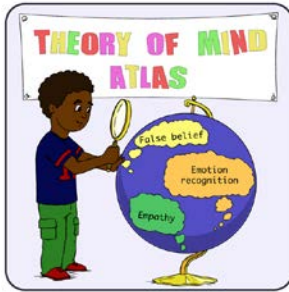


The Theory of Mind Atlas

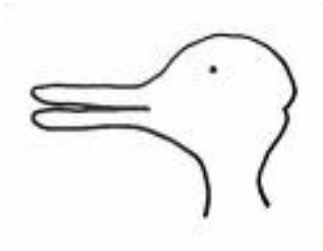
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Item 41: My child understands that two people can see the same image and interpret it differently. For example, when looking at this image, one person might see a rabbit whereas another might see a duck.

Subscale(s): **Advanced**



An “interpretive theory of mind [is] a commonsense understanding that knowledge is interpretive and that the mind itself influences how the world is experienced” (Carpendale & Lewis, 2006, p. 193). This item is intended to tap the understanding of an **interpretive theory of mind** when it takes the form of ‘**ambiguous figure perception**’ (also see ‘biased cognition’ [item 40] which represents another way that interpretive theory of mind has been investigated). In testing whether children have an interpretive theory of mind, researchers usually devise ambiguous situations where there can be at least two interpretations that are equally legitimate. With regard to ambiguous figure perception, it is generally presumed that “if you could acknowledge that a single figure allows multiple interpretations, that is tantamount to appreciating that one mind could impose one interpretation and another mind could impose a different interpretation” (Ropar, Mitchell, & Ackroyd, 2003, p. 388).

Although more precise developmental timetables are tied to the specific procedures used to elicit ambiguous figure reversals, the understanding of ambiguous figure perception is considered a higher-order theory of mind competency that emerges between 5 – 7 years of age (Carpendale & Lewis, 2006; Lalonde & Chandler, 2002; Tafreshi & Racine, 2016). This makes sense because the understanding of ambiguous figures appears to rely on more basic theory of mind understandings including ‘seeing-leads-to-knowing’ (knowing that visual access to an object or event is necessary for knowledge [see description of item 9]; Baron-Cohen & Goodhart, 1994; Lockett, Powell, Messer, Thornton, & Schultz, 2002) and false-belief (understanding that there can be two plausible representations of the same state or event: one that is true and one that is false [see our description of items 8 and 12], Mitroff, Sobel, & Gopnik, 2006). The understanding of ambiguous figures also requires mastery of more basic metarepresentation abilities (Perner & Davies, 1991) and the conceptual understanding of multiple

perspectives (Gopnik & Rosati, 2001). Finally, the shift from understanding knowledge as passively received to *actively interpreted* recognizes knowing “as a constructive, meaning-generated, human activity” (Chandler & Boyes, 1982, p. 395). The construal of ambiguous figure perception as an Advanced theory of mind competency comports well with the findings that ambiguous figure reversal (e.g., being able to identify both the duck and the rabbit as equally plausible interpretations) is correlated with other advanced theory of mind capacities including performance on the Strange Stories tasks (Sobel, Capps, & Gopnik, 2005), the understanding of white lies (Hsu & Cheng, 2013), and a variety of second-order reasoning tasks (see our description of items 5, 22, and 23; Miller, 2009).

It is notable that children (and adults) perform better when they are informed about the ambiguity as opposed to forming their own spontaneous reversals. In fact, several studies have shown that when *uninformed* about the ambiguity, 3- to 4-year-olds never spontaneously reverse, 4- to 5-year-olds rarely spontaneously reverse, and even most adult observers tend to not spontaneously reverse (Doherty & Wimmer, 2005; Rock, Gopnik, & Hall, 1994; Rock, Hall, & Davis, 1994; Rock & Mitchener, 1992). When *informed* about the ambiguity (e.g., ‘This picture can also be something else. What else can it be?’), 3- and 4-year-olds still, overwhelmingly fail to reverse, but performance improves among 5-year-olds leading some researchers to conclude that children begin to understand the relation between an ambiguous figure and its two interpretations at around 4-years of age and that this is a developmental precursor to the ability to reverse figures later in development (Doherty & Wimmer, 2005; Wimmer & Doherty, 2011). As Doherty and Wimmer (2005) argued, children “only attempt reversal once they can understand the representational nature between the figure and its two interpretations” and the process of performing reversals “is hard, probably requiring additional developments in executive functioning and imagery skills” (p. 407). Of course, spontaneous reversals do occur in older children and adults suggesting that ambiguous figure perception is a complex process that relies both on bottom-up visual perception and higher-order cognitive processes (Kosegarten & Kose, 2014; Mitroff et al., 2006; Wimmer & Doherty, 2011).

In summary, the general conclusion from the literature on the development of ambiguous figure perception seems to be that early conceptual developments occur around age 4-years. In the preschool years, the ability to reverse is correlated with performance on false belief tasks (Gopnik & Rosati, 2001; Rock et al., 1994) and the understanding homonymy (i.e., understanding multiple meanings of the same word: e.g., a “bat” is an animal and also a thing used in baseball; Rock et al., 1994). This fits well with the notion that all these tasks require one to impose two different interpretations on the same stimulus which, in turn, requires a more basic capacity for metarepresentation (Luckett et al., 2002; Rock et al., 1994, Wimmer & Doherty, 2011). Although more reliable performance is observed around age 6-years, advancements in the understanding of an interpretive theory of mind continue into adolescence and adulthood (e.g., understanding thought diversity and as well as situations in which people should think alike; Lagattuta, Sayfan, & Blattman, 2010). The understanding of an interpretive theory of mind is associated with working memory, inhibitory control, and aspects of the language-learning environment (Lagattuta et al., 2010). With regard to the latter, Tafreshi and Racine (2016) reported that children’s interpretive theory of mind is correlated with the frequency of mother-child talk about interpretation.

Ambiguous Figure Perception in ASD

Although some studies suggest that ambiguous perception can be a relative strength in ASD (Ropar et al., 2003), results are mixed (deficits are reported by Hutchins et al., 2016; Luckett et al. 2002). The equivocal findings might be explained by data suggesting that whereas persons with ASD understand the representational nature of pictures, they nevertheless lack a metarepresentational

understanding of the mind (Wimmer & Doherty, 2010). In other words, persons with ASD may understand pictorial ambiguity (i.e., this one image can represent two different things) while failing to appreciate the mind as an active interpreter. Indeed, “to use mental imagery effectively, one needs to properly understand the nature of a mental image: that the picture before your mind’s eye is a representation of something and typically a representation one is free to manipulate” (Wimmer & Doherty, 2011, p. 70). In a related vein, Luckett et al. (2002) suggested an alternative route to successful performance on the ambiguous figures task noting that the typical developmental progression (from seeing-leads-to-knowing, to false belief understanding, to ambiguous figure perception) was reversed for some children with ASD (i.e., some performed better on tests of ambiguous figures than on tests of false belief). They also suggested that some children with ASD may use a non-normative ‘hacking’ strategy to pass the test:

“We cannot be certain whether the more able children with ASD in our sample were showing a genuine understanding about minds or were simply demonstrating effective strategies for success on formal [ambiguous figures] tasks...However, it may be that certain qualitative differences between responses offered by ASD and comparison groups offer some clue...More specifically, responses given by the children with autism on all tasks were nearly always brief and ‘to the point,’ without embellishment or qualification until this was asked for. In contrast, answers to test questions given by the delayed [control] group were frequently imaginative and often contained elements of narrative in their explanations” (p. 137).

Still other researchers highlight the quality of figure reversals: children with ASD have been found to generate fewer spontaneous reversals compared to controls and are more likely to perseverate on a single interpretation (Sobel, Capps, & Gopnik, 2005). Taken together, these data suggest that the understanding of ambiguous figure perception (one index of an interpretive theory of mind) is linked to higher-level representation abilities, is likely involved in complex social functions, and is impaired in many individuals with ASD (Sobel et al., 2005).

Ambiguous Figure Perception in ADHD

In light of the finding that the understanding of an interpretive theory of mind is positively correlated with inhibitory control (Lagatutta et al., 2010), one might expect children with ADHD to experience challenges in ambiguous figure perception. Yet, we are aware of only one study on this topic. Hutchins et al. (2016) compared typically developing (TD) males, males with high functioning ASD, and males with ADHD (ages 5-14) for their comprehension of ambiguous figure perception using a single item from a caregiver report (i.e., item 41 on the Theory of Mind Inventory). Results revealed that scores for the ASD and ADHD groups were no different from each other but were each significantly lower compared to the TD group. As such, children with ADHD may be at risk for poor understanding of ambiguous figure perception although their comprehension may be moderated by the amount and quality of executive function (EF) resources which are expected to vary with context. Hutchins et al. (2016) concluded that under decontextualized conditions (e.g., laboratory type tasks that draw on ‘analytical’ EF resources), children with ADHD may demonstrate success on Advanced theory of mind competencies including the understanding of an interpretive theory of mind. By contrast, they may falter in their understanding in such areas when they are trying to solve real-life motivationally-significant problems that draw more heavily on ‘hot’ EF resources.

Ambiguous Figure Perception in DoHH

In light of the finding that the understanding of an interpretive theory of mind is positively correlated with the frequency of mother-child talk about interpretation (Tafreshi & Racine, 2016), one might expect DoHH children to experience challenges in ambiguous figure perception. Yet, we are aware of only one study on this topic. Analyses of caregiver report data (i.e., the Theory of Mind Inventory) from a small sample of children (ages 5 – 11) with corrected hearing loss revealed deficits in ambiguous figure perception in 66% of children (i.e., 8/12 children; Hutchins, Allen, & Schefer, 2017). Hutchins et al. concluded that these difficulties were related to more limited access to language in the prelinguistic and toddler years. Of course, more research is necessary to determine the precise extent to which children with hearing loss may be at risk for poor ambiguous figure perception and to identify risk factors for poor development of the understanding of the mind as an active interpreter.

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