# AQA Psychology A-level

# Option 1: Cognition and Development

Notes

# Cognition and Development

## Part 1 — Piaget's Theory of Cognitive Development

- Piaget suggested that there are two types of learning: accommodation and assimilation.
- Accommodation occurs when we are exposed to new information which radically changes our existing knowledge, and so to deal with this information, we accommodate it by forming a new schema.
- An example of accommodation would be when a child goes to a zoo and mistakes a tiger for a cat. This is because they have not yet been exposed to tigers and so use the most similar schema (i.e. a cat) in an effort to understand the new scenario. As the child observes the tiger, and notices the differences between a tiger and a cat, it will form a new sophisticated 'tiger' schema, with distinctions made between different types of cats.
- Assimilation occurs when we are exposed to new information which does not radically change our existing knowledge, and so we assimilate (incorporate) it into an existing schema.
- An example of assimilation would be a child seeing a tabby cat, when it has only seen black, white and ginger cats previously. The new appearance of a cat does not radically change the child's existing knowledge of what a cat is, how it behaves etc. Therefore, the new understanding of the physical difference between a tabby cat and other types is assimilated into the child's existing 'cat' schema.
- Therefore, the main differences between accommodation and assimilation would be the creation of new schemas (as opposed to not) and the situations in which these two types of learning occur (as seen with the examples above).
- The motivation to learn originates from the unpleasant emotions associated with disequilibrium. Piaget suggested that when we encounter an unfamiliar situation and assimilation is not enough to understand it, we are in a state of disequilibrium. This means that we explore our environment to improve our understanding of the scene and develop our schemas, in a process called equilibration.
- Once we can fully understand the new scenario, we have achieved equilibrium. This is the desired mental state and occurs when our new (accommodation) or existing (assimilation) schemas are complete.
- Piaget proposed that the main cognitive structure which changes during cognitive development is the schema.
- A schema is a mental framework of knowledge and beliefs about a specific place, object, person or time. Schemas influence our cognitive processing, by providing 'short-cuts' (allowing us to process large volumes of data quickly and efficiently, hence avoiding sensory overload), but can also lead to perceptual errors through distorting sensory stimuli.
- Some schemas are innate e.g. all babies are born with the schema for sucking and gripping (innate reflexes).
- Schemas become more sophisticated with time, allowing us to understand more aspects of and increasingly complex situations.

— Unrepresentative Sample = Piaget's sample of children were from the nursery attached to the university, and so the children belonged to predominantly white, middle-class, well-educated families. This, together with the idea that not all children feel the same need to completely understand new situations and achieve equilibrium, suggests that his findings lack ecological validity. This is because children who come from poorer backgrounds and so may have had fewer educational opportunities, may display more or less intellectual curiosity than middle-class or upper-class children. Therefore, Piaget's theory cannot explain cognitive development in all children.

— Comparison with Vygotksy's Theory of Cognitive Development = Vygotsky proposed that learning was a social process, where children acquire new knowledge and more advanced reasoning abilities (to deal with this knowledge) from frequent interactions with experienced peers called 'experts'. On the other hand, Piaget placed far less importance on the social elements of learning, seeing peers and teachers only as facilitators of discovery learning. Vygotsky also emphasised the importance of language far more than Piaget, seeing it as an external expression of thought, as opposed to just another cognitive ability.

+ Research supporting the importance and mechanism of discovery learning = Howe et al (1992) tested 9-12 year old children (placed in groups of 4) who all watched the motion of the same object

sliding down a slope. The children were then allowed to discuss what they had seen. Crucially, despite all seeing the same motion, each child reported different details and had a different understanding of the motion. This confirms Piaget's prediction that individual mental representations are formed through discovery learning, where individual differences in each child's existing schemas affects their understanding of the situation and the accommodation of new information through the creation of new schemas. Therefore, Piaget's theory of cognitive development has evidence supporting the role of schemas, accommodation and assimilation.

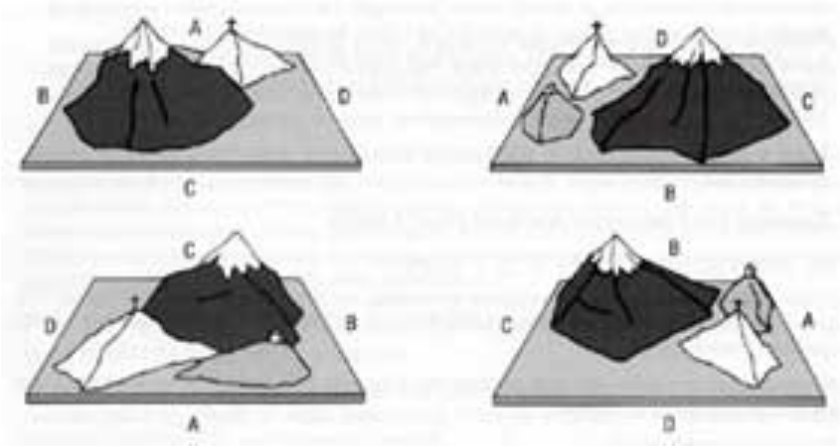
+ Prompted changes in methods and attitudes in education/the classroom = Through emphasising that learning is an active process where children explore their environment, the classroom was changed e.g. a sandpit is used to develop conservation skills in young children. Through Piaget's readiness approach (i.e. that according to the 4 stages of intellectual development, children would be ready to learn certain skills at certain times), it meant that learning about 'concrete' subjects (e.g. science) would be best supported by project-based work between the ages of 7 and 11 years. This changed the role of the teacher from one supporting rote learning to that of a facilitator for discovery learning.

## Part 1B — Piaget's Stages of Intellectual Development

- Piaget suggested that there are 4 main cognitive abilities, which all children acquire as they progress through the stages of intellectual development. These are object permamance, class inclusion, egocentrism and conservation. Although the order of these stages are fixed, the age at which they occur are not i.e. some children may develop at a slower rate than others.
- During the sensorimotor stage (0-2 years), the child focuses on physical sensations and develops a basic use of language. They discover that they can move things using trial and error.
- Object permanence develops at around 8 months (thus, during the sensorimotor stage). This is the cognitive ability to appreciate that an object continues to exist even when the individual cannot see it anymore. Piaget assumed this because before 8 months old, a child would no longer search for an object which had passed out of their visual field (e.g. covered by a scarf) but, after 8 months, they continued searching.
- During the pre-operational stage (2-7 years), children begin to develop the cognitive abilities of class inclusion, egocentrism and conservation. Language becomes more sophisticated, but children still display classic faults in their reasoning.
- Egocentrism is the tendency of pre-operational children to view the world from their own perspective. This is true for both physical terms (as shown by Piaget and Inhelder's 3 Mountains Task) and in social situations (only appreciating their own side of the argument).
- Egocentrism was measured using the Three Mountains Task (Piaget and Inhelder, 1956). Pre-operational children were exposed to 3 mountains, topped with different objects - snow, a cross or a house. A doll was faced opposite to the child, who had to match images of the mountains to what they thought the doll could see. The majority of children recounted their own viewpoint, hence displaying egocentrism i.e. an inability to see the world from another's viewpoint.
- Class inclusion is the cognitive ability to appreciate that a group of objects can form a class, and this same group can be a subset of an even larger group. This was measured by Piaget and Inhelder (1964), who showed 7-8 year olds pictures of 5 dogs and 2 cats, and asked whether there were more dogs or animals, the vast majority of pre-operational children replied that there were more dogs. This reflects the idea that such children cannot understand that a single object or animal can belong to multiple classes.
- Conservation is the cognitive ability to appreciate that the quantity of an object remains the same, even when its appearance changes. For example, in the liquid conservation task, after showing pre-operational children two identical beakers with the same volume of liquid and then pouring liquid into a thinner, taller beaker, most of the children reported that there was more liquid in the taller beaker.
- This also demonstrates how pre-operational children do not understand the concept of 'reversibility' i.e. the idea that an operant can be reversed, and the state of an object can be returned to normal.
- The impairments in egocentrism, class inclusion and conservation show that, according to Piaget, pre-operational children are unable to learn 'concrete' subjects such as science because these subjects require abstract reasoning.

- During the concrete operations stage (7-11 years), children develop their skills of egocentrism, class inclusion and conservation. However, they can only reason about objects physically present in their environment, hence 'concrete' reasoning.
- During the final stage of formal operations (11 + years), children become capable of scientific thinking because they reason about abstract ideas. This was tested by Smith et al. through the use of neologisms.

— Flawed Experimental Methods = Some of Piaget's experimental methods were flawed. For example, some may have caused confusion: McGarrigle and Donaldson showed that 60% of 6 year olds could conserve, compared to only 16% found by Piaget. This was due to different instructions: Piaget's research involved spreading out the coins. This action made the child believe it was deliberate and so the quantity must have changed. Piaget also didn't conduct any statistical analysis, meaning that his data was unreliable because it's unclear whether the results were significant or not. He did not adhere to standardisation and control procedures during clinical interviews, so differences between children were more likely to be due to this, rather than age. He was therefore wrong to assume that task failure equates to a lack of ability.



— Conflicting Empirical Evidence = For example, Martin Hughes (1975) demonstrated that in a task of egocentrism, children aged 3 and a half years old could position a doll where a single police man could not see him 90% of the time, and 4 year olds could make the doll hide from two police men in 90% of cases. This suggests that pre-conventional children are able to conserve, but only when this has been tested in specific ways and when the child fully understands the task. This, therefore, also gives further evidence to the idea that Piaget and Inhelder's original experimental method may have been confusing to 2 or 3 year old children, which may have biased the findings.

— Piaget focused on a domain-general approach to understanding intellectual development = Piaget viewed that intellectual and cognitive abilities all developed together at the same time and at the same rate, with no one ability being more important than the other. This was in contrast with Vygotksy, who adopted a domain-specific approach, where certain cognitive abilities such as language were upheld as being more important than others, especially considering that Vygotksy viewed learning as a social process, where advanced language skills would have been particularly important for maximising interactions with experts. Therefore, this contrast suggests that a more moderate interactionist approach would better be adopted i.e. a 'middle-ground'.

## Part 3 — Vygotsky's Theory of Cognitive Development

- Vygotksy suggested that learning was a social process, in which children acquired new knowledge and more advanced reasoning skills (to deal with this new knowledge), from more-advanced others, who were called 'experts'.
- Language was seen as a crucial cognitive skill, which developed at a time and rate compared to other cognitive skills (i.e. a domain-specific approach to explaining development). This was in contrast with Piaget, who believed that language developed at the same time as all other cognitive skills (and so took a domain-general approach). Nonetheless, both agreed that cognitive development occurred in a set series of stages.
- Vygotsky even suggested that some aspects of knowledge and intelligence could only be acquired through certain interactions with 'experts'. The knowledge is first 'intermental' and then becomes 'intramental' as the learner crosses the zone of proximal development.

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- The Zone of Proximal Development (as defined by Vygotksy) = [1]"The distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance, or in collaboration with more capable peers".
- In order to cross the ZPD, learners could receive help from more experienced peers through the process of scaffolding. This describes the kinds of help the learner receives from the expert, in an effort to cross the ZPD.
- The ZPD had important implications for education because it explained that, whilst a child may be intelligent and eager to learn, there is a limit as to what they can learn as restricted by their current developmental stage, and so the size of the ZPD.
- For example, Wood, Bruner and Ross (1976) identified 5 scaffolding techniques: Recruitment, reduction of degrees of freedom, direction maintenance, marking critical features and demonstration. They also noted that the level and frequency of help given by experts decreases as the child crosses the ZPD.

— Individual Differences = A major weakness of Vygotsky's theory is that it does not take into account individual differences between students/children, in terms of social aptitude and personality. In an attempt to create a universal theory, Vygotksy did not acknowledge that differences in personality and information processing/cognitive style meant that some children are not suited to learning through social interactions. This suggests that Vygotky's theory may have limited practical applications to education, in terms of teachers developing new ways in which students can learn from each other. Therefore, Vygotsky's theory may not be a universal explanation for cognitive development in all children.

— Incorrect Universal Assumptions = According to Vygotksy, if two children experienced the same interactions with the same peers, then hypothetically, they should both develop the same understanding and reasoning skills. However, Howe et al (1992) found that children who observed the same motion of an object down a slope, each developed new understandings and viewpoints of what they had seen. This is a weakness of Vygotsky's theory of cognitive development, because it suggests that Vygotsky incorrectly assumed that all children learn in the same way and have the same pre-conceived knowledge or reasoning abilities.

+ Evidence supporting the zone of proximal development = Roazzi and Bryant (1998) found that 4-5 year olds who received help from an older/more experienced peer, created a more accurate estimate of the number of sweets in a box, compared to those who worked alone. This supports the Bygotksy-Bruner model of methods used in scaffolding to help a child cross the ZPD (in this case, an original inability to work out how to make estimates) and achieve more advanced reasoning skills. The researchers found that [2]"social interaction between less and more advanced children enhances the less advanced children's ability to make logical inferences, and we argue that this is probably due to the effects of discussion and of agreement, rather than to social conflict, during the intervention period".
+ Supporting evidence for the idea of scaffolding = Conner and Cross (2003) observed 45 pairs of mothers and children, completing a problem-solving task, at 4 points across 3 years. The researchers found that [3]"mothers showed systematic decreases in the amount of support offered and systematic increases in their use of contingent interaction, whereas children became more successful in their behaviours during the parent-child interactions". This confirms Bruner et al's

[1] Vygotsky, L. S. (1978). Mind and society: The development of higher psychological processes. Cambridge, MA: Harvard University Press, pp.86

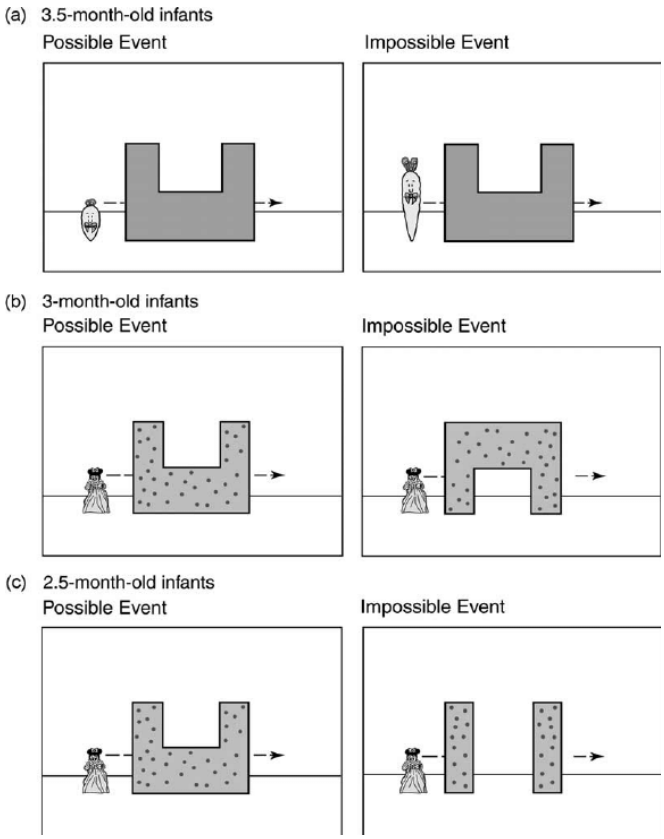
[2] Roazzi, A. and Bryant, P. (1998), The effects of symmetrical and asymmetrical social interaction on children's logical inferences. British Journal of Developmental Psychology, 16: 175–181. doi: 10.1111/j.2044-835X.1998.tb00917.x

[3] Conner, D. B. and Cross, D. R. (2003), Longitudinal analysis of the presence, efficacy and stability of maternal scaffolding during informal problem-solving interactions. British Journal of Developmental Psychology, 21: 315–334. doi:10.1348/026151003322277720

predictions that the level and frequency of help given towards learners by experts decreases as the learner crosses the ZPD. This can also be used as evidence for the idea of a ZPD: Since the children improved their knowledge and understanding of the task with the help of their mothers/ experts, this suggests that there was a gap in such knowledge in the first instance.

## Part 4 — Baillargeon's Explanation of Infant Abilities

- Baillargeon disagreed with Piaget's assumption that just because a child stops looking for an object which has been removed from their visual field, then the child does not have an understanding of object permamence. There may be other explanations for this, such as a lack of motivation, attention and interest in the first instance.
- Baillargeon therefore developed the Violation of Expectation research (VOE). The VOE suggests that if a child has an intact understanding of part of the physical world, then they will have expectations about how objects behave. When these expectations are violated, the child looks at the scene for a longer time because they are surprised, and their physical reasoning system (PRS) means that they pay attention to scenes which may improve their understanding of the physical world.
- Baillargeon et al (1985) tested the idea of object permamence in 24 infants, aged 5-6 months old. In the possible condition, a short rabbit cannot be seen passing behind a window, but a tall one can. In the impossible condition, neither rabbit can be seen passing behind a window. The latter condition was 'impossible' because it is not consistent with the idea of object permanence i.e. an understanding that the tall rabbit is taller than the window, and so should be visible.




- Infants, on average, looked at the impossible condition for 7.96 seconds longer compared to the possible condition. Therefore, the researchers concluded that the infants [4]"(a) believed that the rabbit continued to exist and pursued its trajectory behind the screen; (b) represented the height of the rabbit behind the screen; and therefore (c) expected the tall rabbit to appear in the window and were surprised that it failed to do so".
- Hence, Baillargeon suggested that infants have acquired the cognitive ability of 'object persistence' at age 5 months, as opposed to Piaget suggesting that this ability appeared at age 8 months.
- Baillargeon, also using the same violation of expectation research style, the ideas of containment and support (Baillargeon and Hespos, 2001a).
- Containment is the cognitive ability to recognise that once an object has been placed into a container and the lid has been closed, then the object will still be there after the lid has been removed. Support is the idea that an object will fall if unsupported, but will remain stationary if it is resting on a stable horizontal surface.
- Baillargeon has also suggested the idea of a physical reasoning system (PRS). This is the innate predisposition to pay attention to 'surprising' events which are not in line with our expectations, in an effort to improve and advance our understanding of the physical world, and event categories.
- Each event category represents one way in which two, or more, objects interact.

[4] Renée Baillargeon, Marcia Graber, Where's the rabbit? 5.5-month-old infants' representation of the height of a hidden object, Cognitive Development, Volume 2, Issue 4, 1987, Pages 375-392, ISSN 0885-2014, http://dx.doi.org/10.1016/S0885-2014(87)80014-X. (http://www.sciencedirect.com/science/article/pii/S088520148780014X)

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— Comparison with Piaget's test of object permamence = The limitations associated with Piaget's method of assessing infantile understanding of object permamence is that the children may lack the motor abilities, attention resources and interest in the object which has 'disappeared', and so are ither unwilling or unable to continue searching for the object. Baillargeon's method removes this confounding variable because the child is simply required to look at the scene, which had been demonstrated several times to the child previously, in order to build up their expectations. Therefore, Baillargeon's VOE research and estimate for the age of acquisition of object persistence may be considered as a more accurate and reliable measure of infantile cognitive abilities.

+ Evidence suggesting that the PRS is universal = There are examples of infantile understanding which is innate (e.g. sucking and gripping), whilst a basic physical understanding of the world can be developed through experience. For example, many infants will recognise that if you play a toy on a table, it will stay there, but if you let a toy fall to the group, it shall do so. This suggests that some aspects of the PRS must be universal. This was further supported by Hespos and van Marle (2012) who concluded that [5]"certain core principles about these domains [solidity, continuity, cohesion, and property changes] are present as early as we can test for them and the nature of the underlying representation is best characterized as primitive initial concepts that are elaborated and refined through learning and experience".

— Distinction drawn between behavioural response and behavioural understanding = Bremner drew this distinction, emphasising that the two are not the same. For example, just because an infant looks at the impossible condition for longer, does not necessarily mean that they understand the differences in height and appearance of the different objects, thus also not being able to consciously reason about it. This means that Baillargeon may have overestimated the significance of her results, and so reached potentially incorrect causal conclusions.

— Causal Conclusions = Particularly with such young infants (as used in the VOE research), it is difficult to judge what they actually understand. There may be many reasons as to why one infant finds a certain scene more interesting than the other, and this may not necessarily be due to the violation of their expectations. The second criticism is that we are assuming that their expectations have been broken and they are 'surprised' when looking at the impossible condition. However, we cannot be sure that they even experience expectations about the physical world in the first instance.

## Part 5 — Social Cognition: Selman's Levels of Perspective-Taking

- Perspective-Taking = The cognitive ability to take on the viewpoint or perspective of another person in both physical and social situations. 'Physical' examples may include Piaget and Inhelder's 3 Mountains Task (testing egocentrism), whereas 'social' examples include being able to take on multiple perspectives in an argument or conversation.
- Selman, based on perspective-taking tasks administered to children, developed a series of stages, each characterised by a fault in reasoning.
- Selman (1971) assessed 60 children (10 boys and 10 girls, each of ages 4, 5 and 6) using perspective-taking tasks. These included the 'Holly and her kitten' task, which involved identifying the emotional states of Holly, her father and her friend, whose kitten is stuck up a tree. Holly must therefore make a decision, after promising her father not to climb trees, to rescue the kitten or not.
- On this basis, Selman developed 4 stages of perspective-taking:
- Level 0 (3-6 years) = Socially Egocentric = Children are unable to take on the perspectives of others and so are egocentric.
- Level 1 (6-8 years) = Social Information Role-Taking = Children are now able to take on only a single perspective at each time.
- Level 2 (8-10 years) = Self-Reflective Role-Taking = Children can fully identify with and take on the viewpoint of another person, but again, only focusing on one perspective at a time.

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[5] Hespos, S. J., & van Marle, K. (2012). Physics for infants: Characterizing the origins of knowledge about objects, substances, and number. Wiley Interdisciplinary Reviews: Cognitive Science, 3(1), 19-27. DOI: 10.1002/wcs.157

- Level 3 (10-12 years) = Mutual Role-Taking = Children can fully identify with and take on multiple perspectives at the same time.
- Level 4 (12+ years) = Social and Conventional System Role-Taking = Children understand that social rules are needed to maintain order when simply understanding the other person is not enough.
- Schultz, Selman and La Russo (2003) attempted to complete Selman's original explanation of social cognition through making the following additions: Interpersonal understanding (tested above), interpersonal negotiation strategies (understanding how to deal with conflicting viewpoints and standing your ground) and an awareness of personal meaning of relationships.

— There is a lack of clarity over the precise role of perspective-taking, and specifically whether it is important for the development of prosocial or antisocial behaviour. For example, Buijzen and Valkenburg (2008) suggested that perspective-taking abilities became more advanced with age and so reduced the number of infant-parent conflicts when in supermarkets. Despite this suggestion that perspective-taking could be involved in the development of prosocial behaviour, this was refuted by Gasser and Keller (2009), who found that bullies suffered from no perspective-taking impairments. This is not what we would expect if such an ability is required for the development of cooperative social cognition. Therefore, perspective-taking may have little theoretical value in explaining the development of advanced and mature social cognition.

— A second key issue associated with perspective-taking is that it is a one-sided approach to explaining social cognition, through an over-riding emphasis on cognition. There are other factors which are equally as important in the development of social cognition, such as theory of mind (as suggested by Baron-Cohen et al) and the role of mirror neurons (as suggested by Ramachandran et al). Therefore, reducing social cognition to perspective-taking only is not a holistic approach.

+ However, an improved understanding of perspective-taking may have useful practical applications in terms of understanding those with autistic spectrum disorders, such as ADHD, as suggested by Marton et al (2009). These researchers found that, in a sample of 50 ADHD children aged between 8 and 12 years, these children scored significantly worse on perspective-taking tasks in terms of understanding the situation and weighing up the consequences of each character's actions, compared to a control group of neurotypical children. Thus, through pinpointing the exact impairments experienced by children on the autistic spectrum, more efficient treatments can be developed.

## Part 6 — Social Cognition: Theory of Mind (ToM)

- Theory of Mind (ToM) can be described as the ability to understand/identify what other people are thinking and feeling, through a 'mind-reading'-like process.
- Those with autism may have a deficit of ToM, meaning that they cannot understand the emotions of others, or even comprehend that individuals can have emotions different to their own. Such misunderstandings may explain why those with autism have impairments in empathy, social communication and social imagination.
- Other social deficits caused by ToM impairments include a lack of understanding that behaviour impacts how others think and/or feel, alongside problems differentiating fact from fiction, as characterised by poor performance on 'false-belief' tasks, such as the Sally-Anne task.
- In this case, where the participants were asked to identify where Sally would look for her marble after it had been moved without her knowledge, 85% of the control group (14 with Down's Syndrome and 27 neurotypical children) correctly answered, compared to 20% of the autistic group. This supports the idea that a ToM deficit is responsible for autistic children being unable to understand that people can believe something that is not true. This lack of understanding of others' viewpoints and emotions may also explain another characteristic trait of autism: difficulties predicting the behaviour or emotional states of others.
- ToM can also be assessed specifically in children below the age of 2 years old, as suggested by Meltzoff (1988), using intentional reasoning tasks. In such tasks, Meltzoff found that 18 month olds, after observing an adult struggling to place beads into a jar, dropped no beads and so imitated the intention of the adult, as opposed to the actual action (which is what would have been predicted by social learning theory). Therefore, this we can assume that children as young as one and a half

years old can understand and imitate intention, on the basis of observable behaviour, and so appear to have at least some understanding of ToM.

- Since adults with Asperger's Syndrome can easily perform on false belief tasks, they appear to perform less successfully on 'The Eyes Task', which involves identifying the emotion displayed by a character whose eyes can only be seen. Baron-Cohen et al concluded that since adults with AS continued to perform poorly on such tasks, that they still suffered from ToM deficits, but these deficits simply had to be assessed in another way. This is in line with the original ToM theory and its link with autism!

— Previous research, such as that carried out by Baron-Cohen et al (1985) using the Sally-Anne tasks, has focused on the link between ToM and the cognitive impairments suffered by those with AS. Although this does serve as a comprehensive explanation, ToM deficits cannot explain the desirable characteristics which belong to AS sufferers, such as advanced numerical and logical reasoning. This means that ToM is a limited, and not universal, explanation for autism.

— ToM has close links with perspective-taking, as both involve understanding another person's thoughts and emotions, and thus allowing the observer to take on the perspective of another. However, this also makes drawing the distinction between the two increasingly difficult. For example, Meltzoff's intentional reasoning tasks can be explained in terms of the child taking on the perspective and thus intention of the adult (perspective-taking) as well as understanding the struggles and aims experienced by the adult (ToM). Therefore, this means that it is difficult to differentiate between the mechanisms of ToM and perspective-taking, limiting the theoretical value of both explanations.

— The Eyes Task can be said to have low mundane realism, because the procedure does not represent everyday life where we are usually able to look at the entire person's face and facial expressions, in order to assess their emotions. Verbal cues, such as the tone of their voice, as well as language provide us with essential information about their feelings. Therefore, such studies may produce findings with little ecological validity, because they cannot be generalised beyond the original, specific research settings.

## Part 7 — Social Cognition: The Mirror Neuron System:


- Mirror neurons are a set of specialised neurons, thought to be located in the [6]premotor cortex, the supplementary motor area, the primary somatosensory cortex and the inferior parietal cortex. These neurons are activated when we observe the motor actions of others, but are also activated when we perform motor actions ourselves.

[6] Acharya S, Shukla S. Mirror neurons: Enigma of the metaphysical modular brain. *Journal of Natural Science, Biology, and Medicine*. 2012;3(2):118-124. doi:10.4103/0976-9668.101878.

- Therefore, there is a strong link between mirror neurones and understanding intention in others, as suggested by Goldman and Gallese (1998). By identifying and reenacting the observed behaviours using our motor system, mirror neurons can then be used to understand the intentions behind these actions. Since understanding intention is a ket part of perspective-taking, the activity of mirror neurones can also be considered as the neural mechanism for this process too!
- Ramachandran (2011) placed particular emphasis on the role of mirror neurons in the development of humanity as a social species. He suggested that the evolution of mirror neurons, acquired through natural selection systems, gave our ancestors an evolutionary advantage by increasing their likelihood of survival. This is due to mirror neurons facilitating the learning of language (thus resulting in improved communication skills) and advanced practical skills (through the observation of others hunting and cooking, for example).
- Oberman and Ramachandran (2006) also point to neurological deficits involving mirror neurons as a potential explanation for autistic spectrum disorders. A faulty mirror neuron system, also referred to as the 'broken mirror neuron hypothesis', may result in an inability to understand the intentions and emotions of others. This leads to problems in social communication, awkwardness and manifests itself as adults who struggle to 'read' others i.e. in terms of their intentions, goals, emotions and perspectives.

— Most research conducted into mirror neurons is simply correlational, where increased activity in one brain area upon completing a task is assumed to be mirror neurons. This means that mirror neurons have only ever been indirectly studied, with some researchers even questioning their existence at all, such as Hickock (2009). He argues that even if mirror neurons do exist, it is likely that their role in social cognition has been misunderstood - actually understanding intention is very different to simply using observed motor actions in others to make our own judgements about appropriate behaviour.

— Mirror neuron functional deficits, and specifically the 'Broken Mirror Neuron Hypothesis', may not be a complete explanation for autistic spectrum disorders, as suggested by Hadjikhani (2007). Despite autistic participants having an abnormally small average thickness of the pars opercularis, an area of the brain believed to be rich in mirror neurones according to Mouras et al (2008), there has been evidence to suggest that not all AS sufferers have atypical mirror neuron patterns, and that such dysfunctional patterns of activity are present in disorders other than AS. Therefore, the link between mirror neuron deficits and AS may have been overstated, and is not as 'exclusive' as once believed.

+ There is evidence supporting the role of mirror neurons in social cognition, and particularly with perspective-taking. For example, Mouras et al (2008) found that sexual arousal coincided with increased levels of activity in the pars opercularis (measured using fMRI scans) as participants watched heterosexual pornography. Therefore, this suggests that increased mirror neuron activity had allowed participants to increasingly take on the perspective of the actors within the porn and experience their intentions/emotions, thus leading to increased sexual arousal. Therefore, there is a role for mirror neurons in social cognition.