

Epistemic Actions in Attachment Relationships and the Origin of the Socially Extended Mind

Dean Petters¹ and Everett Waters²

Abstract. Attachment Theory describes how humans possess a strong innate predisposition to emotionally attach to familiar people around them who provide physical or emotional security. When infants learn to trust in intimate and enduring relationships they will tend to use their carers to extend their minds. Such cognitive extension is likely to impact mental health by helping infants reach the upper limit of their cognitive performance. Conversely, a caregiver's failure to gain 'epistemic trust' may act as a contributory risk factor for multiple later psychopathologies

1 ATTACHMENT RELATIONSHIPS AND THE EXTENDED MIND HYPOTHESIS

The extended mind thesis in cognitive science suggests that entities in the external environment may interact with internal mental processes in such a way that these entities can be seen as extensions of the mind itself [4, 5]. Cognitive extension is usually cast in terms of extending the mind onto inorganic objects in the environment, such as a mathematician doing their 'working' on paper. However, extension onto external agents (such as caregivers, teachers, friends or work colleagues) is not ruled out in this approach. For cognitive extension to involve extension of mental states onto an agent rather than an inorganic object, the agent must be strongly trusted, relied upon and accessible as an information provider [5].

There are many adult occupations where intense social interaction and information transfer occurs between workers jointly undertaking complex information critical tasks. When trust is built up over time or through training - in surgical teams, between police partners, or in small military groups, then individuals may use other people to extend their own cognition. However, such adult work related examples of social extension of cognition are not the focus of this paper. Instead this paper will concentrate on considering how examples of social extended cognition may occur when caregivers provide external cognitive support to infants and children (whilst also considering attachment partnerships between caregivers and adolescents and between adult romantic partners).

The idea that infants, older children and even adult attachment partners all look to their carers as information sources about the broader world is a familiar one. For example, social referencing and joint attention are both well studied topics in developmental psychology [3]. From the perspective of the socially extended mind, infant social referencing and joint attention between infant and carer may be seen as physical actions that make the infant's mental computations faster, more reliable or less effortful by actually incorporating the carer's help within those cognitive operations. Socially extended

cognition in infant-carer dyads are likely to be asymmetric - with caregivers providing the extra support and the infant's cognition being extended. So, if a carer (as part of the environment) is coupled to an infant's cognitive system in the right way, they become part of the infant's mind. This approach is therefore treating the infant cognition as occurring 'outside' and well as 'inside the head'.

How well can the affordances provided by a carer match the infant's cognitive requirements? How well can carers support higher performance cognition in infants? How closely coupled can infant computational needs and carer response be? The psychoanalyst Donald Winnicott remarked that: "*There is no such thing as a baby, only a baby and a mother*" [14, page 39]. Winnicott's view of a closely integrated mother-infant dyad is consonant with the idea of carers extending the minds of infants they care for. What this means is that if the infant's ongoing computational needs are met by sensitive and timely support from his or her carer then we might say that the carers cognitive support has become part of the infant's extended mind.

Clark shows how language extends minds:

"First, the simple act of labelling the world opens up a variety of new computational opportunities and supports the discovery of abstract patterns in nature. Second, encountering or recalling structured sentences supports the development of otherwise unattainable kinds of expertise. And third, linguistic structures contribute to some of the most important yet conceptually complex of all human capacities: our ability to reflect on our own thoughts and characters and our limited but genuine capacity to control and guide the shape and contents of our own thinking" [4, page 44]

From our current perspective of exploring how attachment figures may extend infant minds we can see that they may be viewed as fulfilling the same three roles that Clark ascribes to language. That is, caregivers can also help label and conceptualise, structure, and facilitate self-reflection.

In developing a framework to explain the origin of the socially extended mind, this paper draws upon Attachment Theory as an existing well-developed theory which is focused upon long term intimate social and emotional interactions, including how trust is formed and can be lost in close relationships. Attachment Theory is also based upon an information processing foundation which facilitates theorizing in terms of internal and external cognition. Serving as mind extension is clearly part of what attachment theorists mean when they say that an attachment figure enables one to 'live a bigger life' than would otherwise be possible. After showing how the information processing foundation for Attachment Theory leaves it well placed to be augmented with inclusion of socially extended mind mechanisms, this paper will assess how an Attachment Theory extended in

¹ University of Birmingham, UK, email: d.d.petters@cs.bham.ac.uk

² SUNY, Stony Brook, USA.

this way is relevant to mental health issues.

2 INTRODUCTION TO ATTACHMENT THEORY

Prior to the second war, medical and social scientists understood very little about the nature of human relationships and the security they can bring to an individual. Then, about the time that Alan Turing was making brilliant contributions to his country's security and the field of cybernetics was being formed, the child psychiatrist John Bowlby began publishing seminal insights into the nature of the child's tie to its carers and the origins of interpersonal security. Bowlby's attachment theory grew to include insights from numerous disciplines including psychoanalysis, ethology, cybernetics, cognitive and developmental psychology, and artificial intelligence [2]. The theoretical framework provided by Bowlby has structured and focused the empirical observations of attachment interactions in diverse contexts. These contexts include interactions between infants and children and their caregivers; between romantic partners in adolescence and adulthood; in typical and pathological populations; and observing attachment relations from a biological and comparative psychology perspective. Together they provide a rich description of attachment related affect, behaviour and cognitions, and information about the contexts in which they occur - information essential to building and evaluating computational attachment models and simulations [11].

Bowlby's initial research focus was towards understanding particular normative attachment related social and emotional phenomena such as: the separation distress exhibited by children when they or their mothers were absent due to the infant's or mother's hospitalization; the effect of early maternal deprivation on later development; and grief and mourning in infancy [2]. One of Bowlby's early goals was to construct a scientifically respectable attachment motivation theory that could account for an infant behaviour's sensitivity to social context. To accomplish this, he first turned to ethology and developed a framework that described the attachment system as an instinctive behaviour system. However, in his more mature theoretical work, Bowlby drew increasingly on control systems theory and on AI based representations such as internal working models (IWMs) and hierarchical plans. This means that the information processing explanations for attachment phenomena can be integrated with newly proposed information processing structures and mechanisms - such as those suggested by the Extended Mind framework [12].

3 THEORETICAL FOUNDATIONS OF ATTACHMENT THEORY

3.1 Ethological underpinnings

Attachment Theory is an evolutionary theory which was founded upon the Behaviour System concept from Ethology. In this framework Behaviour Systems control behaviours such as mating, fighting and feeding. Each Behaviour System carries out a species specific function, and has survived in the genome because its functions contribute to biological fitness. Therefore Behaviour Systems are related to one meaning of the term 'instinct' [10]. The Behaviour Systems that Bowlby linked to attachment behaviour in human infants are the attachment, fear, sociability and exploration systems [2]. The behaviour systems most closely related to attachment are inherently motivated [9]. This means that infants will work to experience exploration, socialisation and security. These outcomes are therefore primary drives that are not activated as the by-product of any more fundamental process.

Behaviour Systems within the Attachment Control System allow a flexible repertoire of behaviours to be produced when pursuing currently active goals. What defines the attachment control system and its constituent behaviours is the outcomes that reliably follow from activating these behaviours. For example, if an infant is anxious and its current goal is to increase its proximity to a carer the infant may cry (which predictably brings the carer closer), or crawl towards the carer themselves. Of course, crying and crawling may also be activated by other behaviour systems, such as, respectively hunger or exploration.

For Bowlby, behaviours resulting from the attachment behaviour system and the fear system have the predictable outcome of maintaining access and proximity to its primary carer. They might also involve facilitating access to the benefits of cognitive extension.

3.2 The attachment control system involves a hierarchy of forms of information processing

Attachment behaviours can be observed from infancy to adulthood. In adulthood contexts range from caregiving to romantic relationships. So it is unsurprising that a diverse range of information processing structures and mechanisms have been invoked to explain the diversity of empirical findings. From Ethology, Bowlby introduced relatively more simple concepts and mechanisms. In addition to the Behaviour Systems concept mentioned in section 3.1, other ethological concepts drawn into Attachment Theory include Reflex Actions and Fixed Action Patterns. Bowlby also showed how these 'simple' mechanisms can interact in complex ways by chaining and alternation. Behavioural patterns arising when fixed action patterns have been trained into complex sequences can be mistaken for behaviours directed by more complex goal corrected mechanisms because of the sensitive matching of response to stimuli.

Goal corrected feedback mechanisms were also introduced by Bowlby from control systems theory and cybernetics to play an important part in the 'purposiveness' of the attachment control system framework. Whereas younger infants may produce complex behaviour by chaining and training of simple mechanisms like reflexes and fixed action patterns, older infants, children and adults use more complex control mechanisms. Simple and complex mechanisms co-exist, with each sometimes overridden by the other. So higher level processing afforded by cognitive extension should integrate with lower level processing.

Bowlby invoked internal working models (IMWs) and plans as explicit internal representations in the attachment control system. The internal working models (IWM's) concept was used to represent models of self and other in attachment relationships. In this role IWM's do not capture every aspect of reality but enough that the child can formulate plans and make decisions in relation to attachment goals. IWMs represent attachment related world knowledge and expectations about its caregiver's availability and responsiveness. These expectations are derived from the carer's past performance. According to Bowlby simple plans can be formed when several goal corrected steps are chained together, and each step must be completed before the next step is taken. More complex plans were also proposed where simple plans were formed into plan hierarchies. Ultimately plans come to be represented linguistically.

According to Bowlby, natural language is the ultimate and most sophisticated way in which individuals can represent themselves within their social environment. A benefit of the non-communicative aspect of language is that the possession of language allows more flexible and imaginative plans and subplans to be created. Bowlby

noted that linguistically formed representations also have the benefit that “*instead of each one of us having to build his environmental and organismic models entirely for himself, he can draw on models built by others*” [2, page 82].

This paper is thus an attempt to integrate Bowlby’s idea that we can rely upon models built by others with the conceptual framework provided by the extended mind concept. In this integrated view, we not only rely upon models built by others, but these models are also held ‘externally’ and we access these models through our attachment figures. Sometimes, extended cognition may occur in attachment interactions in an enactive manner. For example, an infant can be viewed as possessing embodied enactive models of physical holding and will therefore expect to ‘sink in’ to a greater or lesser degree when being held according to their particular enactive model built from previous experience. However, Attachment Theory includes structural elements such as secure-base scripts which are not enactive but rather originate from a more traditional computational and representational approach within Cognitive Science. Attachment Theory therefore provides an explanatory framework where these diverse approaches are intimately and naturally linked. So one contribution of developing an extended mind approach to attachment phenomena is that it provides a canonical example of social extension which also integrates a traditional computational and representational approach to explaining behaviour with enactive explanatory elements.

According to Bowlby the attachment control system develops from being reliant on simple mechanisms such as reflexes through many intermediate forms to finally being mediated by complex high level representations such as natural language. During this process of change there is often stability in the individual differences in behavioural patterns exhibited by individuals. This continuity is in part explained because often early appearing fragments of instinctive behaviour are integrated into later appearing complete sequences with their normal mature functional consequences. Cognitive extension is an additional cause of stability over time.

These developmental processes described by Bowlby involve intimate interaction between lower level processes, such as simple reflexive responses, and emerging higher level structures and mechanisms. New resources are created over time. Integrating elements into a system depends on (i) biases in infant learning abilities and (ii) information/structure in the expectable caregiving environment. The control system as proposed by Bowlby is not just preformed and waiting to be triggered or maturing without experience, but is rather constructed - through interaction between infant learning abilities and information available in the structure of the caregiving environment. This theoretical approach provides a ready framework to fit with extended mind mechanisms. A cognitively extending carer can provide access to resources which mesh with those already possessed internally.

4 ATTACHMENT THEORY - FROM PHYSICAL PROXIMITY TO INFORMATION PROVISION

Attachment Theory describes how our closest relationships develop and function across the life span. Attachment bonds are formed early in infancy and can reform and develop through the life-span. The hallmarks of attachment include (a) preference, (b) familiarity, (c) relative uniqueness, (d) identity, (d) use as a secure base, and (e) grief and mourning in response to loss [13]. So typically, only a very small number of attachment bonds are formed, most often with primary caregivers and, later, partners in enduring relationships and one’s offspring. In infancy, as in adulthood, we tend to form attach-

ment relationships with only one or a few figures at a time. Any of these may serve as a secure base from which to explore and a haven of safety. Early in life secure-base behaviour may be observed when infants attempt to gain and retain physical proximity with their attachment figures. Later in life adolescents and adults may retreat to their attachment figures without gaining physical proximity by using communications technology to make emotional contact.

Whilst Bowlby was setting out the information processing underpinnings for Attachment Theory, Mary Ainsworth and co-workers [1] studied how differences in infant-care interactions can affect the course of emotional and social development and the growth of attachment. The focus on individual differences in attachment status and development led to an empirically productive new direction for attachment research. Much of the contemporary attachment research on mental health issues and psychopathology is linked to individual differences attachment categories derived from the Strange Situation Experiment [1]. This is not an experiment where infant-carer dyads are randomly assigned to different conditions in the laboratory. Rather it is a standardised laboratory procedure where all infants are presented with the same controlled and replicable set of experiences.

To capture infant responses to changes in context, the Strange Situation procedure consists of 8 three minutes episodes which are designed to activate, intensify or relax the one-year-olds attachment behaviour in a moderate and controlled manner. The infant and carer enter the laboratory setting together, but then undergo a separation. The carer leaves from the room, before a reunion in a subsequent episode. As the first reunion episode ends the infant meets an unfamiliar stranger in the laboratory, before a further separation. In each episode infant behaviour is carefully recorded from behind a two-way mirror. In the final episode the mother is reunited with her one-year-old infant after the infant has been left alone for three minutes in the unfamiliar setting.

The infant’s responses to context changes that occur in the transitions between the eight episodes demonstrate typical normative trends. For example, infants, irrespective of home environment, typically exhibit increased distress when their carer leaves the room so the infant is left with a stranger (in episode four) or completely alone (in episode six). Nested within the normative trends are several patterns of response reflecting the infant’s confidence in the caregivers response patterns. The infant’s response in the reunion episodes correlates strongly with patterns of maternal behaviour and infant responses intensively observed throughout the previous year. Therefore a key finding of the Strange Situation, and which makes it such a valuable research tool, is that infant behavioural patterns observed when the carer returns to the infant after a separation (infant-carer reunions occur in episodes five and eight) provide the best short-hand classification for the attachment behavioural patterns of infant and carer observed at length in the home environment (1).

Individual differences in the Strange Situation cluster into four patterns:

- Secure (type B) infants form the largest proportion in non-clinical populations and secure behaviour is the reference pattern against which the other classifications are evaluated. Infant responses in reunion episodes in the Strange Situation include approaching their mothers in a positive manner and then returning to play and exploration in the room quickly. They receive care at home which is consistently sensitive, more emotionally expressive and provided less contact of an unpleasant nature; at home these infants are less angry and they cry less.
- Avoidant (type A) infants typically make up the second largest

proportion of non-clinical populations. Infants responses in reunion episodes in the Strange Situation include not seeking contact or avoiding their carers gaze or avoiding physical contact with her. These children return quickly to play and exploration but do so with less concentration than secure children. Whilst playing they stay close to and keep an eye on their carer. It may seem that they are not distressed or anxious in the Strange Situation. However, research employing telemetered autonomic data and salivary hormone assays has demonstrate that, despite their relative lack of crying, avoidant infants are at least as stressed by the procedure as secure and resistant infants. Their care at home is consistently less sensitive to infant signals and less skilled in holding the baby during routine care and interaction. At home these infants are more angry and cry more than secure infants.

- Ambivalent (type C) infants typically make up a small but measurable proportion of non-clinical populations. Infants responses in reunion episodes in the Strange Situation include not being comforted and being overly passive or showing anger towards their carers. These infants do not return quickly to exploration and play. Their care at home is less sensitive and particularly inconsistent. In comparison with average levels across all groups, C type carers are observed at home being more emotionally expressive; they provided physical contact which is unpleasant at a level intermediate between A and B carers and leave infants crying for longer durations. At home these infants are more angry and cry more than secure infants,
- Disorganised (type D). This last attachment pattern has been more recently categorised, is the least well characterised or understood, and forms a very small proportion of infants in the general population [8, page 26].

In a risk factors approach to psychopathology, secure status has been suggested as a protective factor whereas the three insecure attachment patterns have been suggested as risk factors for various subsequent psychopathologies.

5 ATTACHMENT, MIND EXTENSION, AND MENTAL HEALTH

Attachment Theory is a developmental theory but also an evolutionary theory. So we should expect that at every age, but especially in infancy and childhood, an effective attachment figure who is a primary caregiver should possess the goal to extend their cared for individual's mental capacities - elevating ongoing activities (enhancement) and supporting development to higher performance over time (enrichment). This might be taken to mean that an attachment figure aids those they care for by providing certain affordances in the social environment. This will be more important in infancy. In moment to moment interactions, a carer (if she recognizes what her infant is up to and is skilful and motivated) adapts her support (including extending and transforming it through the course of the interaction). She may reach for the approaching infant, then make adjustments as it comes close and makes efforts to be picked up. Much the same may occur in her support for exploration.

The Strange Situation emphasises that infants attempt to control physical proximity to their carers - by signalling to the carer or actually moving closer themselves when anxious. Or conversely moving further away to explore when feeling safe. More recent research has shown that young children do not just hold sensorimotor representations of the quality of their attachment relationships. For example, attachment relationship quality can be assessed by the simple drawings young children make of their families. This 'move to the level

of representation' is well established in contemporary attachment research [8, page 36].

What is more novel in attachment research is a finding that infants and young children may filter information that they get from their carers according to how reliable the carer is in facilitating achievement of other goals that are not related to information gathering and exchange. A recent empirical result has shown that securely attached children hold a more nuanced and realistic view of their caregiver as a provider of information than insecure children do [6]. A traditional view in Attachment Theory is that attached children possess expectations about their carers as providers of physical and emotional care. This new result widens this perspective to see children as appraising the information providing qualities of their caregivers. So, in a traditional view, infants assess how effective their attachment figure is in manipulating the physical world. In this new view infants in addition assess how reliably carers process and provide information and may act to optimise how they can gain information from their carers. We can say that secure infants tend to use their carers more in 'epistemic actions' (where the action is not intended to change the state of the world but gain information about the world) [4]. Insecure infants not only trust their carers less to provide security, they also seem to trust their carers less to just provide accurate knowledge about the world [6]. So a secure 2-5 year old might use the mother as an extension of his/her mind. When asking for information he/she assumes that the mother knows what is being requested and assumes that the information provided is true and complete. Being egocentric at this age, the child would not distinguish between information sought from and provided by mother and information retrieved from his/her own memory. That is, limited source monitoring - knowing the answer and knowing that this is something mother told me are not well distinguished. Interaction with the mother facilitates development of a theory of their own mental processes and understanding others mental process. As Clark notes: "*The child is surrounded by exemplars of mind-reading in action, she is nudged by cultural interventions such as the use of simplified narratives, prompted by parental rehearsal of her own intentions, and provided with a rich palate of linguistic tools such as words for mental states*" [4, page 67].

There is substantial evidence that for an infant, gaining secure attachment status confers specific advantages in the subsequent development of social competencies [8, page 201]. Extended mind mechanisms such as use of carers in epistemic actions integrate well within a framework showing how secure attachment promotes social competence. When an infant is trusting of their carer they can use that attachment figure to extend their own mind as well as acting as a secure-base and haven of safety. This trusting relationship is likely to lead to less cognitive effort being needed by the infant when undertaking a range of tasks. So the extended mind mechanism provides part of a putative explanation for the upper reaches of cognitive performance. Therefore, attachment security and mechanisms of cognitive extension may be linked to good mental health in the sense of co-occurring with effective management of relationships and enabling general high-level cognitive performance.

Whilst the evidence linking secure attachment to improved social competence is relatively clear, the relationship of insecure attachment to mental health is not so straightforward. There are several possibilities for simple causal relationships between insecure attachment status and psychopathology which can be discounted. Firstly, insecure attachments are not a form of psychopathology warranting clinical attention, and are often adaptive responses to particular caregiving environments [8]. Secondly, empirical data show that insecure

attachment does not have a direct causal role in the later development of psychological disturbance. The effort to find the 'Holy Grail' of main effects of infant attachment on later psychopathology has so far been characterised as a "fruitless search" [7, page 638] Thirdly, insecure attachment is not even strongly linked to specific threats to mental well-being. Rather, there are multiple pathways to any given disorder. A single disorder might be reached from a combination of other risk factors. So in addition to early attachment relationships, other risk factors are: child characteristics such as temperament; parental socialisation and management strategies; and family ecology (family life stress and trauma, family resources and social support). Also, insecure attachment may contribute, along with these other risk factors, to multiple disorders [7].

A commonly accepted view is that early attachment is just one factor among many that either add protection or increase vulnerabilities to subsequent disorders. Attachment relationship dysfunction can give rise to serious psychopathology. For example, 'reactive attachment disorder' is one of a small number of psychopathological disorders diagnosable in young children [8, 7]. However, such psychopathologies are linked to significant abuse and negligence by caregivers. In contexts such as this, the presence or absence of extended mind interaction between an infant-carer dyad may not be a clinically useful measure. Nonetheless, Attachment Theory provides an evolutionary lense through which to view the socially-mediated development of mind extension. Unlike theories of cognitive scaffolding, Attachment Theory illustrates how mind extension can involve privileged access by an epistemically trusted carer to an infant. This privileged access may be part of the optimal evolutionary expectable caregiving environment. So possessing epistemic trust in a carer may be an important step or precursor to subsequent developments in many socio-emotional developmental trajectories towards mental health. Therefore, failure to experience such epistemic trust may be a contributory factor, rather than on its own push an infant into psychopathology. In addition, the multiple root causes of key psychopathology symptoms may interfere with interactions and learning necessary to develop confidence in a caregiver's availability (and hence extended mind capacity). Thus these multiple root causes and secondary and tertiary effects arising from attachment or extended mind interactions may play a role in the development and tuning of each other.

6 CONCLUSION

Attachment figures are situated centrally in complex interactions. Attachment Theory has set out details of an infant's information processing infrastructure which supports infant cognition in these contexts. Up till now Attachment Theory has focused on representations such as Internal Working Models and plans which are held 'within' the infants head. In this type of tightly coupled interaction, cognitive processes can bridge the traditionally conceived boundaries between social actors. The extended mind thesis suggests that computational processes:

"do not properly decompose into a neat sphere of internally achieved computations surrounded by a well behaved nimbus of calls to the world. In place of such a neat "inside-outside" boundary respecting cycle, we confront a bunch of unfolding internal processes, each of which is directly issuing at different timescales, calls both to other inner processes and to outward-looping epistemic acts that result in cognitively crucial episodes of closed-loop interaction" [4, page 73].

The thesis put forward in this paper is that some carers may be considered 'transparent equipment' within the cognitive processes of infants with whom they are attached [4, page 80]. Not every child-carer dyad can be expected to develop mind extension. The child needs to trust their carer epistemically as well as a secure-base and haven of safety.

We cannot know what the two originators of Attachment Theory would make of the extended mind approach to Attachment Theory presented above. It is possible that John Bowlby would see parallels to psychoanalytic ideas on the absence of self-other distinction and its early development. Mary Ainsworth had a much more informed and finely tuned sense of mother-infant interaction. She may have recognised that her maternal sensitivity scales, particularly 'sensitivity to signals', and 'cooperation vs. interference with ongoing behaviour', [1] include similar ideas to the extended mind approach to attachment presented above. This similarity means that the extended mind concept is likely a useful tool for highlighting the level at which infant and maternal behaviour are coordinated.

Further research may explore how children develop from implicit use of mother as mind extension to explicit use. Questions include whether there are required sequences in these kind of changes, as opposed to trajectories that depend on various facts about the different genomes or different environments. In addition, work should also clarify how an extended mind approach integrated within Attachment Theory contrasts with other developmental approaches such as those that rely on cognitive scaffolding without affective support; and those concerned with mind-mindedness.

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