	16	17	4.58	21	16	41	26	13.23	23.21	9.54
Total	66	55	44	55	11	58	46	96	66.67	26.10	67.07	23.47

## **Participant 20 (Group A, 16 months old, Female)**

### ***Learning, Time and Infant Attention***

Participant 20 did not learn the lightbulb task but learnt a high number of the word-object task, therefore placing them in the “most learnt” category. The infant was not deemed to have learnt the imitation paradigm for Task A because instead of imitating the mother’s head action to turn on the light, the infant looked at both the switch of the main light, and then at the main light itself when asked to switch on the light. Even when the mother pointed to the lamp at the table and passed the box, it appeared that the infant did not remember what had been demonstrated 30 minutes

earlier. When looking at the time taken to administer the tasks, participant 20 spent 96 minutes on Task A which was in line with the mean of the sample. They spent 706 seconds on Task B which was 1 standard deviation above the mean. It may also be important to note that on two occasions, the infant appeared to be distressed due to constipation during Task B. As the infant overall demonstrated excellent learning in Task B but had appeared to have forgotten Task A, it is possible that the time delay was fairly long, and the infant had not retained the imitation paradigm. Across both tasks the infant displayed fairly good levels of attention.

### *Use of Ostensive Cues Across Tasks A and B*

Participant 20 used the most eye contact in Task A out of all six participants and when the frequency of eye contact used in Task A was compared with the other participants in the sample, Participant 20's eye contact frequency was 1 standard deviation above the mean ( $z = 1.06$ ). However, when the number of eye contact was divided by the time taken to teach Task A, it was within mean of the overall sample ( $z = 0.65$ ). This participant addressed their infant by their name the least amount of times out of group A and B in task A ( $z = -0.96$ ) however during Task B, they addressed their infant more. This may be in line with what we would expect as name addressing may be a factor that leads to infant learning.

Although the rating of the quality of IDS and the amount of IDS used appeared to be average compared to the sample, when the amount of IDS was divided by the time taken to teach both tasks, it was close to one standard deviation below the mean.

Other ostensive cues used by participant 20 in task A, such as scaffolding and CB, were in line with the sample mean. The mother's display of warmth also appeared to be fairly average.

Comparing the scores of Task A with Task B for participant 20, allows for a comparison that may be different to the other five participants. Participant 20 was the only participant chosen whose learning outcomes between the two tasks were different (i.e. group A participants learnt task A and B whereas group B did not learn Task A and did not score high in task B). Using participant 20 to compare scores allows for tentative analyses to consider whether the use of ostensive communication is task specific.

The infant appeared to be more focused during Task B (despite their distress relating to constipation noted above) and it is interesting to consider whether this was due to the mother's use of engaging behaviour and ostensive communication. Ostensive communication that was of note during Task B was the average quality of CB. Participant 20 also appeared fairly warm but not to the point of being one standard deviation from the mean. Participant 20 also scored fairly high in co-occurrence which indicates that the use of multiple ostensive cues within a short space of time may have contributed to learning in Task B.

Therefore, when comparing Task A and B, the scores do suggest a slight difference in ostensive communication. Overall, Participant 20's performance mostly appears to be in line with the sample mean however use of CB and time taken to teach the task may have had a factor in learning.

Overall, participant 20's scores did not fully support the hypothesis that higher learning would be due to a higher amount of ostensive communication.

### ***TONI and Self-Report Measures***

Participant 20 scored 107 on the TONI which indicates an IQ level which falls in the average range. Participant 20's scores on the self-report measures fall in the average range when compared to the mean of the sample. Of note, is that they



scored one standard deviation above the mean for IC on the PRFQ ( $z = 1.15$ ) which indicates a fairly high score. Although this may relate to high mentalisation, it is also possible that it indicates intrusive hyper-mentalising (Luyten, Mayes, Nijssens & Fonagy, 2017).

The results on the measures do not support the hypothesis that learning is linked to higher mentalisation.

### ***Observations and Overall Impression***

This mother's speech required translation as she conversed with her infant in a language other than English. The mother and infant appeared to be fairly in tune with each other and the mother generally appeared to have a gentle, sensitive approach with her infant. Due to the infant's high score on Task B, I was surprised that they were not able to perform Task A.

### **Participant 34 (Group A, 16 months old, Male)**

#### ***Learning, Time and Infant Attention***

Participant 34 imitated the lightbulb task and scored 7 out of 9 when asked the names of objects immediately and also scored 7 out of 9 when asked the names of the objects after a delay. The mother spent an average amount of time teaching both tasks and the infant showed fairly good levels of attention across both tasks A and B.

#### ***Use of Ostensive Cues Across Tasks A and B***

In Task A, Participant 34 scored the lowest for demonstrating warmth towards their infant when compared to the sample of the mean ( $z = -1.71$ ). In Task B, out of all six participants, participant 34 exhibited the most amount of eye contact with their infant ( $z = 1.86$ ). They scored the lowest in scores relating to scaffolding language ( $z = -1.08$ ) which means that out of all six participants, participant 34's

language lacked guiding the infant to the task or narrating the task. Interestingly, when the sum of the Likert scale of CB were added and divided by the time, participant 34 had very similar scores of CB in both tasks. Therefore, the mothers use of CB may not have been task-specific and could be a glance into how her and her infant usually communicate. Overall, participants 34's scores for scaffolding and CB are not in line with what we would expect given the infants learning outcome.

Participant 34's scores did not fully support the hypothesis that learning would be due to a higher amount of ostensive communication.

### ***TONI and Self-Report Measures***

Participant 34 scored 107 on the TONI (average IQ). They scored the highest out of all six participants in the 'certainty about mental states' subscale of the PRFQ ( $z = 1.91$ ). This score may indicate intrusive or hyper-mentalising and therefore low reflective function. In terms of the PSI subscale called 'difficult child', participant 34 scored the lowest score out of the six participants ( $z = -1.07$ ) which indicates that the temperament and behaviour of the child does not have a large impact on the mother-child relationship. All other scores were seen as falling in the 'average' range compared to the sample mean and the normative sample mean.

The results on the measures do not support the hypothesis that learning is linked to higher mentalisation.

### ***Observations and Overall Impression***

When observing this mother, she appeared calm during the study. Although she gave direction, she appeared to mostly go at her infant's pace and allowed them to explore the objects.

### **Participant 47 (Group A, 22 months old, Female)**

#### ***Learning, Time and Infant Attention***

Participant 47 imitated the novel head action to turn the lamp on and scored 7 out of 9 when asked the names of objects immediately after they were taught. The time taken to teach Tasks A and B were within the means of the sample. The infant demonstrated high levels of attention across both tasks.

### ***Use of Ostensive Cues Across Tasks A and B***

As Participant 47 imitated the lightbulb task (Task A) and learnt the majority of the word-object (Task B), the mother's use of ostensive cues during these tasks can be compared to explore whether there are any patterns.

Overall, Participant 47's performance on the tasks demonstrated many interesting results. Out of all 6 participants, the majority of participant 47's behaviour in Task A was 1 standard deviation from the sample mean. Participant 47 made the least amount of eye contact with their infant in Task A ( $z = -1.09$ ). Participant 47 exhibited the highest for both quality of contingent behaviours ( $z = 1.00$ ) and quality of infant-directed speech ( $z = 1.69$ ) in Task A. Warmth ( $z = 1.52$ ) and the score for overall emotional support ( $z = 1.71$ ) that the mother provided in Task A were high when compared to the means of the sample population. Participant 47's score for co-occurrence was also high ( $z = 1.33$ ) which indicates that this participant used a high number of ostensive cues within a short space of time in Task A.

Participant 47's language in Task B rated lowest in terms of scaffolding amongst the six participants ( $z = -1.32$ ) which means they used the least amount of language that served to guide their infant towards the task or narrate what was happening during the task. Similar to participant 47's scores in task A, in Task B they scored highest out of all six participants on both warmth towards their infant ( $z = 1.04$ ) and overall emotional support offered ( $z = 1.27$ ).

### ***TONI and Self-Report Measures***

Participant 47's index score on the TONI was 117 which indicates her IQ is classed as 'above average' when compared to a normative sample ( $z = 1.13$ ). This score was also above average when compared to the study sample ( $z = 1.35$ ).

Participant 47 scored 0 on all scales of the BSI which indicates that the participant was not experiencing any symptoms of psychological distress. Participant 47 scored the lowest out of all six participants on the 'parental distress' subscale of the PSI-SF ( $z = -1.33$ ) indicating a low number of personal factors related to parenting.

Participant 47's total score on the PSI-SF was the lowest out of all six participants, below the sample mean ( $z = -0.98$ ) and lower than the normative sample ( $z = -1.91$ ).

Along with participant 35, participant 47 scored relatively low on the PRFQ 'pre-mentalising mode' ( $z = -1.06$ ) therefore suggesting higher reflective function. This finding supports the hypothesis that higher mentalisation may be linked with infant learning. There may also be a link here between high IQ, low parental stress and infant learning however this is a tentative statement.

### ***Observations and Overall Impression***

Participant 47's scores on the ostensive cues tool are in line with what was observed. The mother appeared to be warm (such as a lot of laughter and smiling) and attune to her infant. The infant was older than other infants and this was evident in her ability to engage in the task. Furthermore, the mother appeared to frequently use verbal communication and overall, both the mother and infant appeared to be intelligent and engaged individuals who were attune to one another.

### **Participant 15 (Group B, 20 months old, Male)**

#### ***Learning, Time and Infant Attention***

The infant did not imitate the head action to turn on the lamp and in fact, when the mother asked the infant to turn the light on, the infant did not respond and

instead handed the fake switch to the mother. In Task B, the infant learnt 3 out of 9 objects when asked their names immediately after teaching and also scored 3 out of 9 when a delay in teaching was implemented. In Task A, participant 15 took the longest amount of time to teach the task to their infant but in contrast, took the shortest amount of time to teach Task B. This does not appear to be linked with the infant's attention levels and in fact, the infant was the most focused out of all six participants during Task B. The infant's low level of learning therefore cannot be linked to a lack of attention on the task.

### ***Use of Ostensive Cues Across Tasks A and B***

In Task A, the score of the quality of infant-directed speech (divided by time) that the mother used when communicating with her infant was the lowest out of all six participants and was 2 standard deviations below than the mean of the sample ( $z = -2.01$ ). This was also the case for scaffolding language which was 1 standard deviation below the mean ( $z = -1.75$ ). This means that during Task A, the mother demonstrated the task using mostly adult-directed speech. Furthermore, her verbal and non-verbal behaviours did not appear to aim to prepare or support the infant's engagement with the task. This did not appear to be the case for Task B which suggests that the mother's style of communication may have been task dependent.

Participant 15 appeared to demonstrate contingent behaviours fairly consistently in both Tasks A and B. There was evidence of both warmth and some regulating behaviours in both Task A and B. In each task, Participant 15 only addressed her infant by their name twice which was a low amount compared with the other participants in the sample. Participant 15's score for co-occurrence was high in Task A which indicates that, similar to participant 47, this participant used a high number of ostensive cues within a short space of time.

Overall, it appears that there was a lack of ostensive communication during task A and it is possible the mother simply demonstrated the task using fairly neutral communication as they performance appeared more in line with the mean for task B. The scores of high attention and low name addressing may be linked (i.e. the mother may have felt there was no need to address her infant by their name if they were already attending to the task).

### ***TONI and Self-Report Measures***

Out of the six participants, participant 15 scored the highest on the TONI with an index score of 120 (above average IQ). This score was above the sample mean ( $z = 1.62$ ) and the normative mean ( $z = 1.13$ ). On the BSI, participant 15 scored 0.5 on the ‘obsessive-compulsive’ subscale, scoring the highest out of all six participants. However, this score was in line with both the sample mean ( $z = -0.12$ ) and the normative sample mean ( $z = 0.12$ ). For the PRFQ subscale, ‘interest and curiosity’, participant 15 scored the highest out of all six participants and this score was above the sample mean ( $z = 1.41$ ) and the normative sample mean ( $z = 1.19$ ). This high score may indicate hyper-mentalisation.

Therefore, there does not appear to be a link between how the participant scored on the measures and the infant’s learning outcomes.

### ***Observations and Overall Impression***

The scores on the ostensive cues measures are mostly in line with subjective observations of the task. During task B, the baby at times appeared a little bored and tired however this lack of attention was not present during the teaching segments and therefore was not captured on the tool.

### **Participant 35 (Group B, 16 months old, Male)**

#### ***Learning, Time and Infant Attention***

Participant 35 did not imitate Task A. They scored 5 out of 9 when immediately asked the name of the object after teaching and scored 3 out of 9 in the 'object delay'. Participant 35 spent the least amount of time demonstrating Task A out of the six participants however this demonstration time was within the mean of the sample. Although the infant showed good levels of attention during task A, they were fairly distracted during Task B and appeared irritable near the end of the task.

### ***Use of Ostensive Cues Across Tasks A and B***

For Task A, participant 35's scores fell within the mean of the sample population. Out of the 6 participants, participant 35 did not have any scores for task a that were rated as the highest or lowest. There were two cues to note during task B; eye contact and regulating behaviours. During task B, the number of eye contact that mother and infant made with each other was low and when the frequency of eye contact was divided by time, the score was one standard deviation below the mean of the sample ( $z = -1.11$ ). Participant 35 scored the highest out of the six participants for behaviours that were seen to be directive or intrusive in Task B and this score was also one standard deviation higher than the mean of the sample ( $z = 1.93$ ). This indicates that the mother was fairly intrusive or directive towards the infant during this task.

In sum, it appears that there is a slight difference between how the mother used ostensive communication between task A and B. Although there is evidence of ostensive cues in task A, during Task B the lack of eye contact between the mother and infant, and the mother's directive behaviour may have been related to the infant's low level of attention, or vice versa.

### ***TONI and Self-Report Measures***

Participant 35 scored 113 on the TONI which suggests an IQ level which is above average. Participant 35 scored relatively low on the PRFQ 'pre-mentalising mode', scoring one standard deviation lower than the mean of the sample ( $z = -1.06$ ). This score suggests high reflective functioning. These results do not support the hypothesis that higher reflective functioning may be linked with infant learning as this participant was part of group B (low learning).

### ***Observations and Overall Impression***

The notable ostensive cues in task B were in line with the observation as it does appear to be the case that the infant was distracted and the mother fairly directive. A subjective observation is that the mother appeared to be slightly anxious during the study. It's possible that this was because of the unnatural setting and set up of the experiment. It is also possible that the mother had a slight preoccupation with administering the tasks correctly which could have detracted from engaging with her infant naturally.

### **Participant 55 (Group B, 18 months old, Female)**

#### ***Learning, Time and Infant Attention***

Participant 55 did not imitate Task A but appeared to emulate the goal of turning on the light as they used their hands rather than imitating the novel head action. When asked the names of the objects immediately after teaching, they scored 3 out of 9. Participant 55 spent the shortest amount of time teaching Task A compared to the six participants, but the time taken fell within the mean of the overall sample ( $z = -0.83$ ). In contrast, participant 55 spent the longest amount of time on Task B which was 2 standard deviations higher than the mean of the sample ( $z = 2.10$ ). In both tasks, the infant's attention score was rated the lowest out of the six participants which means that this infant was distracted during both task A and B.



### *Use of Ostensive Cues Across Tasks A and B*

The mother and infant infrequently made eye contact with each other during both tasks and the frequency, when divided by time, was more than one standard deviation below the mean for both tasks A and B ( $z = -2.09$  and  $z = -1.50$ , respectively).

Participant 55 addressed her infant by their name a considerable amount during both tasks and again, these scores were more than one standard deviation above the mean for both tasks A and B ( $z = 2.11$  and  $z = 1.05$ , respectively). Out of the six participants, participant 55 scored the lowest for IDS and CB in Task B. When compared to the sample, the IDS score was below the mean ( $z = -1.00$ ) and the CB score was also below the mean ( $z = -1.29$ ). The IDS and CB scores were also fairly low for task A. This indicates that the mother mostly used adult-directed speech and did not exhibit many behaviours that exhibited mentalisation. The infrequent eye contact, frequent name addressing, low CB and IDS scores may have been in line with the infant's low level of attention.

In Task B, although the mother used a high number of scaffolding language, when this was divided by the time taken to teach the task, it was fairly low compared to the other participants and approached one standard deviation below the mean of the sample ( $z = -0.99$ ). This finding is in line with the other low scores reported above and means that the mother's non-verbal and verbal behaviours did not appear to aim to guide their infant towards the task or narrate what was happening during the task.

Across both tasks A and B the mother demonstrated some warmth towards her infant and these scores were in line with the sample mean. The co-occurrence

scores were high for both tasks which indicates that a high number of ostensive cues were used within short spaces of time.

Overall, participant 55 appeared to have many scores in both tasks a and B that differed from the sample of the mean. The low scores on the ostensive cues scores support the hypothesis that low learning may be a result of low ostensive cues.

### ***TONI and Self-Report Measures***

Participant 55 scored 103 on the TONI which indicates average IQ. They scored the highest total in the PSI-SF out of the six participants. This score was higher when compared to the mean of the sample ( $z = 1.23$ ) and fairly high compared to the mean of the normative sample ( $z = 0.93$ ). This may indicate that this participant experienced a higher amount of parental stress when compared to the rest of the sample. Out of the six participants, this participant also scored the highest total on the BSI although it was in line with both the mean of the sample ( $z = 0.32$ ) and the normative sample ( $z = -0.31$ ). This score could indicate a higher amount of distress compared to the total six participants. This participant scored within the sample mean and normative sample mean on the PRFQ, demonstrating some evidence of reflective function. Although this finding does not support the hypothesis that higher reflective function may be linked with learning, there may be a possible link between parental stress and low learning.

### ***Observations and Overall Impression***

Overall, the scores on the ostensive cues tool appear to capture the ‘real-life’ mother-infant interaction. From observing the interaction, infant’s appeared to be fairly uninterested in the task from the outset and therefore it does not seem likely that the mother’s lack of cues caused the infant’s low attention. It may be important to consider the existing parent-infant relationship outside of the task as it is possible

that the infant's lack of attention is not unusual. The reason for this speculation is that there did appear to be a slight awkwardness to the parent-infant relationship and the mother often appeared to lack interest or attention to the infant's needs. For example, when the infant was not interested in the task and distracted by something else in the room, such as the plug switch, the mother continuously called the infant's name. From observing some of the other participants, acknowledgment and narration of the infant's actions demonstrated an awareness of what the infant may be interested in and shows evidence of mentalisation. However with this participant, the mother did not appear to address where the infant's attention may be and appeared to lack mentalisation

### **Summary**

The results of the 6 participants chosen for an in-depth analysis will be brought together in relation to the hypotheses. Caution must be taken when drawing conclusions from the results due to the small sample size however tentative patterns can be highlighted.

### ***Hypothesis 1 (Learning outcomes will be related to ostensive cues)***

The results from participants 47 (Group A) and 55 (Group B) mostly support the hypothesis that there is a relationship between the use of ostensive cues and infant learning. Participant 47 from Group A imitated the novel head action to turn on the lamp and learnt most of the word-object task. In both tasks, the mother exhibited contingent behaviours and good quality IDS as well as demonstrating high overall emotional support. However, this participant made the least amount of eye contact with their infant in task A and rated lowest in scaffolding in task B which does not support hypothesis 1.

Participant 55 supported hypothesis 1 due to evidence of low learning outcomes and infrequent use of ostensive cues. There was evidence of a low frequency of eye contact and low IDS and CB (Task B) across both tasks. There were also a lack of scaffolding behaviours and language in task B. Although there was evidence of high name addressing across both tasks, this may have been linked with the infant's low attention. The only inconsistency that appeared in the scores was that there was evidence of warmth in both tasks. Overall, participant 55's scores support hypothesis 1.

The other 4 participants in the analysis did not appear to have results that were overall consistent or inconsistent with hypothesis 1. This was because all of these participants demonstrated some use of ostensive cueing but there did not appear to be a pattern between how mothers scored on the ostensive cueing tool and how they presented in the learning interaction. Reflections regarding why these inconsistencies exist will be highlighted in the discussion, along with suggestions for modifications of the design. Although the 4 participants did not demonstrate clear results, some interesting observations are of note.

Some of Participant 20's scores appear to support hypothesis 1 due to the differences of ostensive cueing in Task A compared with Task B. As mentioned earlier, participant 20 was placed in Group A due to the number of objects they learnt in Task B, however they did not learn Task A. It is therefore interesting to note higher frequency of name addressing, contingent behaviours and more displays of warmth in Task B compared to Task A. We can therefore speculate whether the increased use of these cues had a role to play in the infant learning majority of Task B. However, as discussed when reporting the results, cues such as eye contact were more frequent in task A. Overall, there is some evidence of higher use of ostensive

cueing during Task B, as well as the infant being more focused however the inconsistent results do not fully support hypothesis 1.

Participant 34's (Group A) scores appear to mostly reject hypothesis 1 because apart from frequent use of eye contact which could have played a role in the high learning outcome, there does not appear to be a pattern of the ostensive cues tool and learning. In fact, some scores such as warmth and scaffolding were fairly low which is not in line with hypothesis 1.

Participants 15 and 35 (Group B) did appear to lack the high frequency use of ostensive cueing in some areas compared to the participants discussed in Group A however, this was not the case for all cueing meaning that hypothesis 1 cannot be fully accepted.

***Hypothesis 2 (Learning outcomes will be related to IQ, stress and mentalisation)***

In relation to hypothesis 2, participant 47's scores are in line with what we would expect given the literature because as well as the infant learning most tasks and the mother exhibiting many ostensive cues, the mother's TONI score suggests high average IQ. Furthermore, the mother's scores on the BSI and PSI-SF indicate no evidence of psychological distress and low parental distress. The low PM score on the PRFQ indicates evidence of reflective function. These findings support hypothesis 2 and also extends it as it is interesting to observe a relationship between mentalisation and contingent behaviours.

Participant 55's scores on the BSI and PSI-SF supported hypothesis 2 as they scored high on parental stress and psychological distress. However, their scores on the TONI and PRFQ did not support hypothesis 2 due to average IQ and evidence of mentalisation.

These types of inconsistencies were also present for participants 20, 34, 15 and 35, with results on some measures partly supporting hypothesis 2, but others rejecting it. All 6 participants scored either high average or average IQ on the TONI and by taking a look at the overall sample of 14 participants, 10 mothers completed post-graduate education. This demonstrates a sample of highly educated mothers which may be the reason why comparing IQ scores between Task A and Task B proves challenging.

In terms of scores on the BSI, the most obvious observations are that out of all six participants, participant 47 (group A) was the only one who scored 0 and participant 55 scored the highest (group B) which support supports hypothesis 2. There does not appear to be any other patterns with the BSI for the other 4 participants.

When looking at the scores on the self-report measures, there appears to be a relationship between psychological distress and low reflective functioning. This is because the three highest total scores on the BSI (participants 55, 20 and 34) also scored the highest on the pre-mentalising subscale of the PRFQ. High PM scores on the PRFQ may indicate low mentalisation therefore this finding supports Hypothesis 2. Interestingly, 2 of these participants (55 and 20) also had the highest scores on the parental stress measure (PSI) suggesting a loose relationship between psychological distress, parental stress and low mentalisation. This finding also supports hypothesis 2. Furthermore, 2 of these participants (20 and 34) scored highly on the certainty about mental states subscale of the PRFQ. It is suggested that high scores on the CM may also be attributed to low mentalisation therefore this finding also supports hypothesis 2. There does not appear to be any patterns in relation to the interest and curiosity mental states and the other self-report measures.

### ***Other Findings***

Apart from relationships between learning outcomes, ostensive cues, IQ, stress and mentalisation, it is also interesting to take note of any other findings of interest. Results are mostly focused on the mother's performance (i.e. use of ostensive cueing and scores on the IQ measure and self-report measures) however it is also important to take part in factors relating to the infant. What appears to be notable is that in task B, the infants who were most distracted were participants 35 and 55. These infants were both in Group B and as discussed previously, their levels of low attention may have had an effect on how their mother's behaved during the task. For example, during task B, participant 35's mother lacked eye contact with their infant and appeared directive or intrusive (which wasn't the case for task A).

### **Discussion**

The present study used a reliable tool which captured ostensive cues during mother-infant interactions. The tool aimed to increase standardisation of a clear definition of which cues are defined as ostensive. The ostensive cues tool was developed based on the work of Yoder and Warren (1998), Landry et al. (2006) and Klein, Wieder, and Greenspan (1987). Through using this tool, this novel study replicated previously tested infant learning paradigms with mothers as demonstrators to allow for as natural interactions as possible. Data collection was stopped prematurely due to the outbreak of Covid-19 and therefore the study hypotheses and analyses of results required re-development. As the sample size was smaller than anticipated, the study took on the form of a qualitative analysis rather than a quantitative analysis. The power calculation was no longer appropriate and using only 14 participants would not yield enough power to find sufficient themes between all of the constructs (Fugard & Potts, 2015). Therefore, six participants were

selected for an in-depth analysis and the relationship between maternal use of ostensive cues and infant learning outcomes were analysed. Other maternal information including IQ, psychological distress, parental stress and mentalisation were collected and patterns between these factors, infant learning outcomes and ostensive cues were also explored.

### **Infant Imitation**

From looking at the full sample of infants in the present study, it was evident that 9 out of 14 infants imitated the novel head action to turn on the lamp after an approximate eight-minute delay (the average time taken to administer Task B). This supports literature which used the same learning paradigm. For example, Meltzoff's (1988) study found that 8 of the 12 infants imitated the head action after a one-week delay and Gergely, Bekkering and Király (2002) found that 69% of 14-month-old infants re-enacted the head action. The mean age of infants in the present study was 19-months therefore findings support Nielson's (2006) study which reported that 18-month-olds did not always imitate the task. This is in contrast to 12-month-olds who rarely imitated the task and 24-month-olds who mostly imitated the task, even if it was unsuccessful. Thus, the current study confirms that in order for imitation to occur, child-directed interactions are necessary among this age group but may not be necessary among older infants. The present study also may demonstrate that even when the infant's mother is a demonstrator (rather than an experimenter), ostensive communication is still necessary for imitation to occur. The discussion will now focus on the selected six participants to explore the patterns in learning outcomes, ostensive communication, stress and IQ.

### **Infant Learning Outcomes and Ostensive Cues**



From the 14 participants in the sample, six were selected for an in-depth analysis. Two hypotheses were investigated; (1) whether infants who had higher learning outcomes would have been exposed to more ostensive cueing compared with infants who had lower learning outcomes and, (2) whether there was a relationship between higher scores of IQ, mentalisation, and lower scores of psychological distress and parental stress compared with use of ostensive cueing and infant learning outcomes.

Results demonstrated that there was some evidence for both of these hypotheses, with two participants; participants 47 and 55, in particular demonstrating support for hypothesis 1. Participant 47 used a wide range of ostensive cues when interacting with her infant and in comparison, to the rest of the sample, her interactions were rich in contingent responses, infant-directed speech (IDS) and warmth. It is therefore possible that these three cues may have been important additions to the teaching. In contrast, participant 55 lacked eye contact, IDS and contingent behaviours when interacting with their infant. Taking into account the three types of cues mentioned for participant 47 and the three types of cues mentioned for participant 55, together these six types of cues cover Ho's (2020) ostensive cues tool. This may confirm the importance of all of these cues in terms of infant learning outcomes. Although there is no research to state that high use of contingent responses, IDS and warmth are valuable, consideration should be given as to whether multiple ostensive cueing adds to a richer learning experience.

When exploring the use of ostensive cues between Group A and Group B, there does not appear to be a consistent pattern of use of ostensive cues across participants, thus based on the six participants, there is no conclusive evidence for hypothesis 1.

## **Maternal Mentalisation, Intelligence and Stress**

Overall, there did not appear to be a consistent pattern between the mentalisation, intelligence and stress constructs. However, the results of particular participants offer some interesting observations.

Participant 47's scores were mostly in line with hypothesis 2 as they demonstrated an above average IQ, a low rating of psychological distress and parental stress, and an indication of mentalisation. This finding supports existing literature which demonstrated a positive correlation between mentalisation and intelligence and also a positive correlation between mentalisation and parenting stress (Luyten, Mayes, Nijssens, & Fonagy, 2017). The finding also supports the suggestion that mentalisation may increase tolerance of infant distress (Rutherford, Goldberg, Luyten, Bridgett, & Mayes, 2013). Linking this finding with that of hypothesis 1 supports literature which suggests a positive relationship between mentalisation and ostensive cueing, including contingent responsivity. The present study extends this idea further to provide some evidence for the possibility of higher infant learning outcomes in relation to these constructs.

Participant 55's scores were also mostly in line with hypothesis 2 because although they demonstrated average IQ and evidence of mentalisation, the scores of potential parental stress and psychological distress may have played a role in the low infant learning outcomes. As noted in results for participant 55 in the 'overall impressions' section, the use of the measures and ostensive cues tool does not fully capture the nature of the mother-infant interaction. Indeed, the observation is in line with many of the scores reported however as an observer it is also possible to see both the mother's lack of mentalisation in her infant's interests along with the infant's disinterest in both the mother and the task. Therefore, although the ostensive

cues tool and the measures capture some of these traits, meaningful information can be gained from subjective observation.

The finding that the mothers who had the three highest scores on the measure for psychological distress also had the highest PM scores on the PRFQ supports literature which suggests a link between mentalisation and stress (Rutherford, Goldberg, Luyten, Bridgett, & Mayes, 2013). We can speculate that mothers who experience stress may find it more challenging and may lack capacity to adjust their own behaviour in order to consider their infants thoughts, feelings and needs. It would be interesting to explore this in a larger sample to see if those mothers whose scores suggest stress and low mentalisation also lack use of particular ostensive cues when teaching their infant.

As all participants in the sample scored either average to high average scores on the TONI, comparisons could not be made between low and high IQ. Including a more diverse sample of mothers in future research would be recommended in order to collect data which is representative of the general population.

### **Additional Findings**

Outside of the hypotheses, the findings of this study can be explored to support our knowledge on the developmental stages of infant learning. Participant 20's (Group A) learning outcomes suggest that infants as young as 16 months are able to learn novel words. This finding supports previous literature which demonstrated that by the age of 14 months, infants are able to learn novel words for objects (Waxman & Booth, 2001). It seems feasible that the infants level of attention had a role to play in learning outcomes as crude observation of attention levels shows that the infant who was most distracted learnt the least number of tasks whereas the infant who was most attentive, learnt a good number of tasks. This adds to the

literature that infrequent use of ostensive cues may lead to poor attention, however literature suggests that increased attention alone does not satisfy all components of an infant's response to ostensive cues (Csibra, 2010).

However, it is important to interpret the scores on the tool with observing the mother-infant interaction because for example, participant 55 frequently used name addressing which in isolation, may appear a frequent use of an ostensive cue in order to prepare the infant for the task. However, teamed with the rest of the information, it is apparent that the infant was distracted during the task and therefore name addressing may have been a directive and possibly intrusive method of encouraging the infant's attention, rather than a cue to grab attention before showing a demonstration.

### **Experimental Paradigm Design coupled with the Ostensive Cues Tool**

The present study included two learning paradigms; the imitation paradigm of turning on a lamp using a novel head action (Meltzoff, 1988) and a novel word-object paradigm (Floor & Akhtar, 2006). Replicating Meltzoff's study enabled clear results in terms of whether infants imitated the head action to switch on the light, whether they emulated the goal of turning on the light but chose to use a different method such as their hands, or if they did not respond to the direction. Out of the six participants, two imitated the novel action, three did not respond and one emulated the goal by using their hands. It is interesting to note that one of the infants who did not respond, first looked to the main light in the room which demonstrates an understanding of the task but there are a number of possible reasons why not all infants imitated the action. One possible reason could be that the cognitive demand of the word-object task (Task B) was fairly high and this may have had a role in infant's poor memory retention of Task A. However, infants aged 14 to 18 months in

another study by Meltzoff (1995) demonstrated imitation of an action 4 months after imitating it. Another possible reason for some infants not responding may have been due to fatigue from Task B. The average time of Task B was approximately 8 minutes and required a fairly high number of responses from infants. Indeed, from observing the task, one infant who did not respond did appear tired and irritable towards the end of the study. Future research may benefit from including another free play in between tasks because although this may have an impact on memory of the task, it may help infants take a break from the high cognitive demands of the learning paradigms.

### **Strengths and Limitations**

Although the study required re-design, a main strength of the study was the novel design of capturing maternal use of ostensive cues using a reliable tool, whilst exploring infant learning. A further strength which set the present study aside from other research was using mothers (rather than an experimenter) as demonstrators to allow for investigation of ostensive communication in a semi-naturalistic setting. Although this allowed for ecological validity, the established relationship between a mother and their infant should be considered when exploring the role of ostensive communication in infant learning. For example, literature suggests infants are more likely to imitate caregivers (Sharp et al., 2018). This may be because epistemic trust is already be established and therefore may have an impact on how infants respond in a learning paradigm.

A limitation which was unavoidable was the small sample size. In order to investigate the original aims and intended design, future research could replicate the study using a larger sample. As previously mentioned, the sample collected did not appear diverse (average to high average IQ, high household income, white sample),

meaning that the sample is not representative of the wider population. Caution should therefore be taken when interpreting the results.

In terms of the ostensive cues tool, the main challenge when interpreting the scores and attempting to identify patterns was that it was not possible to yield a ‘total’ ostensive cues score. This made comparisons across participants challenging and in future, may be even more of a challenge when the sample size is considerably larger.

The study employed the same number of rounds as in Floor and Akhtar’s (2006) study however, a limitation of using mothers to demonstrate the task is the challenge in all participants administering the task in the same fashion. For example, in Floor and Akhtar’s task, when an object was introduced the mother first used three neutral sentences (such as “I’m going to show you what’s in here) and then the object was labelled three times before being shown. In the present study, although instructions were given to mother to say the name of the object a maximum number of five times, not all mothers kept to this rule. The current study did not instruct mothers to use neutral sentences prior to the object being shown because mother’s use of this scaffolding language was part of the exploration. Therefore, it appears that although there are strengths in using mothers as demonstrators, there are also limitations attached to this.

In terms of the experiment day, there may have been a limitation in administering the TONI straight after the infant learning paradigms. At this point, both mothers and their infants appeared tired, and the TONI was administrated whilst the infant was in the room. This may have distracted the mother and had a negative impact on their scores. Future research including an intelligence measure may benefit

from administering the measures on a different day in order to obtain an accurate IQ score.

### **Clinical and Theoretical Implications**

The present study adds to the literature as it provides detailed information on the nature of maternal ostensive communication during two infant learning paradigms. The clear definition of ostensive cues captured in the tool provides opportunity for replication of studies.

Overall, the findings discussed, when replicated with a larger sample, have the potential to inform the field of clinical psychology. Existing research has explored parent-infant interactions that lack ostensive cues and other capacities which suggest that mentalising may not be sufficiently established. A lack of mentalisation may lead to early difficulties such as aggression as an adaptive response to limited resources. The development of mentalising based therapy (MBT) aims to improve mentalisation (Fonagy and Campbell, 2016). Therefore, this body of work could help to further develop this area. Future research may benefit from comparing ostensive communication in clinical and non-clinical groups such as mothers with a diagnosis of PTSD or borderline personality disorder which could inform further manualised therapies for parents experiencing mental health difficulties.

A heavy focus of the development of the tool was based on the work of Landry et al. (2006). Landry's work had a part to play in the development of a manualised Relationship-Based Intervention (RBI) (Mahoney & MacDonald, 2007) called Responsive Teaching (RT) which focuses on parental influences on infant development. In this work parental responsiveness overlaps with many elements of Ho's ostensive cueing tool such as contingent responding and affect. Alquraini and

colleagues (2018) conducted a randomised control trial of RT in Saudi Arabia which demonstrates that after only a four-month intervention, children's social and language development increased. This study provides evidence that when mothers are given an intervention that modifies their style of interaction, they are able to adopt this new style and benefits are clearly shown. This therefore leads us to believe that with fine-tuning of Ho's (2020) tool and further research in how the additions of ostensive communication can benefit infant learning and social development, this tool could be used as part of parental interventions aimed to improve mother-infant interactions and an infant's social development.

### **Conclusions**

Overall, the present study provides some support of the Theory of Natural Pedagogy as there is some indication that ostensive communication facilitates learning in infants. Furthermore, some of the results suggest a potential relationship among additional constructs such as mentalisation, psychological distress, parental stress and IQ scores. Although the findings and conclusions drawn from this small sample should be tentatively accepted, they pave the way for future research with a larger sample.



## References

- Abidin, R. (2012). Parenting Stress Index: Fourth Edition. Lutz: PAR.
- Adkins, T., Luyten, P., & Fonagy, P. (2018). Development and preliminary evaluation of family minds: a mentalisation-based psychoeducation program for foster parents. *Journal of Child and Family Studies*, 27, 2519-2532.
- Butler, L. P., & Markman, E. M. (2012). Pre-schoolers use intentional and pedagogical cues to guide inductive inferences and exploration. *Child Development*, 83(4), 1416-1428.
- Butler, L. P., & Markman, E. M. (2014). Pre-schoolers use pedagogical cues to guide radical reorganization of category knowledge. *Cognition*, 130(1), 116-127.
- Butler, L. P., & Markman, E. M. (2016). Navigating pedagogy: Children's developing capacities for learning from pedagogical interactions. *Cognitive Development*, 38, 27-35.
- Butler, L. P., Schmidt, M. F. H., Bürgel, J., & Tomasello, M. (2015). Young children use pedagogical cues to modulate the strength of normative inferences. *British Journal of Developmental Psychology*, 33(4), 476-488.
- Butler, L. P., & Tomasello, M. (2016). Two- and 3-year-olds integrate linguistic and pedagogical cues in guiding inductive generalization and exploration. *Journal of Experimental Child Psychology*, 145, 64-78.
- Carpenter, M., Akhtar, N., & Tomasello, M. (1998). Fourteen- through eighteen-month-old infants differentially imitate intentional and accidental actions. *Infant Behavior and Development*, 21, 315-330.
- Cochran, C. D. & Hale, W. D. (1985). College student norms on the Brief Symptom Inventory. *J Clin Psychol*, 41(6):777-779.

- Cohen, J. (1977). *Statistical power analysis for the behavioural sciences*. New York: Academic Press.
- Cooke, D. C., Priddis, L. E., Luyten, P., Kendall, G. E. & Cavanagh, R. F. (2017). Paternal and Maternal Reflective Functioning in the West Australian Peel Child Health Study. *Infant Mental Health Journal*, 38(5):561-574.
- Csibra, G. (2010). Recognizing Communicative Intentions in Infancy. *Mind & Language*, 25(2), 141-168.
- Csibra, G., & Gergely, G. (2006). Social learning and social cognition: The case for pedagogy. *Attention and performance*, 21, 249-274.
- Csibra, G., & Gergely, G. (2009). Natural pedagogy. *Trends in Cognitive Sciences*, 13, 148-153.
- Csibra, G., & Gergely, G. (2011). Natural pedagogy as evolutionary adaptation. *Philosophical Transactions of the Royal Society B*, 366(1567), 1149-1157.
- Derogatis, L. R. (1993). *BSI Brief Symptom Inventory: Administration, Scoring and Procedures Manual* (4<sup>th</sup> ed.). Minneapolis, MN: National Computer Systems.
- Derogatis, L. R., & Spencer, M. S. (1982). *The Brief Symptom Inventory (BSI) Administration, Scoring and Procedures Manual-I*. Baltimore: Johns Hopkins University School of Medicine, Clinical Psychometrics Research Unit.
- Fillingham, K. (2018). *Measuring epistemic trust*. (Unpublished doctoral dissertation). University College London, London.
- Floor, P., & Akhtar, N. (2006). Can 18-Month-Old Infants Learn Words by Listening In on Conversations? *Infancy*, 9, 327-339.
- Fonagy, P., & Allison, E. (2014). The Role of Mentalizing and Epistemic Trust in the Therapeutic Relationship. *Psychotherapy*, 51(3), 372-380.

- Fonagy, P., Gergely, G., Jurist, E., & Target, M. (2002). *Affect regulation, mentalization, and the development of the self*. New York, NY: Other Press.
- Fugard, A. J. B. & Potts, H. W. W. (2015). Supporting thinking on sample sizes for thematic analyses: a quantitative tool. *International Journal of Social Research Methodology*, 18(6), 669-684.
- Futó, J., Téglás, E., Csibra, G., & Gergely, G. (2010). Communicative Function Demonstration induces kind-based artefact representation in preverbal infants. *Cognition*, 117(1), 1-8.
- Gergely, G., Bekkering, H., & Király, I. (2002). Rational imitation in preverbal infants. *Nature*, 415, 755.
- Heyes, C. (2016). Born Pupils? Natural Pedagogy and Cultural Pedagogy. *Perspectives on Psychological Science*, 11(2), 280-295.
- Ho, J. C. Y. (2020). *The development and validation of ostensive communication coding system*, University College London. (Unpublished doctoral dissertation).
- Király, I., Csibra, G., & Gergely, G. (2013). Beyond rational imitation: learning arbitrary means actions from communicative demonstrations. *Journal of experimental child psychology*, 116(2), 471–486.
- Klein, P. S., Wieder, S., & Greenspan, S. I. (1987). A theoretical overview and empirical study of mediated learning experience: Prediction of preschool performance from mother-infant interaction patterns. *Infant Mental Health Journal*, 8(2), 110-129.
- Landry, S. H., Smith, K. E., & Swank, P. R. (2006). Responsive parenting: establishing early foundations for social, communication, and independent problem-solving skills. *Developmental Psychology*, 42(4), 627-642.

- Luyten, P., Mayes, L. C., Nijssens, L., & Fonagy, P. (2017). The parental reflective functioning questionnaire: Development and preliminary validation. *PLOS ONE*, *12*(5):e0176218.
- Ma, W., Golinkoff, R. M., Houston, D. M., & Hirsh-Pasek, K. (2011). Word learning in infant-and adult- directed speech. *Language Learning and Development*, *7*(3), 185–201.
- Mahoney, G., & MacDonald, J. (2007). *Autism and developmental delays in young children: The Responsive Teaching curriculum for parents and professionals*. Austin, TX: Pro-Ed.
- Meltzoff, A.N. (1988). Infant imitation after a 1-week delay: Long-Term Memory for Novel Acts and Multiple Stimuli. *Developmental Psychology*, *24*(4), 470–476.
- Nielson, M. (2006). Copying actions and copying outcomes: Social learning through the second year. *Developmental Psychology*, *42*, 555-565.
- Rutherford, H. J. V., Goldberg, B., Luyten, P., Bridgett, D. J., & Mayes, L. C. (2013). Parental reflective function is associated with tolerance of infant distress but not general distress: Evidence for a specific relationship using a simulated baby paradigm. *Infant Behavior and Development*, *36*(4), 635-641.
- Schwier, C., van Maanen, C., Carpenter, M., & Tomasello, M. (2006). Rational imitation in 12-Month-Old infants. *Infancy*, *10*(3), 303.
- Sharp, C., Shohet, C., Givon, D., Penner, F., Marais, L., & Fonagy, P. (2018). Learning to mentalize: A mediational approach for caregivers and therapists. *Clinical Psychology Science and Practice*. e12334.

- Shneidman, L., Gaskins, S., & Woodward, A. (2016). Child-directed teaching and social learning at 18 months evidence from Yucatec Mayan and US infants. *Developmental Science, 19*, 372-381.
- Shneidman, L., Todd, R., & Woodward, A. (2014). Why do child-directed interactions support imitative learning in young children? *PloS one, 9*(10), e110891.
- Shrout, P. E. & Fleiss, J. L. (1979). Intraclass correlations: uses in assessing rater reliability. *Psychological Bulletin, 87*(2), 420-428.
- Waxman, S. R., Booth, A. E. (2001). Seeing pink elephants: Fourteen-month-olds' interpretations of novel nouns and adjectives. *Cognitive Psychology, 43*, 217–242.
- Yoder, P. J., & Warren, S. F. (1998). Maternal responsivity predicts the prelinguistic communication intervention that facilitates generalized intentional communication. *Journal of Speech, Language, and Hearing Research, 41*(5), 1207-1219.
- Zabora, J., BrintzenhofeSzoc, K., Jacobsen, P., Curbow, B., Piantadosi, S., Hooker, C., Owens, A., & Derogatis, L. (2001). A new psychosocial screening instrument for use with cancer patients. *Psychosomatics, 42*(3): 241-246.

### **Part 3: Critical Appraisal**

## **Introduction**

This critical appraisal will begin with a discussion of what drew me to the project, followed by a critical reflection of the various stages of undertaking this research. The appraisal will end with considerations of working as a scientist-practitioner, followed by a conclusion.

## **Researcher Background**

As part of my undergraduate Psychology degree at Brunel University, I had the opportunity of completing two six-month placements; one of which was at the Infant Research Lab at the Anna Freud Centre (AFC). Working there as an Honorary Assistant Psychologist, I had the fantastic experience of supporting researchers in carrying out research in developmental psychology. Part of my role consisted of recruiting mothers for studies by attending various groups in the community. To my surprise, mothers were excited about being involved in meaningful research and my enthusiasm for recruitment and engaging the community in psychological research grew. Being involved in assisting studies with mothers and their infants was both interesting and enjoyable.

When it came to choosing the area of research for my doctoral thesis, I was keen to be involved in infant learning research and also felt that it would be a great opportunity to be supervised by Professor Peter Fonagy, who had contributed a great deal to the field of developmental psychology. Furthermore, I was excited to carry out my own research at the AFC, with a sense that my journey into becoming a Clinical Psychologist had come full circle.

## **Recruitment**

The empirical study was a joint project with a Trainee Clinical Psychologist at UCL, and together we had the aim of recruiting approximately 50 mother-infant

pairs. As this was a large sample, we used a range of avenues to recruit from and also hoped that this would help to increase the diversity of our sample. Initially, we used our personal social media platforms so that friends, family and colleagues could help spread the word about our research. We also contacted libraries in North London who displayed our recruitment and permitted us to attend mother and baby groups (such as 'Baby Bounce') to advertise our study. Although this proved successful, it was time consuming travelling to libraries and attending these groups on a weekly basis. In an aim to be resourceful with recruitment, I reached out to 'influencers' on Instagram (individuals with a large following) who are well-known in parenting communities. One influencer kindly shared our research poster on her Instagram story and within a few days, I had received approximately 30 messages from interested mothers. I was impressed at how powerful social media could be in research and hope that researchers utilise social media platforms increasingly to not only recruit, but also to engage the interest of the wider community in relevant and important research.

### **Study Design**

The broad idea for the joint research project was for the other Trainee to develop a tool so that an agreed definition of ostensive cues could be developed. My main aim was to replicate existing infant learning paradigms and to use the ostensive cues tool to explore infant learning as well as the relationship with other constructs such as intelligence, stress and mentalisation.

Meltzoff's (1988) imitation paradigm was chosen to be replicated due to factors discussed in the empirical paper however, it was a challenge to quickly grapple with the extensive literature in infant development and to choose another study that would be meaningful to replicate. I found it difficult navigating the broad



research of mentalisation and ostensive cues and finalising a clear research design. However, it was valuable developing the study jointly with another Trainee Psychologist as we were able to assign each other different tasks and discuss our findings to help make sense of the literature.

After selecting Floor and Akhtar's (2006) word-object paradigm, we agreed on a study design and ran three pilot studies. This was useful as it helped to iron out minor complications such as deciding on the placement of the furniture in the room, and where we stood in the room during the study to ensure we were as unobtrusive as possible. We also realised the importance of the experimenter avoiding interaction with the infant prior to the study so that during the study, the infant is not distracted by the experimenter being in the room. We did this by avoiding eye contact, name addressing, and using fairly neutral facial expressions prior to the study. It became protocol that we explained this to mothers before their study visit so that they were prepared for the limited interaction between the experimenter and their infant.

Administering the pilot studies also helped finalise the design. We initially replicated Floor and Akhtar's (2006) study design in terms of preference trials. In their study, preference control trials were included where the experimenter asked the infant to show their favourite object. Preference trials helped determine if infants chose the target object or the preference object during the testing phase. However, during our pilot study it became evident that having the preference object on show increased the risk of infants being distracted by this object and not attending to the teaching of the other objects. Therefore, we made the decision to remove the preference object once it was selected. Overall, this appeared to be suitable.

### **Data Collection**

It was a challenge to book the study room at the AFC on our study days, due to a high volume of therapists and researchers utilising rooms. However, given our large sample, it was important that we kept to our timeline of data collection. Despite the common issue of booking rooms, it was a pleasure to conduct research at the newly built AFC. The room that we used for our study had cameras already set up which allowed for filming of the study from many angles. I was able to appreciate that this was a significant improvement from my time as an Honorary Assistant at the AFC where only one camera was used. Having four cameras in the room allowed for high quality coding of ostensive cues such as recording the frequency of eye contact between the mother and infant.

We began data collection in November, but it was difficult to ensure that all of our room booking slots were booked with participants. We found that as our target infant age was 16-20 months, a large proportion of mothers had returned to work after being on maternity and therefore organising the study during working hours was difficult. We also found that participants' availability greatly decreased in December due to taking annual leave and being busy during the Christmas and New Year season. Although data collection kicked back up again in mid-January, the occurrence of Covid-19 in March meant our data collection had to be ended prematurely.

Once the pilot studies had been completed, administration of condition 1, the 'spontaneous ostensive cueing condition', began. Once 14 participants had been tested in this condition, we moved on to condition 2 to ensure that we had a reasonable number in both conditions. Condition 2 included the 'restricted cueing' condition where mothers were instructed to not use certain cues. Again, pilot studies were carried out prior to commencing condition 2. The pilot studies proved to be

highly important as there were some cues that mothers found to be too challenging to restrict, and there was also a risk that their infants would become significantly distressed. Initially, eye contact and infant-directed speech (IDS) were chosen to be restricted however it appeared that mothers were not able to limit eye contact with their infants and fed back that it felt too unnatural and uncomfortable. The pilot studies confirmed that mothers were able to limit IDS and name addressing, thus these were the chosen restricted cues for condition 2.

During data collection, it was important that clear instructions were given to mothers as they were responsible for demonstrating the learning paradigms. Including two paradigms within our experiment was important in order to explore ostensive cues in different tasks however, there was a lot of information for mothers to remember. Initially, we planned on providing instruction sheets only but in our opinion, the experiment still appeared confusing. This led us to make video instructions, where the two experimenters demonstrated the infant learning task. This was played to the mother on the day of the experiment and helped to ensure consistency in the administration of the study.

### **Covid-19**

Covid-19 is an infectious disease caused by coronavirus, which is a newly discovered virus. At present, there are no vaccines or treatments available (World Health Organisation, 2020). Although I came to know of Covid-19 on the news at the beginning of 2020, I did not anticipate that in just a couple of months, we would be experiencing an outbreak in the UK and the whole country placed in lockdown. On the week of the 16<sup>th</sup> March 2020, it was recommended that UCL research was stopped and that the AFC was closed. At this point we had tested only four

participants in condition 2 and therefore I held an urgent meeting with my supervisors in regard to my research aims.

Although this period was full of uncertainty and anxiety, I found the calm approach from my supervisors and UCL both containing and reassuring. Since the end of March, the research process was more challenging than I had anticipated due to a number of factors. Re-developing the aims of my study left me feeling relieved that I could meaningfully use the data that had been collected but it felt disheartening that the efforts I had undertaken to recruit a large sample of mothers could not be used for the present study. Also, the results from the four participants that had been tested in condition 2 appeared interesting and I had been excited to explore the results. Furthermore, I had planned and prepared for a quantitative write-up so the transition to a qualitative write-up required a significant amount of time dedicated to testing out different ways of presenting my data.

Working from home for four months has been a novel experience and I have found it useful to try my best to adopt a calm and flexible stance. I quickly realised that due to lockdown, many of my strategies for managing stress were not accessible in the same way. For example, taking breaks in the outdoors was limited because at the beginning of lockdown it was only permitted to leave the house once a day. Although I am a gym-goer, I have never considered myself a runner; however I took this opportunity to start the 'couch to 5k'. This was an effective stress-reliever which provided me with a new goal, outside of my thesis. Spending time socialising with friends and family is also another way I manage stress however my time socialising was transformed into virtually spending time with my loved ones over Skype and Zoom. Not being able to study in the library was also difficult as adjusting to writing up the thesis in my home was challenging. I ensured that I had a dedicated study

space, blocked out distractions and overall, tried my best to focus as much as possible. Despite a considerable amount of time being saved by not having to commute to my placement or the AFC, upon reflection it feels as if the occurrence of Covid-19 brought its own unique challenges.

### **Data Analysis**

Due to the study being re-designed from a quantitative to a qualitative approach, decisions needed to be made regarding which criteria I would use to select the small sample of participants for qualitative analysis. As this was a joint project, a meeting was held to discuss how both of our research projects could be re-designed, ensuring that our projects consisted of different aims and hypotheses. As my project was primarily focused on paradigms and infant learning, I decided to choose learning outcomes as the criteria for my participants. Infants who imitated the lightbulb task (Task 1) and scored highly on the word-object task (Task 2) were selected for Group A, and infants who did not imitate Task A and who presented with low scores on Task B were selected for Group B.

The limitation of using mothers as demonstrators meant that not all testing phases in Task B were carried out correctly. Task B required mothers to teach the name of an object and immediately after, ask the infant to select that target object once it had been placed amongst the other objects to test immediate learning. Delayed learning was also tested as mothers were instructed to ask their infant to select each object at the end of the task. Unfortunately, some mothers did not remember to administer both the immediate and delayed learning tests. This made participant selection for the qualitative analysis difficult as, for a small number of participants, not all the tasks had been administered. However, as most participants

had administered the immediate learning task, low and high scores on this task (as well as Task A) were used to select participants.

The ostensive cues tool included a range of cues and due to differing measurements (i.e., frequencies and Likert scales), a sum of ostensive cues for each participant was not a part of the tool. In order to explore potential patterns between the use of ostensive cues in Groups A and B, I attributed meaning to the ostensive cues in the form of means. This allowed me to compare how the individual used ostensive cues compared to the rest of the sample.

Although I was unable to use statistical tests due to the small sample size, the experience of exploring the use of ostensive cues in relation to learning outcomes, as well as delving into scores of the other measures for the six selected participants offered a chance for an in-depth analysis. Although watching the clips of all 14 participants and coding cues into the ostensive cues tool was highly time consuming, by the time I had selected my 6 participants, I felt that I had become familiar with how each mother used ostensive cues.

### **Working as a Scientist-Practitioner**

I am grateful for this opportunity to spend time at the end of my thesis journey, reflecting on how I have grown in confidence as a scientist-practitioner. Despite the many hurdles that I have faced, particularly since the outbreak of Covid-19, I am proud of my ability to adjust to the unexpected circumstances.

Working as a Trainee Psychologist on placement and conducting data collection in my study time allowed me to develop my time management and organisation skills. The experience of working full-time in the office, and then adjusting to working full-time from home when lockdown commenced further helped to develop these skills. Whilst being in lockdown, the skills I learnt in

ensuring I put in place boundaries between placement, research, and social life were valuable and I hope to continue with ensuring that I allocate dedicated time to these areas post-training.

### **Conclusion**

Being able to experience and observe the mother-infant relationship closely and investigate constructs related to maternal communication, infant learning and mentalisation was fascinating. It was unfortunate that the final study hypotheses and analysis of results did not go as planned however being flexible with the data and testing out ways to explore patterns invited creativity which I had not anticipated would be a part of my doctoral thesis.

## References

- DiLalla, L. F. (2000). Development of intelligence: Current research and theories. *Journal of School Psychology, 38*(1), 3-7.
- Floor, P., & Akhtar, N. (2006), Can 18-Month-Old Infants Learn Words by Listening In on Conversations? *Infancy, 9*, 327-339.
- Meltzoff, A.N. (1988). Infant imitation after a 1-week delay: Long-Term Memory for Novel Acts and Multiple Stimuli. *Developmental Psychology, 24*(4), 470–476.
- World Health Organisation. (2020). *Origin of SARS-CoV-2*. Retrieved from [file:///Users/shrutijamnadass/Downloads/WHO-2019-nCoV-FAQ-Virus\\_origin-2020.1-eng.pdf](file:///Users/shrutijamnadass/Downloads/WHO-2019-nCoV-FAQ-Virus_origin-2020.1-eng.pdf)



## **Appendices**

### **Appendix A**

#### ***Contributions to the Research Project***

Both Jeffy Chun Yu Ho and Shruti Jamnadass completed the ethics application and designed the project. The development of the ostensive cues coding tool was carried out by Jeffy and Shruti supported this process. Participant recruitment and data collection was carried out jointly. The coding of the study data into the tool was entered individually and Jeffy then used this information to establish inter-rater reliability for the tool. Analysis of results, and the write-up of the theses were carried out individually.

## Appendix B

### *Ethical Approval*

---

UCL RESEARCH ETHICS COMMITTEE  
OFFICE FOR THE VICE PROVOST RESEARCH



---

26<sup>th</sup> September 2019

Dr Tobias Nolte  
Faculty of Brain Sciences  
UCL

Dear Dr Nolte,

**Notification of Ethics Approval with Provisos**

**Project ID/Title: 16673/001: 'Ostensive Communication, Mentalising and Learning in Mother-Infant Interactions.'**

I am pleased to confirm in my capacity as Joint Chair of the UCL Research Ethics Committee (REC) that your study has been ethically approved by the UCL REC until **26<sup>th</sup> September 2020**.

Approval is granted on condition that you:

- provide us with the data protection registration number when issued.
- amend your participant info sheet:
  - please note that there is new legislation on data protection - the Data Protection Act 2018. Please include a Data Privacy Notice –see our template point 14.
  - please include information who the participants can complain to, including [ethics@ucl.ac.uk](mailto:ethics@ucl.ac.uk)
- amend your consent document:
  - We would expect that details of the researchers and data protection officer (Ms Alex Potts data-pro) will be included on the consent form.
  - As you are collecting personal data, you need to inform the participant about the lawful basis for processing their personal data –public task –please see point 3 of our template for your reference

Ethical approval is subject to the following conditions:

**Notification of Amendments to the Research**

You must seek Chair's approval for proposed amendments (to include extensions to the duration of the project) to the research for which this approval has been given. Each research project is reviewed separately and if there are significant changes to the research protocol you should seek confirmation of continued ethical approval by completing an 'Amendment Approval Request Form'  
<http://ethics.grad.ucl.ac.uk/responsibilities.php>

**Adverse Event Reporting – Serious and Non-Serious**

It is your responsibility to report to the Committee any unanticipated problems or adverse events involving risks to participants or others. The Ethics Committee should be notified of all serious adverse events via the Ethics Committee Administrator ([ethics@ucl.ac.uk](mailto:ethics@ucl.ac.uk)) immediately the incident occurs. Where the adverse incident is unexpected and serious, the Joint Chairs will decide whether the study should be terminated

Office of the Vice Provost Research, 2 Taverton Street  
University College London  
Tel: +44 (0)20 7679 8717  
Email: [ethics@ucl.ac.uk](mailto:ethics@ucl.ac.uk)  
<http://ethics.grad.ucl.ac.uk/>

## Appendix C

### *Participant Information Sheet*

#### Information Sheet



**A study on mother-infant communication and infant learning**  
UCL Research Ethics Committee Approval ID Number: 16673/001

We would like to invite you and your child to participate in this study. Before you decide whether you would like to take part, it is important for you to read the following information carefully. Please ask us if there is anything that is not clear or if you would like more information.

#### **What is the purpose of this study?**

This research is being carried out to help us understand more about how babies learn and what aspects of the mother-child communication promote their learning. We are inviting mothers with babies between 16 and 22 months of age to take part in this study.

#### **Do I have to take part?**

It is entirely up to you to decide whether you take part in this study. If you do agree to participate you will still be free to change your mind at any time without having to give a reason. A decision to pull out of the study at any time will not affect the standard of care you receive and you may withdraw your data from the study at any point up until it is transcribed for use in the final report.

#### **What will I have to do if I take part?**

If you decide to take part in this study, a researcher will arrange to see you and your child together at the Anna Freud National Centre for Children and Families (AFNCCF) where you will be asked to do the following:

- Complete some **questionnaires** about you and your child and a **demographics form**. These should take about 45 minutes to complete.
- **Spend time with your child** for a little while as you would normally do at home. This should take about 10 minutes and will be video-recorded.
- **Teach your child to perform some simple tasks** which will be explained to you by the research team and then let your child carry out the task on his/her own. This should take about 45 minutes and will be video-recorded.
- **Complete a short screening measure** on the day of the study. This will be carried out after the study has taken place and will take approximately 20 minutes.

#### **Will my taking part in the study be confidential?**

All information collected will be kept strictly confidential and the research team will be the only ones with access to it. We make sure of this by keeping the questionnaires and video-recordings locked away, and by only writing your assigned identity number

not your name or any other personal details on these. The consent form that you sign will be stored separately to the video footage. We will not disclose any personal information you give us, unless in the very rare circumstances that there are concerns about the safety of you and/or your child. In these cases we would talk with you first before discussing these concerns with anybody else. All data collected will only be used for the purposes of this study and will be stored in accordance with the Data Protection Act (1998). All data will be destroyed 1 year after the study ends.

**What are the possible disadvantages and risks of taking part?**

We do not anticipate any particular risks to taking part in this study. If you are unhappy about any aspect(s) of it, please contact a member of the research team, who will do their best to help resolve any difficulties.

**What will happen to the results of the study?**

We may publish our results in a scientific journal and present findings at scientific conferences. Your data will be personally unidentifiable at all times.

**Who is organising and funding the project and who has granted ethical approval?**

The project is funded by the AFNCCF.

The study has been approved by the Ethics Committee of University College London, reference number: 16673/001

**Can I speak to someone to find out more information?**

Yes, please do get in touch if you would like to know more. You can contact:

- Tobias Nolte: [Tobias.NolteMD@annafreud.org](mailto:Tobias.NolteMD@annafreud.org)
- Shruti Jamnadass: [Shruti.Jamnadass@annafreud.org](mailto:Shruti.Jamnadass@annafreud.org)
- Jeffy C. Y. Ho: [Jeffy.Ho@annafreud.org](mailto:Jeffy.Ho@annafreud.org)

If you have any complaints or concerns about the study, please contact Tobias Nolte at [Tobias.NolteMD@annafreud.org](mailto:Tobias.NolteMD@annafreud.org) and the UCL Research Ethics Committee at [ethics@ucl.ac.uk](mailto:ethics@ucl.ac.uk)

**Thank you for taking the time to read through this information sheet!**

**Local Data Protection Privacy Notice**

The controller for this project will be University College London (UCL). The UCL Data Protection Officer provides oversight of UCL activities involving the processing of personal data, and can be contacted at [data-protection@ucl.ac.uk](mailto:data-protection@ucl.ac.uk)

This 'local' privacy notice sets out the information that applies to this particular study. Further information on how UCL uses participant information can be found in our 'general' privacy notice: <https://www.ucl.ac.uk/legal-services/privacy/ucl-general-research-participant-privacy-notice>

The categories of personal data used will be as follows:

Your contact details such as email address and phone number. Other demographic information such as yours and your child's age, ethnic background, marital status, housing, education and employment. The study will be video recorded for the purpose of data collection and later analysis. This video material will be stored for

the purposes of the study and will be discarded once the purpose of the study has been met.

The lawful basis that would be used to process your personal data will be to carry out a study in the public interest.

The lawful basis used to process special category personal data will be for scientific and historical research or statistical purposes.

Your personal data will be processed so long as it is required for the research project. If we are able to anonymise or pseudonymise the personal data you provide we will undertake this, and will endeavour to minimise the processing of personal data where possible.

If you are concerned about how your personal data is being processed, or if you would like to contact us about your rights, please contact UCL in the first instance at [data-protection@ucl.ac.uk](mailto:data-protection@ucl.ac.uk).

## Appendix D

### *Participant Consent Form*

#### CONSENT FORM

Please complete this form after you have read the Information Sheet and/or listened to an explanation about the programme evaluation. Thank you for your interest in taking part in this study. If you have any questions arising from the Information Sheet or explanation already given to you, please ask the researcher **before you decide if you would like to take part**. You will be given a copy of this Consent Form to keep and refer to at any time.

#### Initials

1. I confirm that I have read and understood the information sheet for this study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily.	
2. I understand that my participation is voluntary and that I am free to withdraw from this study at any time, without having to give a reason and without my legal rights being affected.	
3. I understand that my personal information (contact details, age and other demographic information such as ethnicity) will be used for the purposes explained to me. I understand that according to data protection legislation, 'public task' will be the lawful basis for processing.	
4. I agree to be filmed for this study and understand the purpose of the filming and that all footage will only be used for purposes relating to this study.	
5. I understand that it may be possible to identify me and my child from the video footage that will only be used for research purposes.	
6. I confirm I have parental responsibility for the named child.	
7. I agree to be interviewed for this study and understand that my responses will remain confidential and will only be used for research purposes.	
8. I agree to have my interview audio-recorded. I understand that this information will remain confidential and anonymous.	
9. I agree to take part in the above study.	

Participant name	Signature	Date
------------------	-----------	------

Researcher name	Signature	Date
-----------------	-----------	------

#### Names and Contact Details of Researchers:

Tobias Nolte: [Tobias.NolteMD@annafreud.org](mailto:Tobias.NolteMD@annafreud.org)

Shruti Jamnadass: [shruti.jamnadass.17@ucl.ac.uk](mailto:shruti.jamnadass.17@ucl.ac.uk)

Jeffy C. Y. Ho: [chun.ho.10@ucl.ac.uk](mailto:chun.ho.10@ucl.ac.uk)

#### Principal Researcher:

Professor Peter Fonagy: [p.fonagy@ucl.ac.uk](mailto:p.fonagy@ucl.ac.uk)

**Data Protection Officer:** Ms Alex Potts

## Appendix E

### *Participant Debrief Form*



#### Debrief Form

**A study on mother-infant communication and infant learning**  
UCL Research Ethics Committee Approval ID Number: 16673/001

Thank you for taking part in our study.

Our study aims to explore whether mothers' use of cues when teaching infants, aged 16-22 months, impacts whether they can learn a task. Some examples of cues we are looking at include eye contact and calling the baby's name.

We are also curious to see whether babies imitate their mother, such as copying the head action to switch on the lightbulb, or whether they can determine that the goal is to switch the light on and thus use their hands instead.

We measured other constructs with the questionnaires we sent you and so will also be exploring the interaction of those constructs with child learning.

As we said before, there is no expectation that that an infant of your baby's age will learn all the tasks, and this study will add to research in this area so that we are able to learn more about development in this age range.

If you have any further questions, feel free to contact us before June 2020:

- Shruti Jamnadass: [shruti.jamnadass.17@ucl.ac.uk](mailto:shruti.jamnadass.17@ucl.ac.uk)
- Jeffy C. Y. Ho: [chun.ho.10@ucl.ac.uk](mailto:chun.ho.10@ucl.ac.uk)

Thank you again and well done to you and your baby!

## Appendix F

### Recruitment Poster

# Mums and Toddlers needed!

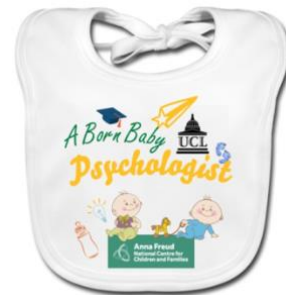
Is your child between the age of 16 and 22 months?

The Anna Freud National Centre for Children and Families is conducting a study about how babies learn, and we need your help!

### What will taking part involve?

A one hour visit to the Centre of:

- structured play activities for your baby;
- a couple of brief questionnaires;



The Centre is at 4-8 Rodney Street, it's 10 minutes' walk from Angel tube Station (Northern Lines).

### What are the benefits of taking part?

It's a visit with **Good Fun** and you will be making an **important contribution with your baby** to research on children's development

You are compensated **£17** for your time and to cover travel expenses to the Centre. Your child will also receive a cool **UCL & Anna Freud Centre limited edition Baby Bib.**

### Interested in participating?

If you are interested in taking part or would like more information, please contact Shruti or Jeffy via Email:

Shruti: [Shruti.Jamnadass@annafreud.org](mailto:Shruti.Jamnadass@annafreud.org)

Jeffy: [Jeffy.Ho@annafreud.org](mailto:Jeffy.Ho@annafreud.org)



## Appendix G

### *Appointment Letter to Participants*



#### **The Anna Freud National Centre for Children and Families Anna Freud Centre**

4-8 Rodney Street,  
London,  
N1 9JH

Dear

As discussed, your appointment slot for our Infant Research Study is booked for:

**Date:**                      **Time:**

**At:** The Anna Freud National Centre for Children and Families Anna Freud Centre  
4-8 Rodney Street  
London N1 9JH

If you are travelling via underground with a pram, the nearest stations are King's Cross St Pancras station (Lift & Escalator Access) and Angel station (Escalator Access Only).

Once arrive, please report to the reception and we will meet you there.

For the purpose of the study, please note that we will initially try to have minimal interaction with your baby. For example, we might come across as a little bit cold or less enthusiastic, but please be reassured that it is part of the study.

Please see enclosed some questionnaires. We would be grateful if you could complete these prior to your visit and bring them with you.

If you have any questions or need to re-book your appointment, please either contact Jeffy at [Jeffy.Ho@annafreud.org](mailto:Jeffy.Ho@annafreud.org) or Shruti at [Shruti.Jamnadass@annafreud.org](mailto:Shruti.Jamnadass@annafreud.org).

We look forward to meeting you and your baby!

Best wishes,

Jeffy C. Y. Ho and Shruti Jamnadass

Clinical Psychologists in Training  
Research Department of Clinical, Educational and Health Psychology  
University College London  
1-19 Torrington Place  
London WC1E 7HB

## Appendix H

### *Instruction Sheet for Experiment*

#### **Instruction Sheet for TASK A (first part)**

**PURPOSE: Help your baby learn to switch on the light with their head**

1. Demonstrate touching your head to the box
2. Demonstrate this 3 times
3. Not allowed to physically move your baby's head to the box
4. After you have shown this 3 times, **DO NOT** let your baby to try on immediately and return the box to the experimenter

#### **Instruction Sheet for TASK B**

**PURPOSE: Teach your baby names of objects**

1. Show your baby all 4 objects in the tray by showing and naming them, one at a time, using whatever strategy you like
2. Then, name one object for your baby to select. Do this again.
3. After your baby has successfully shown you 2 objects, we will move on

#### **Task B continued**

1. There are now 3 objects with labels on them indicating what they are called
2. Show your baby all 3 objects by showing and naming them, one at a time

3. After you have shown and named all objects, repeat this two more times
4. After this, your baby can play with the items for a few seconds
5. Place all 4 items on the tray
6. Ask your baby which one they prefer
7. Say a name of an object that you would like your baby to select
8. Do this for all 3 objects
9. Don't worry if your baby doesn't get it right!
10. We will now give you another set of 3 objects – please do the same as above  
(showing, naming, asking baby which they prefer and then naming each object one at a time for your baby to select)

**Instruction Sheet for TASK A (2<sup>nd</sup> part)**

1. Place the box in front of your baby and ask them to switch on the light
2. **Do not** demonstrate the task anymore and do not tell them how to switch on the light



Thank you for taking part in our study!

## Appendix I

### *Demographics Questionnaire*

#### Demographic Questionnaire

PPT ID: \_\_\_\_\_

Date: \_\_\_\_\_

1. What is the age of your baby? \_\_\_\_\_ (in months)

2. What is your age? \_\_\_\_\_ (in years)

3. How many other children do you have? \_\_\_\_\_

4. How old are each of your other children? Please list their ages (in years):

\_\_\_\_\_

5. What language(s) do you speak at home?

\_\_\_\_\_

6. Place of birth: \_\_\_\_\_ (City/Country)

7. Have you had a diagnosis of learning disability or learning difficulty? YES / NO

If Yes, please specify: \_\_\_\_\_

#### Ethnicity (please circle):

- |   |  |
|---|--|
| 1. White – British                                  | 10. Any other mixed background                               |
| 2. White – Irish                                    | 11. Asian/British Asian – Indian                             |
| 3. White – any other white background               | 12. Asian/British Asian – Pakistani                          |
| 4. Black/Black British – Caribbean                  | 13. Asian/British Asian – Bangladeshi                        |
| 5. Black/Black British – African                    | 14. Asian/British Asian – any other Asian background         |
| 6. Black/Black British – any other Black background | 15. Chinese  |
| 7. Mixed – White and Black Caribbean                | 16. Any other background not stated (please state):<br>_____ |
| 8. Mixed – White and Black African                  | 17. Not stated   |
| 9. Mixed – White and Asian                          |  |

#### Mother's ethnicity (please circle):

- |                                       |   |
|---------------------------------------|---|
| 1. White – British                    | 6. Black/Black British – any other Black background |
| 2. White – Irish                      | 7. Mixed – White and Black Caribbean                |
| 3. White – any other white background | 8. Mixed – White and Black African                  |
| 4. Black/Black British – Caribbean    | 9. Mixed – White and Asian                          |
| 5. Black/Black British – African      | 10. Any other mixed background                      |

11. Asian/British Asian – Indian
12. Asian/British Asian – Pakistani
13. Asian/British Asian – Bangladeshi
14. Asian/British Asian – any other Asian background

15. Chinese
16. Any other background not stated (please state):  
\_\_\_\_\_
17. Not stated

**Father's ethnicity (please circle):**

1. White – British
2. White – Irish
3. White – any other white background
4. Black/Black British – Caribbean
5. Black/Black British – African
6. Black/Black British – any other Black background
7. Mixed – White and Black Caribbean
8. Mixed – White and Black African
9. Mixed – White and Asian

10. Any other mixed background
11. Asian/British Asian – Indian
12. Asian/British Asian – Pakistani
13. Asian/British Asian – Bangladeshi
14. Asian/British Asian – any other Asian background
15. Chinese
16. Any other background not stated (please state):  
\_\_\_\_\_
17. Not stated

**Employment status:**

1. Employed - full time
2. Employed - part time
3. Employed – casual work
4. Self employed
5. Internship/apprenticeship
6. Student
7. Retired
8. Carer
9. Unemployed

Occupation (please state): \_\_\_\_\_

Household Income (please circle):

1. Less than £10,000
2. £10,000-20,000
3. £20,000-35,000
4. £35,000-50,000
5. £50,000-75,000
6. £75,000-100,000
7. £100,000 +

Mother's level of education (please circle):

1. No qualifications
2. Other qualification not listed (e.g. certificate)
3. Vocational level (e.g. NVQ) 1, GCSE (<5 A\*-C) or equivalent
4. GCSE (5 or more grades A\*-C), vocational level (e.g. NVQ) 2 or equivalent
5. A Level, vocational level (e.g. NVQ) 3 or equivalent
6. Higher education or professional/vocational equivalent
7. Post graduate education or professional/vocational equivalent (e.g. Masters, PhD, MD)

Years in education (total): \_\_\_\_\_ years

Father's level of education (please circle):

1. No qualifications
2. Other qualification not listed (e.g. certificate)
3. Vocational level (e.g. NVQ) 1, GCSE (<5 A\*-C) or equivalent
4. GCSE (5 or more grades A\*-C), vocational level (e.g. NVQ) 2 or equivalent
5. A Level, vocational level (e.g. NVQ) 3 or equivalent
6. Higher education or professional/vocational equivalent
7. Post graduate education or professional/vocational equivalent (e.g. Masters, PhD, MD)

Years in education (total): \_\_\_\_\_ years

Have you experienced any significant losses during your childhood (i.e. parents, siblings, close family member)?

Who	How old were you at the time of loss? (years)	Due to what circumstances did the loss occur?

Have you experienced any significant separations during your childhood (i.e. parents, siblings, close family member)?

Who?	How old were you at the time of separation? (years)	Due to what circumstances did the separation occur?	How long for? (months)

Are you currently OR have been seen by mental health services?

Yes                      No

If you are currently receiving treatment, at what stage of the treatment are you?:

1. Preliminary assessment
2. Waiting list for treatment
3. Psycho-educational group started
4. Psycho-educational group finished waiting for individual therapy
5. Psycho-educational group finished waiting for further group sessions
6. Individual treatment started
7. Other. Please specify: \_\_\_\_\_

When were you first seen by mental health services? \_\_\_\_\_  
(month/year)

If you are no longer being seen, when did you stop working with them? \_\_\_\_\_  
(month/year)

If you are still being seen, when did you start working with your current mental health team? \_\_\_\_\_ (month/year)

Are/have you had any psychological therapies as part of your treatment?

Therapy Type	Service Provider (i.e. Trust, private)	Number of sessions	Average contact time (hrs)	Dates (from/to)

Are you currently on any medication prescribed by your mental health service?

Name of Drug	Dosage (mg)	Frequency	How long taken for?