

It is often thought that language provides the concepts that we use to organise our thinking and knowledge. If that is the case, then it would seem to follow that young infants, before they learn language, cannot think or have knowledge. How has recent evidence from psychological research challenged this view?

The belief that young infants think and have knowledge before articulating language is a current debate in cognitive psychology. Research has been wide and varied, investigating whether language is a prerequisite to thinking and knowledge. Through exploration of recent evidence, this essay aims to build an argument for and against language being needed to organise our thinking and knowledge. It will firstly define 'thinking' and 'knowledge', then describe the range of research, addressing whether or not pre-verbal infants are able to categorise the world; discussing evidence in relation to thinking, knowledge and early language development. Finally, it will weigh up the evidence, concluding whether or not it is possible to think and have knowledge before learning language.

Knowledge and thinking can be difficult to define simply, as they encapsulate so much in different contexts. However, Mandler (1983) describes two types of knowledge: procedural (knowing how to do things, often without thinking, such as riding a bike) and declarative (knowledge available to conscious thinking, such as mathematical calculations). Thinking involves the mind consciously reasoning. Vygotsky (1986) explains thinking through language, depicting an inner speech (for internal cognition) and external speech (for social communication); believing it is also possible for pre-verbal infants to apply internal mental reasoning. These definitions highlight the manner in which the two terms are intertwined in a reciprocal relationship.

In establishing when thinking and knowledge arises, the development of early language should be considered. Using words in speech is known as 'production', and understanding words is referred to as 'comprehension'. Comprehension occurs before a child can articulate sounds, around seven months, whereas production of words happens anytime after nine months (Harris, 2004). Skills used in comprehension are fewer than those required for word production; involving word recognition from speech streams, remembering sounds of words to recognise them again and linking words to previous knowledge. These comprehension skills imply that even if an infant cannot speak, he/she can comprehend a word; involving both knowledge and thinking. The way in which infants acquire their first words is dependent upon being exposed to hearing words consistently before speaking; thereby the journey of infants' language relies upon social and cultural experiences.

The belief that thinking and knowledge cannot be present before language has been fiercely disputed by recent psychological research, such as studies investigating how infants categorise. Mandler (1997) defines two types of categories: perceptual (visual features of objects) and conceptual (more complex, abstract features). Categories require storing experiences in memory, in addition to comparing familiar experiences. As the following research implies, if young infants are able to form categories this would assume a presence and application of thinking and knowledge. However, are infants able to form categories before learning to speak?

Assessing the building of mental category representations in pre-verbal infants, Fantz's (1963) familiarization/ novelty-preference method implemented and

standardised simple stimuli. This involved presenting three to four month olds with a cat picture, which they spent time looking at, before being shown a different picture of a dog, alongside the familiar cat picture. Conducted in a laboratory, under stringent conditions, findings demonstrated infants' attention drawn to the new picture of the dog in preference to the familiar cat picture. Recognising differences, knowing when something is new, assumes infants can form category representations of familiar objects; thinking and storing knowledge in their memories. These findings provide evidence against children not thinking or having knowledge before speaking. However, if the principle of parsimony was applied, offering a simpler explanation, suggesting infants looked at the novel picture for longer for other reasons, such as attractive colours or shapes (The Open University, 2006). Applying parsimony would make judging whether or not pre-verbal infants can think or have knowledge difficult to prove.

Based on the novelty-preference concept, Younger and Gotlieb (1988) conducted a study involving categorisation of dot patterns with three, five and seven month infants. Infants were shown six pairs of distorted dot patterns to familiarise themselves with (derived from good, intermediate and poor prototypes), before being shown a familiar distorted dot pattern alongside an unfamiliar prototype dot pattern. Findings revealed infants looked longer at the novel prototype, belonging to a different group to the one studied earlier. Infants perhaps connected distorted dot patterns with the prototype; thereby treating the prototype from the same group as more familiar than a different prototype, despite not having seen it before. This evidence supports Fantz's (1963) findings that infants prefer to look at novel objects and can form representational categories; storing knowledge and thinking about what is familiar or new.

Fantz's (1963) and Younger and Gotlieb's (1988) research illustrated young infants' abilities to form perceptual categories, by grouping things they can see. However, research has also been conducted, investigating pre-verbal infants forming abstract, conceptual categories. Quinn (1994) investigated three month olds' ability to categorise spatial relations, using the familiarity/ novelty-preference procedure but with dots 'above or 'below' a horizontal bar, instead of animal pictures. Infants were presented with four exemplars showing the dot in different places above the line, before being shown two novel exemplars simultaneously, one above and one below the line. Findings revealed infants looked longer at the dot below the line; implying young infants are able to form spatial category representations for 'above' and 'below'. In addition, Quinn et al., (2003) found seven month olds forming categories for 'between' and 'outside', beginning to form conceptual categories; illustrating a more complex form of thinking and therefore challenging the view that language is needed for thinking and knowledge.

Piaget (1955), however, strongly disputed pre-verbal infants thinking in abstract ways. His stage theory of development suggests children cannot perform actions symbolically until the pre-operational stage, when they have the use of language, and furthermore cannot think in abstract ways until the concrete operational stage (Oates, Sheehy & Wood, 2005). Sensori-motor stage infants, from birth to two years old, simply display external behaviour, built on nativism and innate behavioural patterns; supporting the belief of pre-verbal infants not thinking until they have language. However, Piaget's stage theory recognises pre-verbal infants absorbing new knowledge, relating it to existing experiences; indicating, like Fantz (1963), pre-

verbal infants do have knowledge before language, but is concrete rather than abstract in nature.

The single and dual-process models help us explore how categories evolve into understanding concepts, whilst also giving insight into language development. The single-process model is based upon bottom-up processing. For instance, perceptual categories are formed and gradually more and more abstract information is included to form a comprehensive concept. Language development can be understood by further defining and deepening perceptual information; becoming more sophisticated with age. Quinn & Eimas (2000) depict this model to initially identify simple characteristics, and over time knowledge becomes expanded, promoting category enrichment. Even at a basic level, thinking and knowledge are needed to identify perceptual categories, before broadening and building upon knowledge at a later stage; again providing evidence against language being a precursor for thinking and knowledge.

The dual-process model, in contrast, is based upon top-down cognitive processing; incorporating abstract categories and turning just knowing about things to understanding true concepts. Mandler (1992, 2000) was an advocate of this approach, believing forming categories could not simply be perceptual because category meanings, such as image schemas, assist thinking and subsequently mature concepts to form. She believes thinking about categories is different to simply seeing them; perhaps, supporting the notion that language is needed for thinking. In addition, Karmiloff-Smith (1986) supports this view, believing knowledge develops progressively from implicit to explicit, from procedural to a re-described, deeper mental representation; believing in an empiricist approach towards knowledge development.

Research has been conducted into the thinking involved in forming categories and information selected when categorising. Diverse cues, evoking a different response, are involved in the categorisation process. For example, referring to Fantz (1963) familiarisation/ novelty-preference method how could infants differentiate between a cat and a dog? Quinn and Eimas (1996b) revealed infants formed animal category representations using perceptual cues, such as heads. Therefore, young infants hold knowledge of specific features in their memories whilst also categorising animals. However, using pictures has been criticised due to other cues relating to real-life, such as movement styles, being excluded. Therefore the familiarisation/ novelty-preference method lacks ecological validity, failing to reflect infants' real-life experiences. Later studies have been conducted to eliminate these constraints; taking into account the complexities of cues used to categorise in real-life. For example, Arterberry & Bornstein's (2002) research of different object parts on films, demonstrating movement, revealed infants of three months using dynamic movement cues to assist categorisation; highlighting complex cognitive processes in pre-verbal infants. This research indicates thinking and knowledge has to be present in order to use the cues as triggers for categorisation.

From the discussed research we can assume memory and previous knowledge are involved in category formation, but how are these categories stored in memory? Two theories exist surrounding this question: exemplar memory (store every exemplar, comparing each new exemplar with these) and prototype abstraction (storing an average of all exemplars to form a category prototype), (Quinn & Oates, 2004).

Younger and Gotlieb (1988) investigated whether infants used exemplar memory or prototype abstraction to store category representations, revealing the type of experiment and number of examples affected the way infants stored categories; with few examples infants used exemplar memory but with many objects they used prototype abstraction. These experiments also observed infants categorising like adults, implying young infants can categorise in a sophisticated manner, showing competent pre-language thinking.

Despite not possessing language to group objects together, pre-verbal infants can identify similarities between objects; forming categories in similar ways to older children and adults. However, there are different hierarchical levels of categorisation (global/superordinate, basic/intermediate and specific/subordinate) which adults utilise. Behl-Chadha (1996) investigated whether three to four month olds were also able to form specific within global categories, using furniture as a stimulus. Infants were shown twelve photographs of various chairs before being shown novel chairs alongside non-chair furniture. Results revealed infants looked longer at the non-chair photograph; indicating pre-verbal infants distinguishing between different types of furniture. Alongside exposure to social and cultural experiences, this research is strong evidence demonstrating pre-verbal infants think and have knowledge to form categories within categories.

Evidence has illustrated that before speaking infants develop a knowledge structure of categories (Quinn & Oates, 2004). Gopnik and Melzoff's (1987) study on fifteen to twenty months old infants, explored links between categorising and language development. Cognitive psychologists were interested in how, for example, a child could use 'cat' in context without already having built a mental representation, organising and labelling words prior to speaking. Their study involved presenting infants with a range of objects, observing differing levels of categorising from touching to moving objects, as well as assessing a measure of language, supplied by mothers, to establish when a vocabulary spurt occurred. Findings revealed strong correlations between categorisation and vocabulary (Quinn & Oates, 2004), and also highlighted the powerful impact of social and cultural experiences on the depth of categories formed and the number of words learnt. Although conducted on infants with language, this research illustrated how the experiences and use of knowledge and thinking pre-language assist contextual use of language later.

In conclusion, little research illustrates language being a precursor to organising thinking and knowledge. Instead, evidence, from discussed research, is weighted towards challenging this viewpoint. Evidence suggests pre-verbal infants can compare familiar and novel objects and events, store category representations in memory, use cues as triggers for categorisation, form categories within categories, form perceptual and perhaps abstract categories, and categorise like adults; all of which incorporate knowledge and thinking processes. In addition, understanding early language development dictates word comprehension, involving thinking and knowledge, occurs before word production, and, in order for words to be used in context at a later stage, prior foundations in categorisation are required. On balance, although language can work in a reciprocal partnership with thinking and knowledge later, evidence suggests it is not a barrier for thinking and knowledge before learning to speak.

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