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Children's sensitivity to speaker accuracy and explanatory competence with biological concepts

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Abstract

This thesis investigated children's selective trust in contexts that extend beyond a direct comparison of a distinctly accurate labeller with a distinctly inaccurate labeller in the domain of artifacts. In the existing selective trust literature, it has been well-established that children from about the age of three consider informants who accurately label artifacts to be more trustworthy than informants who inaccurately label artifacts. In order to expand on the existing research and present children with situations that are more likely be more representative of what they encounter in real life, there were three main aims in this thesis. First, children were presented with informants who provided information about objects from the human body to examine whether children's evaluations of informant trustworthiness is similar across the biological domain and the domain of artifacts. Second, an informant who provided novel labels for body parts was introduced to investigate how children interpret novel labellers when compared to accurate and inaccurate labellers. Finally, children were presented with informants who provided functional or surface information for objects from the human body to determine whether they could differentiate informants on qualitative grounds, and prefer learning from informants who provided functional explanations.

Across five experiments, children aged between three and eight years of age (N = 379) were tested. The main findings of this thesis were as follows: (a) 4- and 5-year-olds knew more about external body parts (e.g., hand) than internal organs, and some internal organs (e.g., brain) were better known to them than others (e.g., pancreas); (b) five-year-olds began to appreciate that speakers offering novel information were more trustworthy than those offering inaccurate information; (c) four- to eight-year-olds had difficulty with distinguishing between informants who provided either functional explanations or superficial descriptions for highly unfamiliar organs (e.g., pancreas); (d) however, when presented with informants who provided either functional or superficial information for highly familiar body parts (e.g., eye), eight-year-olds (and to some extent, five-year-olds) showed better recall of which informant provided a particular type of explanation, but they did not consider either informant to be a more trustworthy source for learning labels for unfamiliar organs.

These findings indicate that children demonstrate selective trust in the biological domain, as well as in contexts that go beyond comparing accurate and inaccurate labellers. It is apparent that children are balanced in their evaluations of informants who provide new information, as well as those provide information that varies in explanatory depth. However, they are yet to fully consider functional explanations to be superior to superficial

descriptions. Further research is required to examine the contexts in which children might trust an informant who provides functional or surface information, and how they come to decide that certain kinds of explanation should be privileged.

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Chapter 1
How do Children Learn About the World?

Much of our knowledge depends on what a person or group of persons has told us. Our belief in many things is based on the say-so of other people and we are largely inclined to go along with what has been said to us. In a discussion of philosophical ideas of testimony, Australian philosopher, Tony Coady (1992), provided an illustrative example which demonstrates our reliance on what other people say. He states that his knowledge of many things, even things about himself, are known only via testimony. For instance, he notes that the only way he knows about his age and date of birth is because that is what he has been told. Upon arriving at an unfamiliar airport, he can only rely on the crew's word, and other cues, that he has indeed arrived in Amsterdam. While reading a history book about Napoleon Bonaparte, he asserts that neither he nor the writer is able to personally verify the claims in the book. This example shows the extent to which we humans are receptive to information provided by other people and, in most cases, we accept that information to be true.

This thesis seeks to contribute to the extant literature on the nature of children's *epistemic trust* – how children decide that other people are trustworthy sources to acquire knowledge from. The experiments presented in this thesis investigate the extent to which children trust people who make claims that can be considered reliable or unreliable. Much of the existing literature has focused on presenting children with informants who provide either accurate or inaccurate labels for common objects (i.e., *artifacts*) using a methodology known as the *selective trust paradigm,* and it has been well-established that children from the age of three consider previously accurate labellers to be more trustworthy than inaccurate labellers. This thesis presents a series of experiments that modify aspects of the selective trust paradigm in order to create contexts that more closely resemble what children are likely to encounter in the real world. Before such studies can be presented, however, the four introductory chapters of this thesis serve to highlight the importance of studying children's capacity to evaluate the trustworthiness of what other people say. In this chapter, I introduce the theoretical background of children's epistemic trust, and focus on the notion that children heavily depend on information provided by others, even though they acquire much knowledge via firsthand observation or experience. Further, it is discussed that culture has key influences on what knowledge is privileged and transmitted within a society. However, children do not blindly accept everything that they are told. Instead, children become increasingly balanced between credulity and scepticism, such that become more capable of evaluating the claims they hear in light of their existing knowledge, as well as the people that provide them.

Chapter 2 introduces the details of the experimental procedure – the selective trust paradigm – which has been widely used to examine how children evaluate the trustworthiness of others, and will serve as the basis for the experiments presented in this thesis. After discussing key findings from the existing literature, I provide critiques of the selective paradigm and note three ways in which the limitations of the paradigm will be addressed in the experiments. In particular, in Chapter 2, I note that the contrast between accurate and inaccurate labellers does not necessarily reflect what children encounter in real life, and argue that it may be useful to examine how children evaluate informants who provide *new* labels relative to informants who provide distinctly accurate or inaccurate labels. In Chapter 3, I outline findings that show that children rely on cues, other than accuracy of labelling, when determining the trustworthiness of informants. Further, I point out that the information children receive in real life is not limited to the labels of objects, but that they receive other types of information. Of particular note, is that children receive explanations about objects or events, so they might be inclined to evaluate the trustworthiness of informants who provide such claims, in a similar way to how they evaluate informants who are accurate or inaccurate. In Chapter 4, I attempt to bring the arguments of the preceding chapters together under a key approach. Specifically, I argue that the existing literature has emphasised presenting children with informants who provide information about *artifacts*, and that it may be fruitful to examine children's selective trust in other domains. In this thesis, I focus on the biological domain, particularly on children's understanding of the body, given that their knowledge of it has been shown to increase from about the age of four, and that there are many things which they must depend on others to learn about. Further, given the complexity of objects within this domain, it is argued that the biological domain serves as a useful basis on which to investigate children's construal of new information (i.e., labels), as well as their evaluation of different types of claims. To sum, this thesis presents a novel approach to examining children's selective trust, and it is anticipated that it will serve to contribute new findings to the existing research on how children determine the trustworthiness of others.

Children Rely on the Testimony of Others

It is perhaps surprising that interest in when and how children's receptivity to testimony emerges has only grown within the last decade. This delay is likely due to the emphasis that has been placed on children's cognitive development via first-hand experience and exploration (Harris, 2012). In other words, children are considered *autodidacts*, who observe and come to conclusions about the world by themselves. For instance, 18th Century philosopher, Jean-Jacques Rousseau (1762/1969), asserted that children should not be told the answers to their questions; instead, they should be left to figure out the answers for themselves in order to gain greater understanding and autonomy. Following the spirit of Rousseau, Piaget (trans. 1954) viewed children as active seekers of information, who discover the true state of the world for themselves via exploration. With the renewed interest in testimony, there is ongoing philosophical debate in epistemology between two camps of thought as to the status of testimony (McMyler, 2011; Sperber et al., 2010). To put simply, the *reductionist* camp (e.g., Hume, 1748/2007) surmises that, through inductive inference, we come to accept testimony because our previous experiences have shown testimony to be reliable. In other words, we are justified in believing other people's testimony because we have previously been able to determine its veracity via other means, such as through our own observations. On the other hand, the *non-reductionist* camp (e.g., Reid, 1764/1997) argues against the notion that our justifications for believing testimony come about through inductive inferences, claiming instead that we are predisposed to accept testimony, and that our reasons for believing in other people's testimony are analogous to our reasons for believing in our own senses.

Even though young children can, and do, form their own conclusions about many things (e.g., properties of objects, causal relations, theory of mind, naive biology), they quickly come to be knowledgeable about things they would never be able to personally observe or verify for themselves (Harris, 2002; 2007). For example, children believe that the world is round, not flat; that there are unobservable things called germs which can make you sick; and that we breathe oxygen to stay alive (Harris & Koenig, 2006). Children also believe that certain historical figures lived during specific eras and performed certain deeds, despite having never met or seen them. In addition, children even entertain the idea that fictional (e.g., the Tooth Fairy, Santa Claus, mermaids) or metaphysical beings (e.g., God) might exist. Of course, it is not the case that children readily accept the existence of all these different types of entities just because they have heard about them. Harris (2002) noted that children's beliefs in the existence of different types of entities depend on the type of discourse they have encountered. For instance, because people often refer to entities that can be seen in the world and also to scientific entities in ways that do not question or assert their existence but take it for granted, children are likely to categorise observable and scientific entities in the same way; that they do exist. In contrast, for fictional entities, which are generally presented in the context of a fantasy world, and for metaphysical beings, whose existence may be debated depending on the religiosity of certain societies, children are likely to show more doubt in their existence.

The fact that children come to believe in things that are not necessarily a truer reflection of the world, such as believing in the existence of God or the afterlife, goes against the classical notion in cognitive development that children strive to construct a truer representation of the world. As shown by Legare, Evans, Rosengren, and Harris (2012), children, and even adults, can hold conflicting natural and supernatural beliefs about the same phenomenon (e.g., the origin of the species, illness, or death). Further, children's use of *correct* natural explanations does not fully replace or outgrow their supernatural explanations. Given that children can hold such conflicting views, have knowledge of things they would never be able to personally observe, and do not always adopt accurate representations of the true state of the world, they clearly depend on the information provided by other people

Children's reliance on testimony suggests that they come into the world ready to receive information from others. The Vygotskian perspective emphasises the role played by knowledgeable others in providing information and structuring children's learning within a sociocultural context. Through various means, such as modelling, explanation, prompts, and joint engagement, the more knowledgeable person is able to guide the child through the *zone of proximal development*; the distance between what the child can do on his or her own and what the child can do with the assistance of the knowledgeable person (Vygotsky, 1978). In addition, children are taught the things which will allow them to survive and prosper in their respective culture. In some cultures, these things may be hunting or careful observation, whereas in other cultures, reading or knowing how to use a computer are more valuable to learn. Overall, children absorb the culture in which they live, adopting the ideas and beliefs widely held by their community, and they rely on knowledgeable others to provide them with the necessary information.

While culture is argued to be what sets the human species apart from others, some have argued that non-human primate species show indications of cultural transmission. For example, studies of chimpanzees' foraging behaviour have revealed that, when using a tool to retrieve food from an apparatus, chimpanzees engaged in the same instrumental actions they had observed a trained conspecific engage in (Horner & de Waal, 2009). Thus, it appears that certain behaviours can be passed on between chimpanzees via observation and social learning. However, despite such evidence, there is still a clear distinction in the means of ‘cultural transmission’ between both species. As indicated by Tomasello (1999), humans demonstrate a *ratchet effect*, where there is a progressive increase in tool complexity, so that modern tools eventually come to replace older ones. On the other hand, non-human primates demonstrate no signs of creating more advanced tools over time. Further, the knowledge transferred within a non-human primate society is largely aimed at the attainment of basic needs, such as acquiring food. In contrast, humans engage in activities which might serve no obvious adaptive functions (e.g., rituals, customs) but, nevertheless, still proliferate within a society.

One explanation of why cultural knowledge readily spreads in humans but not in non-human primates lies in the distinct imitative behaviours of each species. In an investigation of what young chimpanzees and three- to four-year-old human children attend to when watching a model perform actions, Horner and Whiten (2005) showed that young chimpanzees *imitated* causally opaque irrelevant actions, but *emulated* when the irrelevant actions were causally transparent. In other words, chimpanzees recognised that certain actions performed by the model were not relevant to the goal of retrieving a reward from a specially designed box and they omitted such irrelevant actions when retrieving the reward. On the other hand, three- to four-year-old human children more often imitated the model’s actions, and included the irrelevant actions even though they served no instrumental purpose in retrieving the reward. This tendency to *over-imitate* (Lyons et al., 2007) shows that children are equipped to readily absorb important aspects of their culture; they view the model as intentionally communicating something to them and that his or her actions should be followed. Children are inclined to act in accordance with the norms of the culture they live in rather than solely seek the causally most effective solution or seek to uncover the underlying causal mechanisms of all actions (which may often be opaque). In this way, the practices and customs of a society are likely to be passed on to the next generation, even if they do not necessarily have functional utility. Further, children rely on more knowledgeable others to provide them with information on how they should behave.

Along similar lines, Csibra and Gergely (2009; 2011) put forward a theory of *natural pedagogy*, which argues that human communication specifically evolved in a way that allows for the effective transmission of cultural knowledge; in particular, to children. Under this natural pedagogy system, children do not have to rely solely on statistical or trial-and-error learning to gather information about the world, especially when particular artifacts or instrumental actions may be too complex to learn about using these methods alone. This natural pedagogy system capitalises on infants' early recognition of ostensive cues (e.g., direct eye gaze, infant-directed speech) as referring to some object or event in the world, as well as their recognition that the information communicated in ostensive-referential contexts is likely to be generalisable to other contexts. Further, the benefit of natural pedagogy is that the transmission of cultural information extends beyond the parent-child relationship. Adults willingly teach children who are not their own, and children readily consider other adults to be reliable sources of information. To sum, Csibra and Gergeley concluded that natural pedagogy enables practical and cultural knowledge to proliferate within a community and to be communicated to subsequent generations, thus preserving the foundation of diverse human cultures.

Indeed, the processes and mechanisms put forward by natural pedagogy have been shown to be universal across distinctive human groups (Csibra & Gergely, 2009; 2011). However, that does not necessarily imply that the means by which cultural knowledge is transmitted is identical across cultures. For example, in most Western societies, children are provided with explicit instruction and explanation within formal educational institutions. On the other hand, in certain non-Western societies, where there is little direct teaching in the form of educational institutions, knowledge might be transferred via other means, such as through modelling and demonstration. Within different cultures, there is a set of specific tools (e.g., language, artifacts, beliefs, routines, values, etc.) which allow people to successfully navigate their surroundings. Such cultural tools may in fact, to some extent, influence how the people in that culture think. In other words, the means by which knowledge is passed on might affect what particular modes of thought are dominant within a culture and, subsequently, might mean that children are better able to reason with particular types of information or come to privilege certain types of information. The findings of Luria (1976), presented below, provide a profound example of how particular modes of thought might be influenced by how knowledge is transmitted.

Luria (1976) examined the differences in logical reasoning ability between illiterate peasant farmers with no formal schooling and collective farmers who had been provided with one to two years of formal schooling as a result of Soviet reforms. Both groups performed equally well when asked about propositions that matched their personal experiences. For instance, when asked, "Cotton grows well where it is hot and dry. England is cold and damp. Can cotton grow there or not?" members of both groups, who were well aware of the necessity of a hot and dry climate for optimal cotton-growing, made the appropriate inference that cotton would not grow in England. However, when presented with propositions that did not fit with their experiences (e.g., "In the Far North, where there is snow, all bears are white. Novaya Zemlya is in the Far North. What colour are bears there?"), only the educated farmers inferred that bears would be white. In contrast, the illiterate peasant farmers were reluctant to provide an answer, often stating that they would not know what colours the bears were because they had never seen them before. Hence, it can be seen that formal education facilitates the emergence of particular modes of thought; in this case, the tendency to draw a (logical) inference from premises that are beyond personal experience. Such results have implications for children's receptivity to testimony. For instance, it is likely that formal education strengthens children's capacity to consider objects and events that are beyond the here and now. Indeed, Harris and Richert (2008) argued that this ability to conceive of events or objects that are not bound to the current situation (i.e., including things that cannot be observed) is necessary for making sense of other people's testimony. Therefore, it is plausible that, in societies which utilise formal education systems, which consistently require children to imaginatively reconstruct events, circumstances, and conditions, children are more able to learn from testimony.

The research outlined above highlights how important the information provided by other people is for children's learning. Although a great deal of research has previously focused on how children gain knowledge through independent exploration, at present there is growing interest in how children learn from what other people say. Indeed, the testimony of others serves as a valuable source of information, providing not only information about things that children can personally observe for themselves, but also information about things which they will never observe or experience in their lives. In addition, many of the things children learn are embedded within a culture. For instance, it is culture that supplies the system for how objects should be classified, labelled, or used; and, as stated earlier, to some extent, structures how children should think about and perceive their environment.

In summary, rather than working exclusively towards a more objective and rational understanding of the world, a deep assumption of Piaget's genetic psychology, children absorb the culture they grow up in. They adhere to the norms of their culture, including its language, and acquire knowledge via observing others and relying on those they trust for information (Harris, 2012). However, that is not to say that children readily accept everything they are told, nor do they fail to evaluate for themselves what they have been told. Indeed, Gelman (2009) has argued that the testimony of others and the child's capacity to assess the testimony which they receive are equally important for their conceptual development. In the following section, I will discuss children's early learning from others as well as evidence that they are not credulous with respect to all the information they receive.

Children Accept Information They Hear at an Early Age, But Not Everything.

Given that testimony involves the transfer of verbal information, it could be thought that children's receptivity to testimony only emerges when they are fully capable of understanding language. As a result, learning from testimony might be thought of as rare during infancy. However, it is apparent that the foundations for learning from testimony are present from a young age. In a review of the social referencing literature, Baldwin and Moses (1996) pointed out that infants from 12 months of age are capable of making sense of the information received from others (e.g., emotional expression, actions, utterances) and they appreciate the referential quality of communication; that people provide information which refers to specific objects or events. Similarly, Harris and Lane (2013) reviewed evidence which shows that infants are receptive to the emotional signals of others, and that they recognise, by the age of two, that information is shared within a bi-directional communicative exchange.

In addition to emotional signals, non-verbal gestures, such as pointing, can serve as a type of testimony. It is now fairly well established that infants use and interpret pointing behaviour in systematic ways (Liszkowski, Carpenter, & Tomasello, 2007). For example, Behne, Liszkowski, Carpenter, and Tomasello (2012) showed that 12-month-olds successfully searched a container for a hidden toy when the experimenter had pointed to that specific container. Although infants' ability to orient towards the direction of another person's pointing may appear trivial, infants have to be able to infer *why* a pointer is directing them in order to fully understand that the pointer is intentionally providing information. Thus, infants may consider how the pointing is relevant to the situation and whether the pointer is a helpful source of information. Behne et al. also showed that infants who were better able to follow the experimenter's pointing were more likely to point to the correct container when the experimenter was searching for a hidden object. Hence, infants appear to understand that they can receive information from other people's pointing and also that they can use pointing as a way to provide information for others.

From the studies presented above, infants demonstrate behaviours that are proposed to be the early foundations for learning from testimony (Harris & Lane, 2013). For example, infants' ability to engage in social referencing suggests that they are receptive to information from others and can modify their behaviour based on the information they receive (e.g., in response to positive or negative facial expressions). Further, infants' sensitivity to pointing gestures, as well as their own use of such gestures, indicates that they recognise that information can be exchanged bi-directionally. In addition to this emerging ability to modify their behaviour in response to information provided by others and understanding the bi-directional nature of communication, there is growing evidence that very young children respond appropriately to the information provided by reliable or unreliable informants. For instance, 14-month-olds are more likely to imitate the novel actions presented by previously reliable models than of previously unreliable models (Poulin-Dubois, Brooker, & Polonia, 2011; Zmyj, Buttelmann, Carpenter, & Daum, 2010). In studies with younger children, 12-month-olds have been shown to behave in accordance with the emotional signals provided by previously reliable informants rather than previously unreliable informants within a social referencing paradigm (Stenberg, 2013). In addition, using an eye-tracking paradigm, even 8-month-olds have been found to systematically search locations that are repeatedly cued by reliable human faces rather than unreliable human faces (Tummeltshammer, Wu, Sobel, & Kirkham, 2014). Hence, it appears that children from a very young age are sensitive to the nonverbal reliability of informants and they can use such information to regulate their subsequent behaviours. Further, it is likely that these capacities contribute to their developing sensitivity to the reliability of verbal testimony.

Drawing parallels to how a child learns from spoken testimony, the child has to be able to *decode* the information they hear, and to understand that the information is being intentionally communicated and is about specific objects or events in the world. As a result of the testimony, there will likely be a change in the child's state, wherein they might modify their behaviour appropriately, or gain knowledge about something they were previously ignorant of. In addition, the child recognises that others may be more knowledgeable than they are themselves and should be attended to. Conversely, the child is able to provide information to a less knowledgeable conversational partner. Overall, it can be seen that the building blocks for children's ability to learn from verbal testimony emerges early in infancy, in which they are receptive to information from others, even though it is not verbal information.

Despite such early capacities, however, it is not until children have passed their second birthday that they have been shown to reliably modify their behaviour exclusively in response to verbal testimony. In a study by Ganea and Harris (2010), 30-month-olds, but not 23-month-olds searched a toy's new hiding location in response to being told by an experimenter where the toy had been moved. On the other hand, 23-month-olds tended to make perseverative errors and searched in the toy's initial hiding location, which corresponded with their first hand experience (i.e., they had seen the toy in that location), even though the experimenter had stated where the toy had been moved to. Similarly, Baldwin and Moses (1996) argued that children's ability to appreciate others as informative sources, as well as their ability to successfully elicit information from others, does not fully develop until about the age of three, which coincides with their nascent understanding of the distinction between knowledge and ignorance. Hence, it appears that it is not until about 30 months of age that children begin to appreciate that verbal testimony can be as informative as direct observation. In social referencing research, the information provided about the referent is, of course, confounded with children's direct observations. However, with testimony, the information provided about the referent is often not within children's direct experience.

Children's receptivity to verbal testimony offers them opportunities to acquire knowledge of things they are unlikely to observe or experience for themselves, which suggests that, in order to maximise learning, children should treat information obtained via testimony in the same way that they treat information obtained via direct experience. Indeed, there is evidence in support of this notion. For example, cognitive biases, such as the *curse of knowledge*, emerge when children acquire knowledge through direct observation as well as when they acquire knowledge through testimony. The curse of knowledge occurs when a person is biased by his or her own knowledge when attempting to judge what a less knowledgeable other person is likely to know or do. Bhandari and Barth (2010) showed that three- and four-year-olds displayed the curse of knowledge in response to verbal testimony. Specifically, after being told by an experimenter about the contents of a toy box, three- and four-year-olds stated that a puppet, who admitted that he had not seen the toys before, would know about the identity of the toys inside the box. Hence, it appears that children place similar emphasis on the epistemic nature of knowledge obtained from both direct observation and via testimony.

Although it may seem surprising that children place such faith in testimony, they have been shown to be quite deferential to the testimony of others in certain contexts. Jaswal, Croft, Setia, and Cole (2010) found that three-year-olds were continually misled by an informant who provided incorrect verbal testimony about the location of a hidden sticker. These young children persisted in choosing the location stated by the informant even though it was repeatedly revealed that there was no sticker to be found at that location. In contrast, children who watched the informant place an arrow over the wrong location more quickly realised that the arrow was not a reliable marker of the sticker's location. Hence, from about the age of three, children have a strong bias to trust direct verbal testimony. A study by Jaswal (2010) also revealed that 30-month-olds deferred to an experimenter's testimony, even if it conflicted with their understanding of the physical world (i.e., the trajectory of a ball through a tube). However, children were not excessively deferential. If children could see where the ball was, or if they were given the chance to closely examine how the tubes were aligned, they more often dismissed the experimenter's testimony in favour of what they knew. Therefore, when claims are not easily verifiable or children are uncertain, they are credulous to what other people say. However, if such claims appear implausible or strongly conflict with their existing knowledge, they dismiss them in favour of their own observations or knowledge.

The research outlined above suggests that, while children generally accept what they are told, especially when they are uncertain or lack knowledge, children are not irrationally credulous. Children disregard what they have been told when claims are clearly inconsistent with what they can observe (Ma & Ganea, 2010). Further, children's dismissal of conflicting testimony is not isolated to specific communicative exchanges. From the age of three, they expect that a person who initially provides blatantly misleading testimony will be unlikely to provide reliable testimony in a future situation. For instance, Ganea, Koenig, and Millett (2011) showed that 36-month-olds were more likely to follow an experimenter's statements if she was previously reliable in reporting where a toy had been moved than if she was previously unreliable, whereas 30-month-olds still deferred to the experimenter's suggestions, even if she had been unreliable. Hence, just as infants are sensitive to the reliability of nonverbal information provided by other people (as discussed earlier), children from the age of three are initially credulous to verbal testimony but quickly become sceptical of informants who provide false testimony that flatly contradicts what they have seen or experienced. Furthermore, they make use of an informant's history of accuracy, if it is available, to appropriately decide whether they should trust that informant's claims in future situations.

In a systematic investigation of how children simultaneously consider informants' history of accuracy and whether the testimony strongly contradicts with children's personal observations, Clément, Koenig and Harris (2004) showed that children from a young age do not simply trust everything other people say. Instead, they consistently monitor the information they are exposed to in light of informants' prior reliability as well as their own observations. From three years of age, children give priority to their own observations and do not endorse false testimony, even from an informant who was previously reliable. Further, there is evidence of a developmental transition between the ages of three and four wherein children become more discerning about whom to trust and are wary of informants who have proven unreliable in the past, particularly in situations where they are unable to check an informant's testimony against their own observations. That is, from four years of age, children predict that a previously reliable informant will continue to make accurate statements and that a previously unreliable informant will continue to make inaccurate statements. In addition, they prefer a reliable informant's testimony in circumstances when they cannot determine the answer for themselves via direct observation. Three-year-olds, on the other hand, are more likely to predict that both previously reliable and unreliable informants will provide accurate statements, and they display *indiscriminate* trust and are likely to agree with the statements provided by both informants. Hence, given that children are monitoring the reliability of informants, it appears that they are forming an impression of that informant as a *potential* future source of information. In keeping with this notion, in the next section I argue that children do not only evaluate the claims they hear, they also make evaluations of the informants who provide them.

Children need to be able to Evaluate who is a Trustworthy Source of Information

Under most circumstances, children readily accept the information they receive from others unless there are good reasons not to, such as if the informant has made statements that strongly contradict children's knowledge or experience, or if he or she has a history of inaccuracy. In addition, children consider the epistemic value of information obtained via testimony to be comparable to the epistemic value of information obtained via direct observation or experience. Testimony does not serve only to supplement children's knowledge (Harris, 2012). In other words, once children hear a piece of testimony, they do not have to search for observable evidence to verify the truth of the statement and decide whether the informant should be trusted. If children engaged in such a strategy of empirically confirming everything they hear, this would be ineffective for two reasons. First, children are unlikely to have adequate time and resources to figure out for themselves the veracity of statements (Sperber et al. 2010). Indeed, in some instances, it might be dangerous to do so (e.g., if a child is told that a stove should not be touched because it is hot). Second, as discussed throughout this chapter, there are many things which children will never be able to see or experience for themselves (Harris, 2007), so it will be impossible to determine the truth of what they hear. Therefore, children's willingness to trust what other people say by default is a strategy which allows them to effectively acquire knowledge of the world.

Of course, because children are not always able to check the truthfulness of a statement by comparing it with what they have observed or experienced for themselves, children need to rely on other means to decide if an informant should be trusted. As suggested by Harris (2007), even if an informant provided accurate testimony in one particular situation, which a child is able to check against his or her own experience, it is not necessarily a good indicator that the informant's testimony is accurate in future situations where the child is unable to check the testimony against his or her own knowledge. Hence, rather than solely monitor the correspondence between an informant's statement and their own experience (i.e., the content of the *message*), children also need to monitor *who* provides such statements. That is, informants who are construed as *reliable* are more likely to provide accurate information in a particular instance as well as in future instances. Indeed, various researchers argue that children place great emphasis on *who* the statement is coming from (Harris & Corriveau, 2011; Koenig, 2010). Children infer that informants who were reliable in the past are likely to be reliable in the future. In addition, when exposed to an informant who provides incorrect information, children brand that informant as an untrustworthy source. Indeed, Harris (2007) proposed that children from an early age create a global impression or profile of an informant based on a wide range of cues, such as an informant's history of accuracy, demonstrated knowledge, degree of confidence, the reactions of others, and so on. As a result, children see some informants to be more epistemically trustworthy than others and are selective about whom they trust; in other words, they are balanced between credulity and sceptism.

By being both accepting and cautious toward the wealth of information they receive, children are in a good position to accept reliable claims and dismiss unreliable claims. Such an ability is important given that, while most interlocutors are likely to provide reliable information, there are instances where children may be exposed to misinformation as a result of an informant's ignorance, lack of expertise, or an intention to deceive (Sperber et al., 2010). In addition, children may receive contradictory information and need to decide which informant to accept and keep track of in the future. Hence, *active epistemic vigilance* is required, and Sperber et al. argued that it serves as the foundation for trust in others' claims. We adjust our degree of vigilance in a number of ways, by attending to the content and to the source of the information. In most cases, we expect interlocutors to be honest so that our vigilance is low, but it is this vigilance which allows us to trust others and provides us with reasons not to when necessary. On a similar note, Koenig (2010) argued that children are selective in whom they trust and are competent in finding reasons for accepting or dismissing the claims they hear. When evaluating the truth of statements, children can assess the statement itself; for instance, by examining whether the statement matches with what they have experienced. In addition, children can reflect on the speech act and the context in which the informant expresses his or her statements (e.g., whether there are signs of humour, confidence, an imaginative setting, etc.). Finally, children can evaluate characteristics of the informant to determine whether the statements he or she makes can be trusted; for instance, whether the informant has a track record of reliability or appears knowledgeable (to be further discussed in the next chapter).

It is important to note that even when children have found an informant trustworthy or untrustworthy, they do not necessarily accept or reject all the testimony from that specific informant. In fact, children are capable of deciding whom to seek information from and whom to approach for certain kinds of information. For example, they might consider an informant to be knowledgeable when providing information from one domain (e.g., cooking), but ignorant when providing information from another domain (e.g., computers). Research by Keil and colleagues has investigated how children recognise expertise in the minds of other people, and suggests that children from about the age of three have a nascent understanding that knowledge is clustered in others' minds in ways that reflect a person's experiences, interests and environments (Danovitch & Keil, 2004; Lutz and Keil, 2006). Keil (2006) argued that this *division of cognitive labour* is necessary for human survival as no single person could possibly acquire all the knowledge of the world. The findings of Keil, Stein, Webb, Billings, and Rozenblit (2008) revealed that children from about the age of five are starting to cluster knowledge in ways that are partly consistent with the academic disciplines. Remarkably, despite having no formal instruction as to how academic disciplines are grouped, children are skilled at distinguishing between specific types of knowledge and appropriately matching them with the appropriate discipline, such as the natural or social sciences. To sum, children's understanding of the division of cognitive labour enables them to decide from whom they should seek information as well as to evaluate the quality of the information provided. Children from three years of age have some sense, albeit fragile, of who might be a more credible source than others for certain topics; and this understanding plays an integral role in how they decide whether to trust an informant.

Summary

This chapter has discussed children’s strong reliance on others’ testimony from an early age and shown that children are neither entirely credulous nor entirely sceptical. Instead, they balance their evaluations of the claims of other people and such evaluations are made in light of their existing knowledge. In the next chapter, I present an experimental paradigm which has been extensively used to examine children’s *selective trust,* and will serve as the primary methodology of the studies presented in this thesis. In addition, I highlight existing limitations of the paradigm as well as my attempts to address them. Specifically, in Chapter 2, I argue that existing studies of children’s selective trust heavily emphasise the contrast between accurate and inaccurate informants, but are yet to adequately investigate what children do with informants who provide *new* information, which is arguably more representative of what children encounter in the real world. In Chapter 3, I note that many studies on selective trust present informants who provide information in the form of *labels* for objects. However, I argue that children also receive many other types of information, including *explanations* about objects. Specifically, it is plausible that children’s precocious capacity to discern accurate from inaccurate labellers extends to other verbal information that can, arguably, distinguish someone who is knowledgeable, and therefore epistemically trustworthy, from someone who is unlikely to be a good source of information. In Chapter 4, I argue that the selective trust literature largely comprises informants who provide information about *artifacts*. However, because children’s understanding of the body burgeons between the ages of four and eight, and much of what they know about the body is learnt through what they hear from others, I argue that that the biological domain would be a fertile one in which to further investigate how children evaluate the trustworthiness of informants.

Chapter 2
The Selective Trust Paradigm

Key Findings

The selective trust paradigm, devised by Koenig, Clément, and Harris (2004), is used to examine whether children differentiate reliable informants from unreliable informants, and whether they selectively prefer learning from a reliable informant. The first phase of the paradigm is a *familiarisation* phase, in which children watch two informants repeatedly provide accurate or inaccurate labels for familiar objects (e.g., ball, doll). In a subsequent *test* phase, children are required to learn about the labels for unfamiliar objects, and are asked to decide which informant they would prefer to learn from. Because information about the accuracy of labels for the unfamiliar objects is unavailable in test trials, children need to rely on the information they obtained about each informant’s reliability in the preceding familiarisation trials. Each test trial typically consists of an *ask* question, where children select one of the informants for help with the labels for unfamiliar objects; an *endorse* question, where children decide which of the informant's labels are correct; and an *explicit judgement* question, where children categorise each informant as "very good", "not very good", and "better" at labelling objects.

Studies that have used the selective trust paradigm typically contrast an accurate labeller with an inaccurate labeller, and have established that children between the ages of three and four are sensitive to the differential reliability of such labellers. Earlier studies (Koenig et al., 2004; Koenig & Harris, 2005) indicated that four-year-olds are more systematic than three-year-olds in their preferences for the previously accurate labeller. However, if provided with more evidence of the informants' reliability (i.e., with additional familiarisation trials), three-year-olds also show a systematic preference to learn from previously accurate labellers (Corriveau & Harris, 2009a; Corriveau, Meints, & Harris, 2009). So, when learning labels for unfamiliar objects, children from the age of three prefer to seek and endorse the labels provided by a previously accurate labeller, rather than a previously inaccurate labeller. Further, in the explicit judgement questions, children provide more favourable assessments of the previously accurate labeller (stating that she was "very good" and "better" at labelling the objects) than of the previously inaccurate labeller. To sum, with repeated exposure to informants who consistently provide accurate or inaccurate information, children from the age of three are sensitive to such differences and are more likely to trust informants who had provided accurate information.

Although it is apparent that children can track the accuracy of informants' labelling, it is also important to examine whether their selective trust is bound only to the situation in which the brief paradigm is presented, or whether it extends over a longer period of time. In real life, for instance, it would be detrimental to children's learning if they were unable to recall an informant's previous unreliability during a subsequent encounter. Corriveau and Harris (2009a) confirmed the persistence of children’s selective trust after a time delay. Their results showed that three- and four-year-olds continued to display selective trust in the previously accurate labeller in a subsequent testing session conducted either one day, four days, or one week after an initial testing session. Further, even when explicit judgement questions were removed from the initial testing session, children continued show a systematic preference for the previously accurate labeller either four days or one week later. Therefore, from the age of three, children require only a minimal amount of information about the differential accuracy of informants to show a systematic preference for learning from accurate informants. Such results suggest that children maintain their evaluations of the trustworthiness of informants over an extended period of time; that it is not situation-bound, but can be retained for later referral.

As well as establishing whether children's selective trust persists over time, the scope of children's selective trust is also necessary to consider. For example, as children encounter others who are knowledgeable of a specific subject (e.g., labels for objects), it may be beneficial to also attend to the information those informants provide about other closely-relevant subjects (e.g., how objects can be used). At the same time, children need to ensure that they do not overgeneralise their trust and accept information about things that extend too far from the informant's area of expertise. In a study by Koenig and Harris (2005), three- and four-year-olds were familiarised with an informant, who provided accurate labels for familiar objects and another informant, who claimed ignorance (e.g., "I don't know what that's called"). When children were required to seek information from the informants about a different subject, the *functions* of unfamiliar objects (i.e., how they are used), both three- and four-year-olds preferred to seek and endorse object functions from the previously accurate labeller rather than from the previously ignorant informant. In other words, children expect accurate labellers of objects to be trustworthy sources when learning about other characteristics of objects; in this case, nonverbal information about how objects are used.

Children generalise their selective trust in accurate labellers, not only when learning novel object functions, but also when learning novel morphological forms (e.g., irregular past tense or plural forms). For instance, the findings of Corriveau, Pickard, and Harris (2010) showed that, when familiarised with informants who either differed in accuracy of labelling or differed in accuracy of morphology (i.e., used correct or incorrect plural forms), four-year-olds systematically preferred the previously accurate labeller over the previously inaccurate labeller, and the previously accurate morphologist over the previously inaccurate morphologist, when learning novel labels and, more importantly, when learning novel irregular past tense forms. Further research by Sobel and Macris (2013) demonstrated that four-year-olds are better able to differentiate between accurate and inaccurate labellers when learning about novel irregular plural forms than novel irregular past tense forms, which suggests that there are nuances in how children generalise their trust. Summarising across these studies, children conceive of accurate labellers as being knowledgeable about other object- or word-related topics. Such results also suggest that children demonstrate a *halo effect*, in which they over-attribute positive characteristics to the accurate informant. However, as outlined below, it is unlikely that children consider an accurate informant to be knowledgeable about things that are beyond his or her area of expertise.

In a study of whether children demonstrate a halo effect when evaluating informants' trustworthiness, Brosseau-Liard and Birch (2010) showed that five-year-olds, but not four-year-olds, decided that a previously accurate labeller would have greater knowledge of words and facts (e.g., "who knows that cats can see at night?") and would also be more prosocial. Therefore, Brosseau-Liard and Birch concluded that five-year-olds consider an informant's prior accuracy to be indicative of broader knowledge, and that five-year-olds' construal of the previously accurate labeller as being more prosocial was evidence of a halo effect because prosociality is distinct from knowledge of labels. However, in arguing against this conclusion, it is important to note that children's expectations that the accurate labeller would be more prosocial are hardly surprising. That is to say, the accurate informant was inherently more prosocial because she had provided relevant information when labelling the familiar objects, whereas the inaccurate informant had not. In addition, when asked to evaluate the trustworthiness of informants in unrelated subject areas, such as deciding which informant had more talents (e.g., " who can draw pretty pictures"), possessions (e.g., “who has a cat?”), or situation-specific knowledge (e.g., “who knows where I put my books?”), five-year-olds did not favour the previously accurate labeller. To sum, children extended their trust in the accurate labeller when asked who would know more about closely related subject areas (e.g., knowledge of words and facts), but not about irrelevant subject areas, and they reasonably concluded that the accurate labeller was more helpful. When the results of Brosseau-Liard and Birch are interpreted in a different light, it appears that children do not demonstrate a halo effect when evaluating the trustworthiness of informants who differ in accuracy.

In further investigations of whether the lack of a halo affect is specific to children's evaluations of informants' accuracy, Fusaro, Corriveau and Harris (2011) showed that three- to five-year-olds were prone to a halo effect when presented with informants who differed in *strength*, but not when presented with informants who differed in accuracy. For example, when presented with an informant who successfully lifted heavy objects and an informant who failed to lift heavy objects, children decided that the strong informant would be more knowledgeable of novel labels for unfamiliar objects, and rated this informant as stronger, smarter and nicer. In contrast, when presented with informants who differed in their accuracy of labelling, children decided that the accurate labeller would be more knowledgeable of novel labels for unfamiliar objects and rated this informant as smarter, but not stronger or nicer. Hence, children evaluated informants who differed in accuracy on aspects which were relevant to knowledge (i.e., smartness) and future labelling behaviours, but not to unrelated abilities such as strength. Children are sensitive to differences in the accuracy of others, and they make relevant and specific evaluations of such people. Additional studies (Brosseau-Liard & Birch, 2011) have shown that children from the age of four also distinguish between *person-specific* knowledge, in which a person's knowledge generalises across contexts (e.g., prior accuracy, knowledge of words and facts), and *situation-specific* knowledge, which is limited to information a person obtains within a specific context (e.g., whether a person had visual access). When all these studies are considered, even though children might generalise their trust across subject areas, children are remarkably specific when determining the trustworthiness of others in particular contexts.

Children's Strategies for Selective Trust

The research reviewed above shows that children from the age of three likely consider an informant's accuracy to be a largely stable person-specific trait. Children prefer learning from those who have been shown to be reliable in the past and, in certain contexts, generalise their preference for reliable informants when learning about things that are within informants' area of expertise. With such consistent findings, another direction the existing research has taken is to clarify the *nature* of the strategy children use when evaluating the trustworthiness of informants. There are two potential strategies children could use when deciding who is a trustworthy source of information. The first strategy is that children increase their trust in the reliable informant whenever he or she makes an accurate or knowledgeable statement. The second strategy is that children reassess, and thereafter reduce, their trust in the unreliable informant whenever he or she makes an inaccurate or ignorant statement. Of course, such strategies are not mutually exclusive; children could simultaneously utilise both. Existing studies indicate that children younger than the age of four primarily use the second strategy, in which they are sensitive to inaccuracy and are unforgiving, even when a largely reliable informant makes a single error (Pasquini, Corriveau, Koenig, & Harris, 2007). After the age four, however, children begin to privilege accuracy (Corriveau et al., 2009). For example, four-year-olds, but not three-year-olds, preferred learning from a previously accurate informant over a previously neutral informant; that is, an informant who made neutral remarks to draw attention to objects (e.g., “Let me take a look at that”).

Given the apparent differences between three- and four-year-olds’ selective trust, the age-related change has been proposed to be due to children’s developing Theory of Mind (ToM), their ability to construe an individual’s actions in terms of internal psychological states such as intentions, desires, beliefs and emotions (Wellman, Cross, & Watson, 2001). Research on ToM has particularly emphasised the development of children’s understanding of *false beliefs,* the understanding that other people hold beliefs about the world which may contradict the true state of the world. It has been well established that this ability emerges at about the age of four. In relation to selective trust, Koenig and Harris (2005b) suggested that three-year-olds might have difficulty in evaluating the trustworthiness of informants because they fail to grasp why an unreliable informant (i.e., the one who supplies inaccurate labels) would make statements that are in conflict with reality. On the other hand, four-year-olds are perhaps able to recognise that an informant’s unreliable statements are a result of his or her erroneous beliefs, and they may then become sceptical of any future statements he or she makes. Fusaro and Harris (2008) also suggested that more advanced ToM may be indicative of children's ability to treat the knowledge or ignorance of potential informants as an enduring trait, rather than limited to a specific instance.

Despite the developmental advances that occur between the ages of three and four with regards to ToM and selective trust, results of several studies that have sought to establish a link between these two abilities have been mixed (Diyanni, Ninim Rheel, & Licelli, 2012). For instance, in addition to examining how three- and four-year-olds monitor the relative accuracy of informants, Pasquini et al. (2007) included a measure of children’s false belief, an unexpected contents task, in which children were shown a crayon box that contained candles rather than crayons. After children confirmed that there were candles inside the crayon box, they were asked what another person, who has never seen the contents of the box, would think was inside. To demonstrate appropriate false belief understanding, children had to recognise that a less informed person would mistakenly believe that there were crayons inside. Overall, the findings of Pasquini et al. did not establish that children who had higher false belief understanding were more likely to demonstrate selective trust in accurate labellers.

In one of the few studies that have found a link between children's ToM and their selective trust, Fusaro and Harris (2008) used a battery of ToM tasks, which assessed understanding of diverse desires, diverse beliefs, perceptual access and knowledge, false beliefs, and hidden emotions. Results revealed that children who were higher in ToM systematically favoured an informant, whose labelling elicited cues of assent (e.g., nods and smiles) from two bystanders, over another informant, whose labels elicited cues of dissent (e.g., headshakes and frowns) from the bystanders. On the other hand, children who were low in ToM were less systematic in differentiating between the informants. Hence, even though an informant's reliability was determined by the nonverbal reactions of bystanders rather than through the direct accurate or inaccurate labelling of familiar objects, the results of Fusaro and Harris suggested that there is a possible link between individual differences in children's selective trust and their understanding of other people's minds. Such results also indicate that it is necessary to assess other aspects of children's ToM, rather than be limited to assessing false belief understanding only.

Further evidence suggests that the link between ToM and selective trust might differ across cultures. Lucas, Lewis, Pala, Wong, and Berridge (2013) presented three- and four-year-old Turkish, Chinese and English children with a *flexible trust* task, a modified version of the selective trust paradigm featuring two informants, a *toy expert* and a *food expert*. In the first phase, children watched the informants provide labels for familiar toys, with the *toy expert* providing correct labels and the food expert providing incorrect labels, and were asked which informant they would prefer when learning about novel toys. In the second phase, the informants provided labels for familiar foods; this time, the food expert was more reliable than the toy expert. Children then had to decide which informant they would prefer when learning about novel foods. In the final phase, the flexible trust component, children were presented with both novel toys and foods and asked which informant they would prefer learning from. The purpose of this final phase was to determine whether children could flexibly switch their preferences between informants, depending on the type of novel object that was presented. It was expected that children would prefer the toy expert when learning about novel toys, but would prefer the food expert when learning about novel foods.

Measures of children's false belief understanding and executive function skills were also taken. Lucas et al. predicted that children's executive function skills might play a role in how well children would be able to inhibit and switch their preferences between the informants in the flexible trust task.

Findings revealed that, while the executive function skills of Chinese children were superior to English and Turkish children's, false belief understanding for Turkish children was superior to that of Chinese and English children. In the first two phases of the task, when the novel toys and foods were presented separately, children across all cultural backgrounds preferred learning about novel toys from the toy expert, and preferred learning about novel foods from the food expert. However, in the flexible trust component, when both novel toys and foods were presented within the same task, only the Turkish children were better able to flexibly switch their preferences between the toy and food expert in response to the type of object presented. Lucas et al. (2013) suggested that the superiority of the Turkish children's performance may be due to the fact that certain languages comprise *evidential markers* which allow speakers to explicitly state *how* he or she came to know something. For instance, the Turkish language, unlike English and Chinese, differentiates between information which is acquired via observation, inference, or testimony. Hence, the Turkish children's ability to systematically prefer the appropriate informant when learning about specific types of objects might be a result of the early exposure they have to such evidential markers. Of course, it remains to be seen whether similar associations between children's ToM and selective trust also emerge in other cultural groups which utilise evidential markers in their language. Nevertheless, the results of this study provide evidence of a link between children's selective trust and false belief understanding, and suggest that children's preference for the more reliable informant appears to be driven by their understanding of others as sources of knowledge, rather than a result of an increase in general cognitive ability (given that no relations were found between executive function and selective trust).

To sum, the various findings presented above have been informative in establishing the nature of children's selective trust. However, in the next section, I argue that the labels provided by inaccurate informants in existing studies are problematic, and that this gap in the literature can be addressed by the introduction of an informant who provides novel labels.

The Problem with Inaccurate Labelling

From the studies reviewed so far, the defining feature of the typical selective trust paradigm is the differential accuracy of labels presented by the informants. The reliable informant provides labels for objects which children know to be the accepted labels, and are likely to be the same labels that children would themselves use. In contrast, the unreliable informant offers labels which are blatantly inaccurate and strongly conflict with children's pre-existing knowledge. Such sensitivity to inaccurate labels is present early, even from infancy. For instance, a study by Koenig and Echols (2003) showed that 16-month-olds gazed longer at a speaker who provided incorrect labels for familiar objects than at a speaker who provided the correct labels, as if to express their surprise at the false labels. Several infants also protested against the inaccurate labels and attempted to correct the speaker by pointing to a correct referent (e.g., infants pointed to their own shoes if the object had been mislabelled as a “shoe”).

The provision of inaccurate labels also violates the Gricean maxim of *quality* (Grice, 1982), which states that an interlocutor should aim to provide information which is truthful. In an investigation of children’s sensitivity to violations of Gricean maxims, Eskritt, Whalen, and Lee (2008) found that from about the age of three, children become increasingly aware of such violations. For instance, in a task where they had to locate a sticker under a cup, three-year-olds dismissed information from an informant who violated the quality maxim by stating the incorrect location. Similarly, children dismissed information from an informant who flouted the *relation* maxim by making comments that were irrelevant to the goal of locating the sticker (e.g., “I like these cups”). However, three-year-olds had difficulty with interpreting an informant who flouted the *quantity* maxim by providing insufficient information (e.g., “It’s under *a* cup” without stating which coloured cup), suggesting that there is fragility in younger children’s construal of violators of particular maxims. Therefore, given children’s sensitivity to violators of Gricean maxims, it is likely that children conceive of an inaccurate labeller in the selective trust paradigm not only as an erroneous source of information, but more broadly as someone who does not conform to conversational expectations. In the real world, children are unlikely to encounter informants who continually provide inaccurate information, unless in the context of pretence or humour. Indeed, Hoicka and Akhtar (2012) showed that at the age of three, children begin producing novel humorous acts which are label-based (e.g., holding a cat and saying, “here’s a fish”). Hence, given that children find inaccurate object-labelling to be funny, it is plausible that children consider inaccurate informants in selective trust paradigms to be an unhelpful and non-genuine source of information.

Interestingly, in contrast to the findings of Hoicka and Akhtar (2012), when children are presented with in the selective trust paradigm, featuring informants who differ in accuracy, and are asked to explain why the inaccurate labeller was “not good at answering questions”, children seldom state that the labeller was “pretending” or “being silly”. Instead, they more often state that the labeller was ignorant and “didn’t know” the answers (Koenig & Harris, 2005a). It is plausible that the contrasting results are due to the manner in which the informants make statements. In the context of humour, an informant’s statements are typically accompanied by special facial expressions and vocal cues which signal that the informant is intentionally providing incorrect information. On the other hand, in selective trust paradigms, such facial expressions and vocal cues are absent, and both informants provide labels in a serious manner, so children might be more inclined to infer that the inaccurate labeller is ignorant. In the presence of such serious and non-humorous informants, several studies have examined how children treat information offered by informants who are ignorant. Sabbagh, Wdowiak, and Ottaway (2003) proposed that children may simply block learning from ignorant informants by refusing to encode the incorrect word-referent link. On the other hand, children may encode the word-referent link but mark it as originating from an erroneous source. The results of Sabbagh and Shafman (2009) lend support to the latter *encoding-and-marking* strategy. Four- and five-year-olds accurately recalled what an ignorant informant had said. That is, when asked, “Which one did I say is the modi?” children remembered which toy the informant had labelled as “modi”. However, children did not maintain a strong semantic representation of the word-referent link because they were less able to select the target toy when later asked, “Which one of these things is the modi?”. Hence, it can be seen that children not only dismiss information from an unreliable source, they also note that the source was unreliable.

Of course, despite children’s dismissal of unreliable informants, their evaluations of such informants are not in absolute terms. In examining how children’s evaluations differ as a function of whether an inaccurate informant is the only source of information available to children, Vanderbilt, Heyman, and Liu (2014) showed that three- and four-year-olds rated an informant negatively if she provided inaccurate information in the presence of an accurate informant. However, if the informant provided inaccurate information on her own (i.e., if there was no conflicting testimony to be compared with), children’s ratings of this informant were more positive. In addition, regardless of whether the inaccurate informant was presented alone or with another informant, children stated that the inaccurate informant would be a good source of information when learning about new objects in the future. Hence, children's evaluations of inaccurate informants are not absolute. They evaluate inaccurate informants in light of other available information, such as another informant who provides conflicting testimony, and they do not entirely distrust such informants. Further, children are forgiving of informants who have appropriate reasons for being inaccurate. Against this notion, however, Nurmsoo and Robinson (2009) argued that the odd context of the selective trust paradigm leads children to only consider the *output* of the informants and not engage in any mentalistic reasoning about the informants' knowledge or ignorance. That is, children only learn that one informant gives correct answers, whereas the other informant gives incorrect answers, and they make no appeal to any specific mentalistic reasons as to why the informants differ in accuracy. In their study, three- to seven-year-olds were shown to be similarly distrustful of two informants who provided inaccurate labels, even though one of the informants was blindfolded and, hence, had reasons for being inaccurate. In a subsequent study, Robinson and Nurmsoo (2009) proposed that children's tendency to engage in mentalistic reasoning may vary depending on the type of information presented. For example, they suggested that children may be more wary of accepting inaccurate information that is person-specific and hence, generalisable across situations (e.g. object labels), than information which is situation-specific (e.g., object identity or location). Indeed, in their subsequent study, Robinson and Nurmsoo demonstrated that three- to five-year-olds were more forgiving of an informant who made errors of object identity due to inadequate perceptual access (e.g., by stating the incorrect colour of a toy only after touching it), and they were more distrustful of an informant who made errors despite having adequate perceptual access (e.g., by stating the incorrect colour of a toy even after looking it). Hence, children are capable of engaging in mentalistic reasoning; rather than simply dismiss inaccurate informants, they appeal to reasons for their inaccuracy.

In addition to considering reasons as to why informants are inaccurate, children also consider the degree of plausibility of inaccurate statements. For example, since tigers and lions share similar perceptual features and belong to the same category of "big cats", an informant who labels a tiger as a "lion" could be seen as less inaccurate than an informant who labels it as an entirely unrelated object, such as a "clock". In exploring children's sensitivity to this *magnitude of error*, Einav and Robinson (2010) found that six- to seven-year-olds, but not four- to five-year-olds, preferred learning labels for unfamiliar animals from informants who made smaller errors rather than from informants who made larger errors. Even though both age groups were capable of appropriately grouping perceptually and categorically similar animals, only six- to seven-year-olds utilised this information when deciding which informant to trust. Therefore, it appears that the ability to differentiate between magnitudes of error does not emerge until much later in development, at least when the information pertains to object labels.

However, a study by Kondrad and Jaswal (2012) demonstrated that four- and five-year-olds were able to consider the magnitude of error when deciding which inaccurate informant to trust so long as there was a plausible reason for forgiving the informant who made smaller errors. Specifically, when objects were partially obscured so that the objects could not be easily identified, children were more forgiving of an informant who made smaller errors (e.g., by calling a comb a “brush”) than of an informant who made larger errors (e.g., by calling a comb a “thunderstorm”). On the other hand, if the view of the objects was unambiguous such that the identity of the objects was obvious, children were then unwilling to trust either informant, even if one of them had made smaller errors.

To sum, children from about the age of four or five are able to consider magnitude of error as a cue to reliability and endorse inaccurate labellers in particular contexts; they do not immediately distrust them. However, in order to trust an informant who has provided inaccurate labels in the past, children require the informant to provide labels that are closely related to the correct labels, as well as a plausible explanation for the errors. Informants who offer blatantly incorrect and implausible labels for no specific reasons are not given credence.

Moving Beyond the Accurate and Inaccurate Labelling of Objects: Novel Labels

Much of the early papers on children’s selective trust have focused on the contrast between accurate and inaccurate labellers. However, within the last decade, there has been a proliferation of studies that have varied characteristics of the contrasting informants, as well as the form of information they provide; such variations are discussed in the next chapter. Hence, it is apparent that the selective trust paradigm has enormous flexibility in its use within research and it has demonstrated children’s sensitivity to a broad range of differences between informants. Further, as discussed above, for the researchers who continue to focus on the contrast between accurate and inaccurate labelling, many have highlighted the ambiguity inherent in informants who make overt mistakes and, hence, have directed efforts to clarify the nature of children’s distrust of such speakers. Children dismiss inaccurate informants, not only because she provides incorrect information, but also because her contributions are seen as non-genuine and unhelpful. In addition to being implausible and non-genuine, overtly inaccurate labellers are not frequently encountered in children's everyday experience. In contrast to the misinformation provided by inaccurate labellers, in real life, children are continually exposed to new information (whether accurate or inaccurate), which they will need to make sense of in light of their existing knowledge. For instance, children eventually realise that a cup can also be called a mug, or that the epidermis also refers to the skin. Certainly, when learning a new language, children must accept that referents can have different labels, and it has been shown that even 19-month-olds are capable of doing so (Bhagwat & Casasola, 2014). However, there has been little focus on children's interpretation of novel labels in selective trust research.

The few studies that have featured novel labels examined how children consider novel labels for familiar objects which are provided by informants who have a history of reliability or unreliability. For example, using a single informant paradigm, Koenig and Woodward (2010) found that 24-month-olds were sensitive to the prior accuracy of a labeller when learning novel labels. After being familiarised with an accurate labeller, who then assigned a novel label to a target object, children were more likely to appropriately recall the target object in a subsequent test phase. However, after being familiarised with an inaccurate labeller, who then assigned a novel label to a target object, children were less likely to recall the target object in the test phase. Similarly, using a similar single informant paradigm, Krogh-Jespersen and Echols (2012) showed that, when learning novel labels, 24-month-olds more often selected the appropriate target object if they had been taught the novel label by an informant who was either accurate, knowledgeable (i.e., who said, "I know what that is!"), or uninformative (i.e., who said, "look at that"). In contrast, when an informant was either inaccurate or ignorant (i.e., who said, "I don't know what that is"), children were less likely to select the target object. Overall, it appears that reliable labelling overrides mutual exclusivity, children's tendency to assume that whole objects have only one category label. Further, children have a 'default trust' in which they expect adults to be reliable labellers unless they are shown to be inaccurate or ignorant. Hence, children are likely to entertain an alternate label for an object they already have an existing label for, so long as the informant who provided the alternate label was not erroneous in the past.

Older children are similar in their interpretations of novel labels provided by informants who have a history of accuracy or inaccuracy. Sobel, Sedivy, Buchanan, and Hennessy (2012) showed that, when presented with three objects – two of which were familiar to children, and one of which was novel – children were more likely to select the novel object when a previously accurate labeller requested for an object using the novel label in comparison to when a previously inaccurate labeller made the request. In addition, children showed better recall of the novel label used by the accurate labeller than the inaccurate labeller. Such findings suggest that the reliability of speakers generates different pragmatic environments. When the previously accurate labeller used a novel label, children likely expected that she already knew the labels for the two familiar objects, so her novel label must have been directed to the novel object. On the other hand, when the previously inaccurate labeller used a novel label, children perhaps inferred that she was not knowledgeable of object labels and, as a result, concluded that she was referring to any of the objects. Overall, the findings reviewed so far show that children from a young age are capable of interpreting novel labels for objects for which they have pre-existing labels, and that such interpretations are influenced by the previous reliability of the labeller.

However, no studies have directly examined how children interpret informants who provide novel labels from the outset, and whether such novel labellers are treated differently from accurate or inaccurate labellers. In the study described in Chapter 5, therefore, children's trust in informants who provide *new information* was compared to their trust in informants who provide straightforwardly accurate or inaccurate information. It was predicted that informants providing novel labels for familiar objects (i.e., new information) would appear more credible to children than informants providing inaccurate information about objects. It was also reasoned that informants providing novel information would more closely approximate what children encounter in the real world.

Summary

This chapter outlined the selective trust paradigm that has been used to examine how children evaluate the trustworthiness of informants. The results of the studies presented above show that, from the age of three, children trust informants who provide accurate information. They prefer learning labels for unfamiliar objects from informants who have a history of accurate labelling than from informants who have a history of inaccurate labelling. Their trust in such informants is also not limited to the specific instance in which the informants provide the labels. They continue to trust accurate labellers after a brief time delay, and generalise their trust in such labellers when learning about closely-related concepts, including the functions of objects as well as novel morphological forms. In addition, although children's selective trust emerges from the age of three, there are age-related changes between the ages of three and four, in that older children begin to privilege accuracy whereas younger children are more sensitive to inaccuracy. Attempts have been made to link this age-related change to children's developing ToM but the evidence so far has been mixed.

In the latter half of this chapter, it was argued that there are limitations to the typical selective trust paradigm. In particular, although existing studies have emphasised the contrast between accurate and inaccurate labellers, the inaccurate labels provided by informants have been problematic in that children might have difficulty interpreting an informant who has no clear reasons for providing blatantly incorrect labels. Further, the provision of inaccurate labels by informants who appear serious is not necessarily representative of what children encounter in real life. In order to present a more ecologically valid context for children to evaluate the trustworthiness of informants, it was argued that presenting an informant who provides new information (in the form of novel labels) would be a suitable approach. This empirical question is addressed in Chapter 5.

In the next chapter, I argue that another limitation of the existing selective trust research is that it has heavily focused on what children do with informants who provide information in the form of labels. However, in real life, children rely on other cues to determine the trustworthiness of informants, and they also receive other types of information, such as explanations. As a result, children might also evaluate the trustworthiness of informants who supply such explanations in order to learn from those who are more knowledgeable. That is to say, just as children differentiate between accurate and inaccurate labellers, they may also be sensitive to the differences between informants who provide explanations that differ in quality.

Chapter 3

Moving Beyond Accurate and Inaccurate Labelling

In Chapter 2, it was established that from about the age of three, children are discerning of informants who provide accurate labels for objects when compared to informants who provide inaccurate labels for objects. It was also established that children consider a previously accurate labeller to be a more trustworthy source of information when learning labels for unfamiliar objects. The wealth of studies that have utilised the selective trust paradigm show that it has been a valuable methodology in revealing the extent to which young children evaluate the trustworthiness of informants based on accuracy. However, although existing findings have been informative in establishing the scope and nature of children's selective trust, there are some limitations. One of these limitations, as argued in Chapter 2, is that the presence of the inaccurate labeller does not adequately reflect what children encounter in real life. Hence, to create a more true-to-life context for children, it was proposed that they could be introduced to an informant who provides *new* information in the form of novel labels, and it could be examined how children construe such an informant in comparison to informants who provide labels that are distinctly accurate or inaccurate. This question is examined in Chapter 5.

Another limitation to the existing studies of children's selective trust is that it has largely focused on examining how children evaluate informants who offer information in the form of labels. Of course, in real life, there are a range of other cues children can use to decide whether to trust an informant. Further, informants can provide other types of information about objects (e.g., descriptions, functions, explanations, properties, locations), that are likely to be accurate and relevant to the communicative exchange. Therefore, children will need to rely on cues other than accuracy to decide whether to trust informants who provide such information. In this chapter, I briefly outline evidence of children's ability to use other cues when determining the trustworthiness of informants. This is followed by a discussion of how children determine the trustworthiness of informants who provide information that differs in quality, with an emphasis on how children consider different types of explanations. In the latter half of this chapter, I argue that it is possible that children might trust informants who provide explanations about the functions of objects, who are arguably more competent than informants who provide obvious descriptions for objects.

Children's Use of Cues, Other than Accuracy, to Evaluate Informants' Trustworthiness

Much of the selective trust research has focused on presenting children with informants who differ in the accuracy of labelling. However, there is much evidence to show that children use other cues when evaluating the trustworthiness of informants. Such cues may pertain to *attributes* of the informant. For instance, it has been shown that children generally prefer testimony from attractive informants over unattractive informants (Bascandziev & Harris, 2013), from informants described as *kind* over informants described as *mean* (Lane, Wellman, & Gelman, 2013; Mascaro & Sperber, 2009), from familiar informants over unfamiliar informants (Corriveau & Harris, 2009b; Reyes-Jaquez & Echols, 2013), from native-accented informants over foreign-accented informants (Kinzler, Corriveau, & Harris, 2011) and, depending on the topic of interest, even from children over adults (Jaswal & Neely, 2006; VanderBorght & Jaswal, 2009). Further, children also consider the *manner* by which informants provide information. For example, children as young as two are sensitive to other people's non-verbal markers of uncertainty, such as puzzled facial expressions and shoulder shrugging, and they prefer to imitate the actions of a model who expresses more confidence (Birch, Akmal, & Frampton, 2010). Additionally, verbal markers can signal to a listener that the speaker is not confident in the accuracy of the information he or she provides. In studies which examine whether young children are receptive to the confidence of a speaker's labelling (Jaswal & Malone, 2007; Sabbagh & Baldwin, 2001), children from the age of three prefer, and show better memory for, labels offered by informants who express confidence (e.g., "This is a spoon", "This one's a blicket") than informants who express uncertainty (e.g., "I *think* this is a spoon", "*Maybe* this one's a blicket").

In addition to expressing uncertainty, informants can express their intentions through their reactions to particular outcomes. Liu, Vanderbilt, and Heyman (2013) examined children's sensitivity to the intentions and outcomes of informants' testimony. Five- and six-year-olds first watched an informant provide information about the location of a sticker to a confederate. The informant with positive intentions expressed joy when the confederate found the sticker, or expressed disappointment when the confederate failed to find the sticker. Conversely, the informant with negative intentions expressed disappointment when the confederate found the sticker, or expressed joy when the confederate failed to find the sticker. Children were sensitive to the intentions of the informant; when asked whether the informant wanted the confederate to find the sticker, children accurately stated that the informant with positive intentions wanted the confederate to find the sticker, and that the informant with negative intentions did not want the confederate to find the sticker. However, when children were asked to locate the sticker for themselves in response to the informant's testimony about its location, they weighed information about both intentions and outcomes, but they placed greater emphasis on outcome. That is, they were more likely to follow the directions of an informant who previously provided correct information to the confederate, regardless of whether the informant had positive or negative intentions. For children, such a strategy might be optimal given that the outcomes of an informant's testimony may be easier to discern than his or her underlying motives.

Overall, the research outlined above involves cues which can be thought of as social cues, in which judgements of trustworthiness are dependent on evaluating the attributes of the informant or the manner by which they convey information. Indeed, there have been many such studies that attempt to isolate the social cues that children attend to and use to make judgements. The studies presented in this thesis, however, will focus on how children evaluate the trustworthiness of informants based solely on the nature of their *claims*; in particular, their evaluation of different types of explanations. In other words, in this thesis, informant attributes and manner will be carefully controlled such that the only difference between informants is in the type of explanations they provide. In the next section, I outline evidence on children's production and receptivity to different types of explanations.

Children's Production and Evaluation of Different Types of Explanation

In moving away from examining whether children differentiate between informants who are accurate or inaccurate in labelling, the next step can be to examine what children do with informants who offer other types of information. In real life, children receive other types of information about objects (e.g., how they work, why they do certain things, what they look like, where they are found). In addition, just as inaccurate claims can differ in their magnitude of error (Einav & Robinson, 2010), accurate claims can differ in their *magnitude of accuracy*; specifically, in how much they demonstrate an informant's underlying knowledge or expertise. For example, Einav and Robinson (2011) showed that children from the age of four consider the reasons for the accuracy of informants. Specifically, children recognised that accurate information provided through the assistance of another person was not indicative of trustworthiness in the future, and that an informant who provided accurate information without assistance was likely to be more knowledgeable in future situations. Hence, while both informants, in all respects, provided accurate and relevant information, the unassisted informant had an advantage in terms of knowledge. In the following section, I review children's receptivity to other types of information, beginning with the possibility that the types of questions they ask others reveals what information they are seeking.

Children's questions. It has been argued that children use questions as a cognitive tool by which they can gather information when there is a *gap* in their knowledge (Mills, Legare, Bills, & Mejias, 2010). Hence, the types of question that children ask may indicate what kind of information they privilege. Of course, children ask questions which may not be for the purposes of information-seeking, such as to clarify (e.g., "what did you say?"), seek permission (e.g., "Can I do this?"), or seek attention (e.g., "Mum?"). In a comprehensive monograph, Chouinard (2007) examined the nature of children's spontaneous questions between the ages of two and five. In general, the majority of children's questions were fact-seeking or explanation-seeking, and the prevalence of the other aforementioned types of questions was lower. Fact-seeking questions, defined as a piece of information which had no causal component, were more prominent before the age of 2½ years, especially with respect to requests for labels (e.g., "what's that?"). On the other hand, the quantity of explanation-seeking questions (e.g., "why is ___?", "how come ___?", "how do you ___?") peaked shortly before the age of four. In addition, many of children's follow-up questions in an exchange tended to be explanation-seeking. That is, after establishing a fact, such as a label, children sought explanatory information in subsequent questions. The types of questions that were most frequent related to function (e.g., "what does it do?"), activities (e.g., "what is he doing?"), psychological states and motives (i.e., "do you want my milk?") and temporary states (i.e., "is it broken?"). Questions were less frequently asked about external properties, such as appearance (e.g., "what colour is it?"), property (e.g., "what is it made of?"), part (e.g., "is that the donkey's ear?"), count (e.g., "how many ___?"), possession, hierarchy and generalisation. One interpretation of these results is that the shift to explanation-seeking questions is indicative of children's recognition that adults are useful sources for increasing their understanding of the world, particularly in relation to causal relations they are unable to establish through observation alone. In keeping with this view (Harris, 2012), children's asking of questions is an important ability they use for gathering information they need to fill the gaps in their knowledge.

Experimental studies of children's questions complement the findings of Chouinard (2007) and demonstrate that children's questions become increasingly effective in obtaining information and solving problems (Mills, Danovitch, Grant, & Elashi, 2012; Mills, Legare, Grant, & Landrum, 2011). For instance, in a problem-solving task in which children had to direct questions to an expert in order to find out which key would open a locked box, Mills et al. (2010) showed that four- and five-year-olds, but not three-year-olds, more often directed questions to an appropriate expert than to an inappropriate expert. Further, the relative proportion of ineffective questions in comparison to effective questions changed with age. Ineffective questions were questions that were considered irrelevant to the task of identifying the correct key (e.g., “is your dad a fireman?”) or vague (e.g., “is it this one?”). In contrast, effective questions were questions that referred to specific dimensions of the correct key (e.g., “which shape/colour [key] is it?”, “is it [specific colour/shape]?”). Three-year-olds’ questions were largely ineffective, four-year-olds asked similar amounts of ineffective and effective questions, whereas five-year-olds asked more effective questions than ineffective questions. Finally, regardless of age, the children who asked a sufficient amount of effective questions were more often able to solve the problem, demonstrating that children can successfully utilise the answers they are supplied with. Hence, children use questions as a tool to solve problems and it appears that they are first able to discern who to direct a question to before they can generate an effective question.

The developmental shifts that occur in children’s production of effective questions can be interpreted as the result of their increased competence in determining what information is required to solve a problem or fill a gap in knowledge. However, since children at the age of five still ask ineffective questions, it suggests that their ability to generate effective questions is not fully established. Further, as shown in the study above, children are better able to grapple with *whom* to ask before they appreciate *what* they should ask. It is plausible that the difficulties children encounter when generating effective questions are because they are yet to explicitly understand that certain questions bring about certain types of responses. For example, in reference to the findings of Chouinard (2007) presented earlier, it might be premature to conclude that children use explanation-seeking questions (e.g., “how/why is ___?”) because they expect to get explanations in return. Of course, it is possible that the development of children’s questions is driven by increasing knowledge. However, such a notion is not incompatible with the possibility that the formulation of children’s questions is still not fully defined at younger ages.

In addition to studies of whom children direct questions to as well as what questions they ask, Kemler Nelson, Egan, and Holt (2004) investigated whether children’s questions differ depending on the type of object they are asking about. The findings of Kemler Nelson, et al. also support the notion that children are not explicitly aware of the correspondence between specific types of questions and specific types of answers. In their study, two-, three-, and four-year-olds were presented with a series of unfamiliar artifacts, and it was found that they initially asked an experimenter a general question (e.g., "what's this?"). When the experimenter responded by providing a label for the artifact, children were more likely to ask a follow-up question. In contrast, when the experimenter responded by demonstrating how the artifact could be used (i.e., its function), children were less likely to ask a follow-up question. However, when the experimenter continually provided labels in response to children's general questions, three- and four-year-olds began asking more specific questions about artifact function (e.g., "what does this do?"). That is to say, children were more interested in knowing about the functions of the artifacts, rather than simply the names of them. Hence, it appears that preschoolers' largely construe artifacts in terms of their intended functions. In contrast, when presented with familiar or unfamiliar animals, children's specific questions were more often about biologically-relevant properties, such as food choices, reproduction, habitat, and category membership (Chouinard, 2007; Greif, Kemler Nelson, Keil, & Gutierrez, 2006). Such findings imply that children have different notions about the type of information they should seek when learning about objects from different domains, despite the fact that they have difficulty in explicitly stating how artifacts and living things differ in terms of their underlying explanatory structure.

The evidence presented above shows that children more often ask questions that elicit explanatory information (e.g., how objects work), and that they cease asking questions once they receive such information, although it is unclear whether they are fully aware that explanation-seeking questions elicit explanatory information. Nevertheless, it has been shown that it is not sufficient to simply supply any type of information in response to their questions. Frazier, Gelman, and Wellman (2009) examined preschoolers' causal questions (i.e., comprising *how* or *why* questions) and their reactions to an adult's answer in both a naturalistic and an experimental context. In both contexts, if children asked a question (e.g., "Why does this [hat] have a hole in it?") and received an explanatory answer (e.g., "It's to put a ponytail through"), children generally agreed with the answer and asked a relevant follow-up question. However, if they received a non-explanatory answer (e.g., "Hats don't usually have holes in them"), children more often asked the original question again or generated their own explanations. In other words, children's reactions depended on the availability (or lack) of explanatory information.

Summarising across this work on children's questions, it is clear that children do not simply seek to prolong a conversation by repeatedly asking questions; they appear to use causal questions as a means to gather explanatory information and they are satisfied once they obtain explanations. In the next section, I review evidence that children are discerning of different *types* of explanations.

Sensitivity to different types of explanations. In real life, children are exposed to a wealth of information provided by well-intentioned interlocutors. Indeed, at a young age, it is perhaps an optimal strategy to remain receptive to informants who provide information which appears earnest and relevant. However, with age, it is likely that they come to realise that certain types of information signal an informant's underlying knowledge or expertise and, hence, in future instances, it would be beneficial to seek information from informants who appear more knowledgeable. In keeping with this interpretation, the studies reviewed above show that children prefer asking explanation-seeking questions (i.e., answers to "how" and "why" questions) after they acquire answers to fact-seeking questions (i.e., answers to "what" and "where" questions), which might suggest that children eventually come to privilege explanations which refer to causal relations between objects or events. According to Keil and Wilson (2000), explanations can be used as a means of placing phenomena within a coherent causal framework in order to better understand the world. However, it remains to be seen how children's ability to seek and privilege certain types of explanations emerges during development.

It is possible that children's ability to discern different types of explanations is present from an early age, and that they are able to distinguish such explanations in the same way they are able to differentiate between accurate and inaccurate claims. Alternatively, children's abilities to evaluate certain kinds of explanations might only come about through formal instruction; such evaluations may turn, to some degree at least, on socio-cultural educational practices. Such a possibility would be in accordance with the findings of Luria (1976), presented in Chapter 1, in which cultural influences impact the development of particular modes of thought in a society. Luria showed that, with formal education, previously illiterate farmers were able to demonstrate logical reasoning with premises beyond their personal experience, whereas illiterate farmers who did not receive formal education were less able to do so. Hence, it may be the case that it is only through formal education that children learn to privilege specific types of explanations over others.

Along similar lines, Brewer, Chinn, and Samarapungavan (1998) argued that, like scientists and laypersons, children use a range of criteria to evaluate the quality of everyday or scientific explanations. However, unlike scientists, there are certain criteria that children do not readily use to evaluate explanations. Samarapungavan (1992) showed that children from the age of seven privileged scientific explanations that had empirical support over explanations that lacked empirical support. Further, children demonstrated some evidence of evaluating scientific explanations for logical consistency, so long as the explanations did not strongly violate their existing beliefs. Hence, it appears that children's production and evaluation of explanations is not markedly dissimilar to that of adult non-scientists'. However, it is only through formal classroom instruction that children are taught how to evaluate scientific explanations using other criteria, criteria that have arisen with the establishment of science as a modern discipline (Brewer et al., 1998). Such criteria include determining whether a scientific explanation generates precise and testable predictions, whether it can be expressed in formal or mathematical terms, and whether it paves the way for further research to be conducted. Thus, it seems plausible that children will demonstrate some early capacities to distinguish between informants based on the quality of the explanations they provide, but with formal education, they may begin to focus on additional aspects that make certain explanations better than others. Below, I outline several studies that have examined young children's sensitivity to different types of explanations; such sensitivities are likely to be present prior to schooling.

One such cue that children can use to determine the trustworthiness of an informant's claims is to consider how the informant explains how he or she came to know about something. In a study by Koenig (2012), three-, four-, and five-year-olds reliably distinguished between *good* and *bad* reasons for knowing something (i.e., what was inside a box), and preferred learning from an informant who provided good reasons. Good reasons included justifications that the informant knew what was inside the box because they had heard it from a teacher, had previously looked inside the box, or inferred that there were cookies inside the box because it was a cookie jar. Bad reasons included justifications that the informant had a desire for a particular object to be inside, was pretending that a particular object was inside, or was guessing that a particular object was inside. Hence, children consider the quality of the explanations for how informants are knowledgeable.

Explanations can also be evaluated in terms of whether they provide a sufficient amount of information. In a study by Gillis and Nilsen (2013), four- to five-year-olds (preschoolers) and six- to seven-year-olds (school-aged children) were introduced to informants who provided *sufficient*, *insufficient* or *inaccurate* information. The sufficient informant provided appropriate information to assist children in locating a target object (e.g., in an array of red stickers of different shapes, this informant said, "it's under the triangle one"). The insufficient informant provided information which was accurate, but was inadequate for locating the target (e.g., in an array of red stickers of different shapes, this informant said, “it’s under the red one”). Finally, the inaccurate informant provided incorrect information for the target’s location (e.g., “it’s under the circle one” when the target was not). In some instances, children were given feedback and were allowed to observe the outcome of their choices; when they selected a location in response to the informant’s testimony, it was revealed whether the target was in the chosen location. In other instances, children were not given feedback, so they could not observe the outcome of their choices. Unsurprisingly, children preferred the directions of the sufficient informant over the inaccurate informant. However, while both preschools and school-aged children preferred the directions of the sufficient informant over the insufficient informant, younger children had greater difficulty differentiating between the informants when they were not given feedback (i.e., when they were not able to see whether the target was in the location they selected). To sum, it appears that children have a developing ability to evaluate claims in terms of whether they provide a sufficient amount of information.

Children from about the age of three also consider the quality of explanations based on whether they refer to some causal element. Even children as young as four years of age show a preference for statements that simply feature the causal connective, “because”. In a study by Bernard, Mercier, & Clemént (2012), three-, four-, and five-year-olds were introduced to two speakers who gave contradicting statements about the location of an object, but gave similar reasons for their beliefs. One speaker used the connective, “because”, in her statement (e.g., “the ball is in the blue box *because* Camille always puts her ball in the blue box”), whereas the other speaker did not use the connective (e.g., “the ball is in the green box, Camille always puts her ball in the green box”). Findings showed that four- and five-year-olds, but not three-year-olds, systematically preferred the statements of the speaker who had used the connective, “because”. Such results suggest that young children do not initially privilege causal explanations when it is indicated using the connective, “because”, and that it is not until later that children become attuned to the use of “because” in arguments and interpret the word to imply some causal relation.

Other studies have featured more elaborate explanations in the form of circular and non-circular arguments and have revealed children’s ability to evaluate arguments to develop from about four years and onwards (see Mercier, Bernard, & Clément, in press). In one such study, Baum, Danovitch, and Keil (2008) investigated children’s sensitivity to explanations which differ in *circularity*. Five- to ten-year-olds were required to select which of three informants was the “smartest”, according to distinct explanations they provided about a phenomenon (e.g., why polar bears have white fur). One informant provided a short circular explanation, which was very brief and failed to provide new information (e.g., “They have white fur because their fur is always white”). Another informant provided a long circular explanation, which contained more words, but also failed to provide new information (e.g., “They have white fur because the colour in their fur is white, not black or another colour. All polar bears are white; you will not see one that is a different colour”). The final informant, however, provided a noncircular explanation that contained an actual causal explanation (e.g., “They have white fur because they live in snowy places. Since the snow is white, it’s hard for the bear’s enemies to find it and hurt it. So, the white bears live longer, and they make more white bears”). Results showed that by about five or six years of age, children demonstrate a preference, albeit fragile, for non-circular explanations.

Using a simpler procedure, Kurkul and Corriveau (2014) presented only two opposing informants to three- and five-year-olds in a selective trust paradigm. One informant provided circular explanations (e.g., when asked why it rains, this informant said, “sometimes it rains because it is wet and cloudy outside, and water falls from the sky. When water falls from the sky it is called rain and it gets us all wet”), whereas the other informant provided non-circular explanations (e.g., “sometimes it rains because there are clouds in the sky that are filled with water. When there is too much water in the clouds it falls to the ground and gets us all wet”). Results revealed that, when the informant provided novel explanations for unfamiliar objects in test trials, both three- and five-year-olds endorsed the novel explanations provided by the informant who had provided noncircular explanations. However, five-year-olds were more advanced in that they generalised their trust in the informant who had provided noncircular explanations to the learning of novel labels for unfamiliar objects, and they systematically judged this informant as “very good” and “better” at explaining about the objects. In contrast, three-year-olds did not generalise their trust in the informant who had provided noncircular explanations during the novel label test trials, and they did not systematically favour her in the explicit judgement questions. These results were still evident even after the explanations in the training trials were simplified, suggesting that three-year-olds’ lack of systematic performance in the novel label trials was not due to cognitive demands. In other words, it is only at about the age of five that children consider informants who provide noncircular explanations to be more knowledgeable, and that they are likely to be a good source of explanations as well as labels.

So far, the evidence presented above indicates that four- to five-year-olds are beginning to discern different types of explanations, and they prefer explanations which contain causal elements over explanations which do not. In addition to their preference for causal explanations, children also prefer certain *types* of causal explanations. For example, Kelemen (2003) demonstrated that children have a bias for teleological-functional explanations, in which they assume that the existence of an object or event is for a specific purpose; that an object or events exists *because it is designed to do X*. Kelemen proposed the notion of *promiscuous* teleology to explain the origin of such biases, whereby children have tendencies to attribute teleological properties to objects, both living and non-living, and such tendencies originate from their early intentional reasoning and their understanding of goal-directed and object-centred behaviour. Kelemen argued that, with age, as well as exposure to formal scientific and causal explanations, children come to be more selective in what they apply the teleological stance to. In other words, young children have a default bias to view objects in terms of their purpose.

Evidence for children's teleological reasoning is presented by Kelemen (1999a), who showed four- to five-year-olds, and adults, various objects; such as whole living things (e.g., tiger), artifacts (e.g., clock), natural objects (e.g., mountain), as well as parts of living things (e.g., hand), artifacts (e.g., pocket) and natural objects (e.g., cloud trail). In response to being asked what each object was "for", preschoolers assigned functions to all types of objects, whereas adults were more selective in which objects they ascribed functions to (i.e., whole artifacts, parts of artifacts, and parts of living things). Further, while four- to five-year-olds have been shown to produce teleological explanations and demonstrate a preference for explanations which invoke the notion of purposeful design over explanations which simply refer to how an object can be used, Kelemen (1999b) showed that children, before the age of ten, prefer specific forms of teleological explanations over physical-reductionistic explanations when talking about biological or behavioural properties of animals as well as properties of nonliving natural kinds (e.g., rocks). For example, when presented with a phenomena (e.g., why rocks were so pointy), seven- to eight-year-olds endorsed a teleological explanation (e.g., "so that animals wouldn't sit on them and smash them") over a more scientifically-appropriate physical explanation (e.g., "because little bits of stuff piled up on top of one another over a long time"). Hence, it appears that, from a young age, children are biased to view objects and events, both living and nonliving, in teleological terms. It is only from about the age of ten, and perhaps with exposure to formal scientific education, that children's conceptions begin to resemble those of adults.

Given children's emerging ability to distinguish between informants' explanations on a number of dimensions, and their preference for causal (in particular, teleological-functional) explanations, children might show a similar preference for explanations which are about the functions of objects over other types of explanations which do not contain causal elements. Existing studies provide evidence of children's early capacities in distinguishing between informants on other attributes, such as confidence, honesty, and even the circularity of explanations. However, in keeping with the arguments raised in Chapter 2, where it was argued that inaccurate labels are not necessarily representative of what children encounter in real life, (sententially) circular arguments are also not commonplace. Instead, what children are more likely to encounter are informants who provide non-causal descriptions for objects that refer to the clearly visible properties. Along these lines, in the section below, I outline evidence that children are sensitive to the differences between informants who provide information about either non-visible or clearly visible properties. I also argue that, with increasing age, children may also show a similar sensitivity to the difference between explanations which refer to non-visible functional elements and explanations which only refer to visible and obvious (*surface*) elements. Given that children are readily discerning of informants who differ in accuracy and are distrusting of inaccurate labellers from the age of three, it remains to be seen whether children are similarly discerning when evaluating explanations that differ in depth (i.e., whether such explanations provide functional or surface information), and whether they recognise that certain explanations reveal something about an informants' knowledge or lack thereof.

Children's differentiation of visible and non-visible properties. As argued earlier, it is possible that formal education might influence the readiness by which children decide that informants who provide causal explanations are preferable when compared to informants who provide non-causal explanations. Indeed, scientific education largely focuses on establishing causal relations within a coherent framework (e.g., how things work, underlying processes or mechanisms, scientific principles). For children, science education begins in the fifth or sixth grade, when they are about ten years old. As a result, it is possible that it is only by the age of ten that children readily privilege causal explanations over others. At this age, they may recognise that informants who provide causal (or functional explanations) for objects are more competent than informants who merely describe, for instance, the outward appearance of objects. For adults, the intuition that functional explanations are superior is perhaps easier to grasp given that most are likely to have undergone formal schooling, obtained qualifications, or taken on careers that privilege causal knowledge. As adults, we may conceive of a person who talks about what an object is used for and how it works as being more informative and knowledgeable than a person who merely describes the outward appearance of the object.

However, against such notions (i.e., that children can only evaluate explanations once they have undergone a significant amount of schooling), it has been established above that children are able to generate, seek, and prefer explanations that consist of causal information (Kelemen, 1999b). In most instances, children are not necessarily able to acquire the causal information solely via observation or experience. Hence, they have to rely on others to provide such information and, as a result, they might consider functional explanations to be indicative of an informant's deep level of understanding. Further, as argued by Brewer et al. (1998), children as young as seven are able to evaluate everyday and scientific explanations on the basis of certain criteria (e.g., empirical and logical consistency), even though they probably have not received formal instruction as yet. In the existing literature, however, the question of whether children willingly differentiate between informants who provide functional or surface explanations has not been investigated. Further, there is little research that has examined when children begin to possess adult-like intuitions that functional explanations are more informative than surface explanations. The studies presented below attempt to draw some distinction between different levels of explanation; particularly in relation to whether the information is about internal or external features of objects.

Research by Fitneva, Lam and Dunfield (2013) demonstrated that children develop an understanding of how certain ways of gathering information are more effective for visible properties compared to non-visible properties. In their study, four- and six-year-olds were shown a series of novel creatures, referred to as "moozles", and had to decide whether to ask a moozle expert for help or have a look for themselves when finding out particular characteristics of the moozle. Some of the characteristics were visible (e.g., "what colour is the moozle's hair?") and could be easily identified if children looked for themselves, whereas other characteristics were non-visible (e.g., "do moozles like pizza?") and could only be determined if children asked the expert for help. While most children preferred to look at the moozle when finding out visible properties, four-year-olds were more likely to have a look for themselves, even for non-visible properties. In contrast, six-year-olds more often appropriately chose to ask the expert when learning about non-visible properties. Hence, older children were more capable of judging the optimal method by which to determine visible and non-visible properties. Such results indicate that older children recognise that other people are good sources of information about things they cannot easily experience or observe by themselves. In light of the research questions raised in this chapter, it is possible that children might consider informants who can provide information about non-visible properties, consisting of functional information, to be more knowledgeable and competent than informants who provide information about visible properties that children can easily determine by themselves.

Given that children distinguish between ways to acquire knowledge of visible or non-visible properties, Sobel and Corriveau (2010) investigated whether children were more likely to prefer learning information from informants who were knowledgeable about non-visible properties. Three- and four-year-olds were asked to decide which informant they would prefer to learn object labels from. The two informants differed in how knowledgeable they were about objects' "insides". One informant was a "green expert", who knew all about objects which had green insides, and the other informant was a "red expert", who knew all about objects which had red insides. Results showed that four-year-olds, but not three-year-olds, sought and endorsed the green expert when learning labels for objects which had green insides and, conversely, they relied on the red expert when learning labels for objects which had red insides. Interestingly, when the green expert was said to know all about objects which had green *outsides* (as indicated by a green sticker) and the red expert was said to know all about objects which had red *outsides* (as indicated by a red sticker), four-year-olds were less systematic in preferring one expert over the other. Such findings suggest that children from the age of four are sensitive to informants' knowledge of object properties in a specific manner; they prefer to learn labels from informants who are knowledgeable of objects' internal characteristics rather than external characteristics. Therefore, in reference to the arguments outlined in this chapter, children might consider informants who know about non-visible properties (i.e., by providing functional explanations) to be better sources of information when compared to informants who know about immediately visible properties (i.e., by providing descriptions of surface properties).

In extending the research beyond differentiating between informants who are knowledgeable about visible or non-visible properties of objects, Kushnir, Vredenburgh, and Schneider (2013) presented three- and four-year-olds with informants who differed in their causal knowledge. Specifically, one informant (the labeller) only knew labels for tools but not how to use them to fix a toy, whereas the other informant (the fixer) only knew how to use the tools to fix a toy but not the labels for them. Four-year-olds (and to a lesser extent, three-year-olds) appropriately asked the fixer for help with fixing broken toys and the labeller for help with learning labels for novel objects. In addition, four-year-olds did not overgeneralise their preference for the fixer when learning about conventional *functions* of novel objects, indicating the degree of specificity with which they attribute knowledge to informants. In other words, children did not consider a person who can fix toys would also know about how novel objects could be used. In addition, when four-year-olds were introduced to two other informants – a fixer, who was able to successfully fix a broken toy, and a non-fixer, who was unable to fix a broken toy – children preferred to ask the fixer to fix broken toys but, again, they did not generalise their preference for the fixer when learning about labels for novel objects. That is to say, it seems that children's inferences about informants' knowledge are domain-specific and differ between word labels and causal knowledge for objects. However, when the two informants offered different causal explanations as to why the toy was not working (e.g., "the motor has stopped moving" or "it is out of batteries"), children were more likely to endorse the causal explanations offered by the fixer. To summarise, children from the age of about four are sensitive to differences in informants' causal knowledge and they favour informants who have greater causal knowledge when learning other causal information.

Summary

This chapter has outlined evidence that children are receptive to cues about informant trustworthiness that are not limited to the accuracy or inaccuracy of labelling, such as the attributes of informants as well as the manner by which informants make claims. In addition, in solely focusing on how children evaluate the nature of claims made by informants, it can be seen that children are discerning of certain types of claims. Indeed, in real life, children receive information about objects that extends beyond labels, such as how and why objects work, as well as descriptions of what objects look like. The focus of this chapter was on how children make sense of different types of claims, with an emphasis on their receptivity to explanations.

Based on the findings of independent research into the nature of children's questions, children begin to ask explanation-seeking questions, which contain causal elements, at about the age of four. Various researchers have proposed that children use questions as a cognitive tool that allows them to fill a gap in their knowledge. Indeed, it is likely the case that the increasing sophistication of children's questions is due to their developing knowledge. However, as argued above, it may be premature to assume that children's question asking behaviour implies a wish for causal explanation per se. Therefore, children's use of questions may represent only a fragile understanding of the usefulness of questions in filling the gaps in their knowledge, and it is possible that children do not initially assume that explanation-seeking questions beget explanatory information, counter-intuitive though that may seem. Nevertheless, it does appear that children appear satisfied once they receive explanatory information.

Research that examines children's ability to distinguish different types of explanations was outlined, with a focus on their receptivity to causal explanations. In a discussion of whether children are able to make such discernments in the same way that they can evaluate informants' claims for accuracy from a young age, evidence suggests that children's preference for specific types of explanations (e.g., scientific, physical-reductionist) likely only comes about with scientific education which largely emphasises causal explanations. However, it is possible that children might privilege causal explanations when compared to explanations that are less informative (e.g., those that do not contain causal elements). In keeping with what children are likely to hear in real life, it was proposed that children might consider an informant who can provide causal information, in the form of functional explanations, to be more trustworthy than an informant who only describes obvious (surface) characteristics of objects that are highly visible. Indeed, the evidence shows that children recognise the differences between informants who are knowledgeable about non-visible features of objects as compared to informants who are knowledgeable about externally visible features of objects. However, no studies have directly tested whether children differentially trust informants who differ in the depth of their explanations, and whether they consider informants who provide functional explanations to be more trustworthy than informants who provide surface explanations. Therefore, the studies described in Chapter 7, 8, and 9 present informants who both provide accurate and relevant information. However, the question of interest is whether children consider an informant who provides explanations for the *functions* of objects to be more competent and trustworthy than an informant who merely provides descriptions of *obvious (surface) characteristics* of objects. This research question is interesting because it suggests that children might have an early-emerging capacity to evaluate the depth of explanations, as well as a tendency to prefer functional explanations at an age where they are yet to be explicitly taught the value of causal explanations.

In the next chapter, I propose that the biological domain is useful for examining the research questions presented in this thesis. In particular, given that children’s knowledge of the body increased from about the age of four, they are likely to be receptive to informants who provide information about the body. Such information will pertain to new labels for parts of the body when compared to distinctly accurate or inaccurate labels (Chapter 6), as well as functional explanations for parts of the body when compared to surface explanations for parts of the body (Chapters 7 to 9).

Chapter 4
The Biological Domain and the Current Approach

As outlined in the preceding chapters, the studies presented in this thesis investigate how children interpret informants who provide new information about objects, as well as whether they are sensitive to informants who differ in explanatory adequacy. In this chapter, I argue that the biological domain of the human body is well suited to introduce children to informants who provide novel labels or different types of explanations because it is one in which much of children's knowledge, despite their first hand experience, is derived via testimony. Up to this point, existing studies of children's selective trust typically present informants who provide information about artifacts, and few studies have presented informants who provide information about objects from other domains. Objects from the human body, particularly organs and internal processes, are distinct in that they are typically unobservable, even though children have indirect experience of their processes (e.g., feeling the heart beat, the sensation of breathing). Hence, children must heavily rely on testimony to learn about them. Indeed, in science education, emphasis is placed on the processes of different parts of the body and their necessity in maintaining life and well-being. While there is no reason to expect that children's selective trust in the biological domain will differ markedly from their selective trust in the domain of artifacts, the complexity of objects from the human body, and the relevance of body knowledge for growing children, presents a suitable domain in which to examine children's trust in situations that extend beyond accurate and inaccurate labelling. In the next section, I present evidence that children's knowledge of the body rapidly develops from about the age of four. Further, several studies described below are indicative of children's sensitivity to causal explanations for parts of the human body. I end by summarising the approach and the content of the ensuing empirical chapters.

Children's Understanding of the Biological Domain Burgeons at Fours Years of Age

Children's knowledge of the biological domain undergoes extensive conceptual change from about the age of four onwards. Keil (1992) outlined that, between the ages of three and ten, children become increasingly aware of many biological notions, such as recognising that biological objects have particular internal properties which are essential for their functioning and are likely to be heritable, and that biological objects have specific pathways or patterns of growth which differ from that of artifacts. Keil argued that the development of children's biological understanding likely stems from an early bias to perceive biological objects differently from other objects (but cf. Kelemen, 1999b). In other words, from an early age, children recognise the biological domain as distinct and different from other domains. Indeed, Erickson, Keil, and Lockhart (2010) showed that five-year-olds appropriately paired biological statements with other biological statements and treated such statements as distinct from psychological statements. Further, children appropriately attributed biological mechanisms when questioned about the cause of specific biological changes (e.g., that ingesting a pill or undergoing an operation can bring about a biological change), and they appropriately attributed psychological mechanisms when questioned about the cause of specific psychological changes (e.g., that taking a class or undergoing training can bring about a psychological change). Such a finding suggests that children have a sense that there is a fundamental distinction between the causal mechanisms in these respective domains, and that the underlying processes within a domain are fundamentally similar.

In outlining the nature of children's naive biology, Inagaki and Hatano (2002; 2006) termed children's underlying causal explanatory framework as a *vitalistic* causality, an intermediary framework used to reliably explain and predict biological phenomena from about the age of four. Within this framework, bodily processes are attributed to the functions of a *vital power* (i.e., some unspecified substance or energy) which maintains and enhances life. Specifically, children believe that vital power is taken in from outside sources, such as food and water, and utilised by the body's organs in order to sustain life and enable the organism to grow. Conceptually, the notion of vitalistic causality is situated between an intentional causality framework (i.e., that a person's intentions cause a phenomenon) and a mechanical causality framework (i.e., that physiological mechanisms cause a phenomenon). When explaining bodily functions, rather than attribute intentions to the person who possesses the organ, children use the notion of vitalistic causality when they are not knowledgeable about the underlying physiological mechanisms. Children attribute some form of agency to the bodily organ and believe that there is a transfer of vital power which allows the function to occur, as discussed in the findings below.

To investigate whether children demonstrate preferences for such vitalistic explanations, Inagaki and Hatano (2002) first obtained open-ended explanations from six-year-olds on different biological phenomena (e.g., "why do we eat food every day?") and then asked them to endorse one of three types of causal explanations: intentional (e.g., "because we want to eat tasty food"), vitalistic (e.g., "because our tummy takes in vital power from the food"), or mechanical (e.g., "because we take the food into our body after its form is changed in the stomach and bowels"). Left to their own devices, six-year-olds failed to generate vitalistic explanations, instead providing non-biological explanations (e.g., "because we eat food every day to grow bigger") or claimed that they did not know the answer. However, when presented with the three alternative explanations, children favoured the vitalistic explanation over the mechanical and intentional explanations. Using a similar methodology, but in a sample of Australian children, Morris, Taplin, and Gelman (2000) investigated children's preferences for vitalistic explanations and distinguished between the notion of organ agency and energy transfer. Results showed that five-year-olds largely favoured vitalistic explanations. For example, when asked, "Why do we breathe and take in air?" children preferred a vitalistic explanation, "Because our chest takes in energy from the air we breathe", over a physiological explanation, "Because our lungs take in oxygen and change it into carbon dioxide that we have no use for" or an intentional explanation, "Because we want to make ourselves feel fresh again". In addition, while children generally favoured vitalistic explanations involving organ agency or energy transfer, they showed a stronger preference for explanations about energy transfer. Such a finding suggests that the transfer of energy or life force is emphasised in children's understanding of biology. Overall, vitalistic causality functions as a transitional phase of children's naive biology prior to their knowledge of precise mechanistic explanations.

Inagaki and Hatano (2004; 2006) also argued that, in addition to vitalistic causality, children use teleological causality when understanding biological phenomena. Teleological causality, as mentioned in Chapter 3, refers to the idea that an entity exists or is designed for a purpose. Indeed, Keil (1992) showed that five- and seven-year-olds preferred teleological explanations (e.g., [plants are green] "because it is better for plants to be green and it helps there be more plants") over reductionist explanations (e.g., [plants are green] "because there are little tiny parts in plants that when mixed together give them a green color"). However, when presented with the same explanations for a nonliving natural object, such as why an emerald is green, children preferred reductionist explanations over teleological explanations. While Keil proposed that teleological reasoning is the first explanatory principle children grasp in the biological domain and approximates that of adults' reasoning, Kelemen (1999a) asserted that children apply teleological reasoning in other domains, such as when understanding artifacts or other people's behaviour. Hence, Jaakkola and Slaughter (2002) argued that, in order to be a genuinely biological explanatory principle, the form of teleological reasoning should be specific to biological goals; it should not be possible for the purposes and functions ascribed to biological objects be applied to non-biological objects.

As suggested by Inagaki and Hatano (2002), children come to rely on the notion of *life teleology*, by which the purpose of bodily organs is to maintain life, and that the maintenance of life is likely carried out by the transfer of energy or vital power; overall, referred to as a *teleo-vitalistic framework*. Similarly, Jaakkola and Slaughter (2002) proposed that the maintenance of life is one potential biological goal, at least in the context of children's reasoning about bodily functions. Their investigation of children's knowledge of the body showed that children's knowledge of bodily functions and the locations of particular body parts increased between the ages of four and eight. Further, between the ages of four and six, children increasingly made more appeals to life, by referring to the goal of maintaining life or avoiding death when asked what particular body parts (X) were "for" or "what would happen if someone did not have an X?". Children who made appeals to life were categorised as *life theorists*, and children who did not make appeals to life were categorised as *non-life theorists*. Interestingly, findings showed life theorists were more knowledgeable of bodily functions than non-life theorists, but the groups did not differ in their knowledge of the locations of the body parts. Jaakkola and Slaughter concluded that such a finding indicates that there is a dramatic shift in their understanding of the body when children understand life as a biological goal. That is, their recognition that the goal of bodily functions is to maintain life represents their use of biological (or life) teleology as a causal explanatory principle or framework.

If it is the case that children's acquisition of a biological teleology framework aids in their understanding of the body, Slaughter and Lyons (2003) further argued that it could be possible to improve children's knowledge of the body by emphasising the necessity of the bodily organs for sustaining life. In their study, three- to five-year-olds were assessed for their knowledge of bodily organs as well as their understanding of death. Children were then categorised as either life theorists or non-life theorists, according to their responses in the body parts interview. As also found in Jaakkola and Slaughter (2002), life theorists had more knowledge of organ functions than non-life theorists. Children who subsequently participated in a training procedure, designed to teach them about vital body parts and processes and the essential role of organs in maintaining life, showed significant improvements in their understanding of biological matters. Children who were previously categorised as non-life theorists could be categorised as life theorists after undergoing training. In fact, life-theorists and non-life theorists performed equally well on the body parts interview after receiving training, and their knowledge of death also improved. Slaughter and Lyons concluded that, at least when reasoning about the body and death, children use a biological teleology framework in which the organs are recognised as being crucial for life. In addition, children's acquisition of this explanatory framework likely prompts a reorganisation of their biological understanding so that they become better positioned to learn and recall new information about biological concepts, including life and death.

Summary

The research reviewed in this chapter shows that children's understanding of the body rapidly increases from about the age of four, and suggests that they are highly receptive to information about the body. At the age of four, they begin to grasp the notion that biological objects are different from other types of objects. Further, as they get older, children start to consider the causal mechanisms that are responsible for biological processes and for the maintenance of life, which are unique to the biological domain. Based on the findings presented above, it was expected that the biological domain would be a fertile one in which to further investigate how children evaluate the trustworthiness of informants. First, there exist many labels for parts of the body that are not learnt by children until well into formal education, and such information may even pertain to objects of which children already have some knowledge (e.g., learning that *epidermis* also refers to the skin) or to parts of such objects (e.g., *nostril*, *pupil*). Hence, the study presented in Chapter 6 consists of an informant who provides novel labels for familiar body parts, and is compared to informants who provide clearly accurate or inaccurate labels for those body parts. Second, in contrast to artifacts, the complexity of body parts and their processes allows for elaborate explanations of function and appearance to be provided. Indeed, as discussed above, children appear capable of evaluating different types of causal explanations about the body. Therefore, in line with the arguments presented in the prior chapter, the studies presented in Chapter 7, 8, and 9, examine children's construal of informants who differ in the types of explanations they provide for parts of the body; specifically, on the basis of whether informants provide explanations for the *functions* of body parts or descriptions of *obvious characteristics* of body parts.

Chapter 5
Study 1

As discussed in Chapter 4, previous studies of children's selective trust (e.g., Corriveau et al., 2009; Koenig & Harris, 2005) have mainly focused on presenting informants who provide testimony for observable common objects (i.e., artifacts), such as a cup or book, for which there is generally an unambiguous label and little scope for informants to demonstrate profound knowledge of the objects. By contrast, the area of biological knowledge is a domain in which a person can show how competent he or she is at talking about various body parts and organs, and it also offers many novel labels which children do not learn about until formal schooling. Given that children's knowledge of the human body rapidly expands from the age of four (Inagaki & Hatano, 2006; Jaakkola & Slaughter, 2002), I proposed that biological knowledge would be a suitable domain in which to examine children's selective trust. In the studies outlined in this thesis, I presented children with informants who provided information, in the form of labels and/or explanations for various body parts and organs. The domain of biological concepts also allowed for the inclusion of plausible labels which are novel to children. The study presented in this chapter was a preliminary investigation of children's biological knowledge to determine which body parts and organs they are most and least familiar with. In addition to identifying common themes in children's explanations for parts of the body, this study also helped to establish the well-recognised body parts/organs to feature in the familiarisation trials, and the unfamiliar body parts/organs to feature in the test trials for the subsequent studies in this thesis which use the selective trust paradigm.

Methods

Participants

27 children (15 girls), living in the Sydney metropolitan area, participated in this study: 14 four-year-olds (M = 53.64, SD = 3.15, range: 48-57) and 13 five-year-olds (M = 62.00, SD = 1.35, range: 60-64). Most children were Caucasian, although a range of ethnicities was represented. All children spoke fluent English. Children were recruited through invitations to parents of children attending local daycare centres. Children were tested individually by a single experimenter in a designated quiet room or space within the centre.

Materials

Participants were asked a series of questions about 18 body parts and organs. A girl/boy puppet (same as the child's gender), controlled by the experimenter, was used to present the questions. The body parts/organs were shown in a random order, alternating between *easy* external body parts (e.g. eye, foot) and *difficult* internal organs (e.g. lungs, pancreas), to maintain children's attention and limit frustration. The body parts/organs were stylised pictorial representations printed on A4-sized paper and are listed in the left-hand column of Table 5.1. An example of one of the organs presented to children is shown in Figure 5.1. Pictures of other organs used in this study, as well as in the subsequent studies presented in this thesis, are presented in Appendix C.

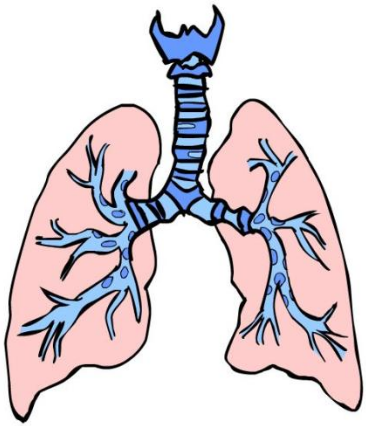

Figure 5.1. Lungs.

Design and Procedure

The procedure was adapted from a study on children's body knowledge by Jaakkola and Slaughter (2002). The testing session lasted for approximately 10-15 minutes.

The first part of the procedure involved the introduction of the puppet and a warm-up task. Participants sat with the experimenter at a table and the experimenter introduced the puppet by saying, "Do you know who this is? This is my friend, Johnny/Jenny. Johnny/Jenny is a bit little (i.e., young). He's/she's only three years old and doesn't know much about the body. How old are you? You're a little bit bigger, aren't you? In this game, maybe you can help Johnny/Jenny learn about the body?" The puppet then spoke to the children, "Hi [child's name], can you help me please?"

In the warm-up task, to familiarise children with the format of the questions in the task, the experimenter presented a picture of a woman's head with long wavy hair (Figure 5.2) to the children and puppet. The puppet examined the picture and looked expectantly at the children. The experimenter pointed to the woman's hair and said, "Can you tell Johnny/Jenny what this is called?" After the children's response (all of the children said "hair"), the experimenter asked, "Can you show Johnny/Jenny where else you can find hair?" Once the children successfully pointed to their own hair or the puppet's hair, the experimenter said, "Can you tell Johnny/Jenny what you use your hair for?" and, if necessary, "Can you tell Johnny/Jenny anything else about hair?" The puppet nodded after all responses made by children. Following this warm-up task, the test trials began.

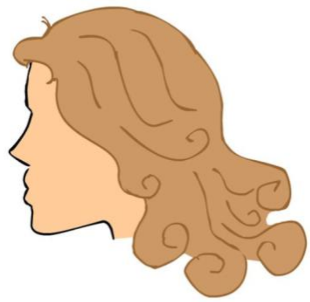

Figure 5.2. Warm-up stimulus: Hair.

The experimenter brought out the test pictures, which were facedown in one pile so children could not see them. The pile was prearranged such that the pictures of body parts/organs alternated between *easy* and *difficult* body parts/organs. The experimenter presented each picture one by one and asked children the same series of questions as the warm-up task. Children were given as long as they needed to answer each question and given positive encouragement for their efforts. The questions were:

(1) Label trial: "Can you tell Johnny/Jenny what this is called?" If children stated the correct label, they were praised and asked the next question. If children stated an incorrect label, the experimenter said, "Actually, I don't think that's what it is called. Can you guess what else this might be called?" Finally, if children stated that they "did not know" or were "not sure", they were given a two-choice alternative question to see if they would be able to recognise the organ/body part after hearing its label (two-choice alternatives are shown in the right-hand column of Table 5.1). For instance, if children were unsure about a picture of a liver, the experimenter said, "I can give you a clue. This has two names. Which name sounds better? Liver or Hepatic?" The order of the correct answer in the two-choice alternative question was randomised. The experimenter always remained

neutral in delivering the two-choice alternative so that children were not cued towards the correct answer.

(2) Location Trial: “Can you show Johnny/Jenny where the X is?” X referred to either the label used by children who gave a correct response in the Label Trial or the label endorsed by children given a two-choice alternative. If children responded with the correct location, they were praised and asked the next question. If children were unsure or were silent, they were asked to guess where they thought the respective organ/body part was located. However, if children refused to guess, the experimenter assured them that their responses were satisfactory and continued with the next question.

(3) Function Trial: “Can you tell Johnny/Jenny what you use your X for?” Children were questioned about what they thought was the primary function of the organ/body part. If children stated a correct function, they were praised and asked, “Can you tell Johnny/Jenny anything else you use your X for?” If children were hesitant, they were asked to guess. Finally, if they were still unsure, the experimenter assured them that their responses were satisfactory and continued with presenting the next organ/body part.

(4) Extra Trial: “Can you tell Johnny/Jenny what else you know about X?” This final question was used to maximise the amount of information obtained from children about their knowledge of the body part/organs.

Table 5.1

Body Parts and Organs Presented and Respective Two-choice Alternatives.

Body Parts Presented (Easy)	Two-choice Alternative
Nose	Naris
Eye	Sclera
Foot	Talus
Ear	Auricle
Teeth	Molar
Mouth (Lips)*	Philtrum
Arm	Humerus
Leg	Femur
Hand	Manus
Organs Presented (Difficult)	**Two-choice Alternative**
Brain	Cerebrum
Liver	Hepatic
Lungs	Pleura
Larynx	Vagus
Gall Bladder	Bile duct
Stomach	Fundus
Pancreas	Acini
Heart	Aorta
Kidney	Renal

* Upon testing, it became apparent that children were more likely to label the picture of the mouth as "lips". This response was categorised as also correct, but will be considered further in the Discussion.

Results

Findings will be presented as follows. First, an overview of children's accuracy of labelling, when unprompted, is considered. Second, children's accuracy when prompted with the two-choice alternative question, featuring the accurate and novel label, is presented. Third, children's ability to locate body part/organs is summarised. Finally, the forms of explanation children give for the body parts/organs are outlined. Age differences in children's responses were not found and, therefore, will not be detailed in this section.

Accuracy of Labelling

The percentage of children who provided a correct label for each body part/organ, unprompted, is shown in Figure 5.3. In general, children were highly accurate with external body parts. All children were able to accurately label the eye, nose and teeth without assistance. By contrast, children had more difficulty with internal organs. The brain, heart, lungs, and kidney were the only organs which were recognised by some children. However, all children were unable to label the gall bladder, larynx, liver, pancreas and stomach.

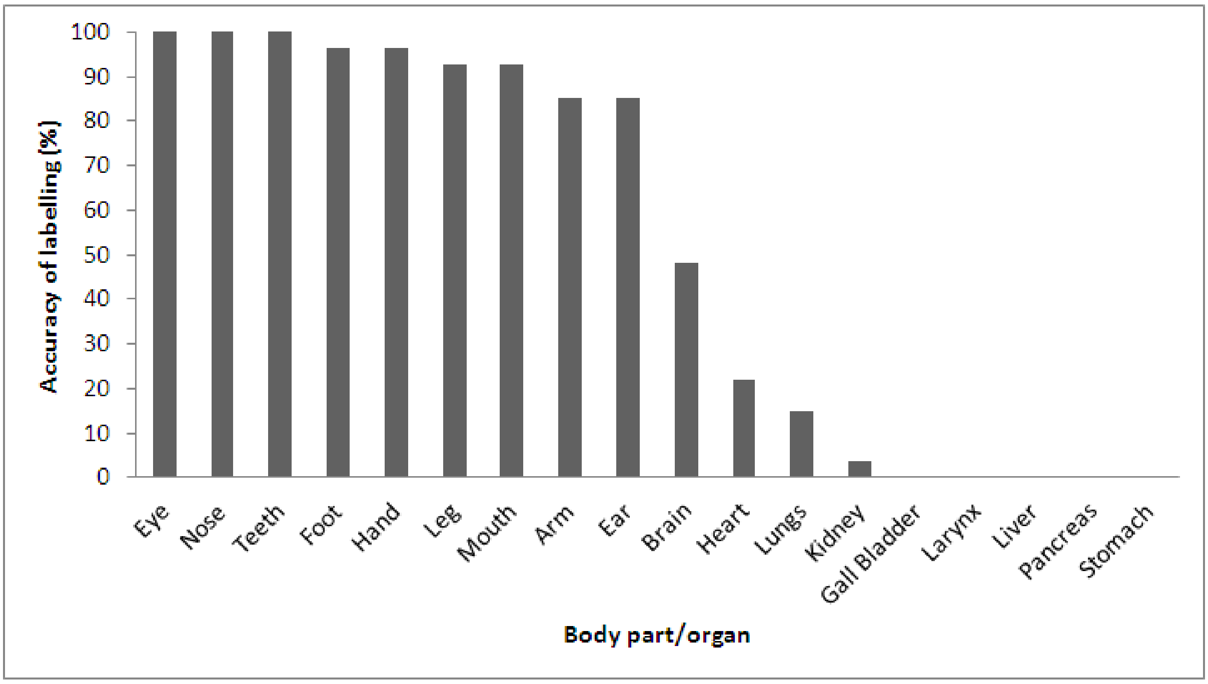

Figure 5.3. Percentage of children who gave a correct label (unprompted) for each body part/organ, in descending order.

Most children offered one label for each body part/organ. However, there were often multiple responses for the mouth, arm and leg when children were asked to provide a label. While it was anticipated that children would accurately label the picture of the mouth as a "mouth", 20 out of 27 children referred to the body part as "lips", whereas the remaining children labelled it as a "mouth". During testing, it became apparent that most of the children's first response to the picture of the mouth was "lips". Given that "lips" was also an accurate label for the picture of the mouth, "mouth" and "lips" were both scored as correct responses in the label trial. However, if children said that they "did not know" what it was, the two-choice alternative question was offered. For the arm and leg, children also opted to respond with smaller parts, such as hand, fingers, knees, foot and toes (48.1% and 51.9%

respectively). Nearly all children offered the name for the full limb after being prompted with, “Can you guess what else this might be called?” However, if children were still unable to give the correct label for a body part/organ, they were given a two-choice alternative question, in which they had to endorse either the accurate label or a novel label.

Accurate vs. Novel Labels

A small number of children had responded incorrectly when first asked to label the arm (1), ear (3), leg (1) and mouth (2). With the exception of the mouth, all children chose the correct label for the arm, ear and leg when presented with the two-choice alternative question. The two children who incorrectly labelled the picture of the mouth endorsed the novel label, “philtrum”. This finding will be elaborated further in the Discussion.

The percentage of children, who were prompted with the two-choice alternative question for the internal organs, and chose the accurate label is shown in Figure 5.4. Children chose the correct label at a rate above chance for the organs: brain, lungs, stomach and heart. However, responses did not differ from chance for all other internal organs.

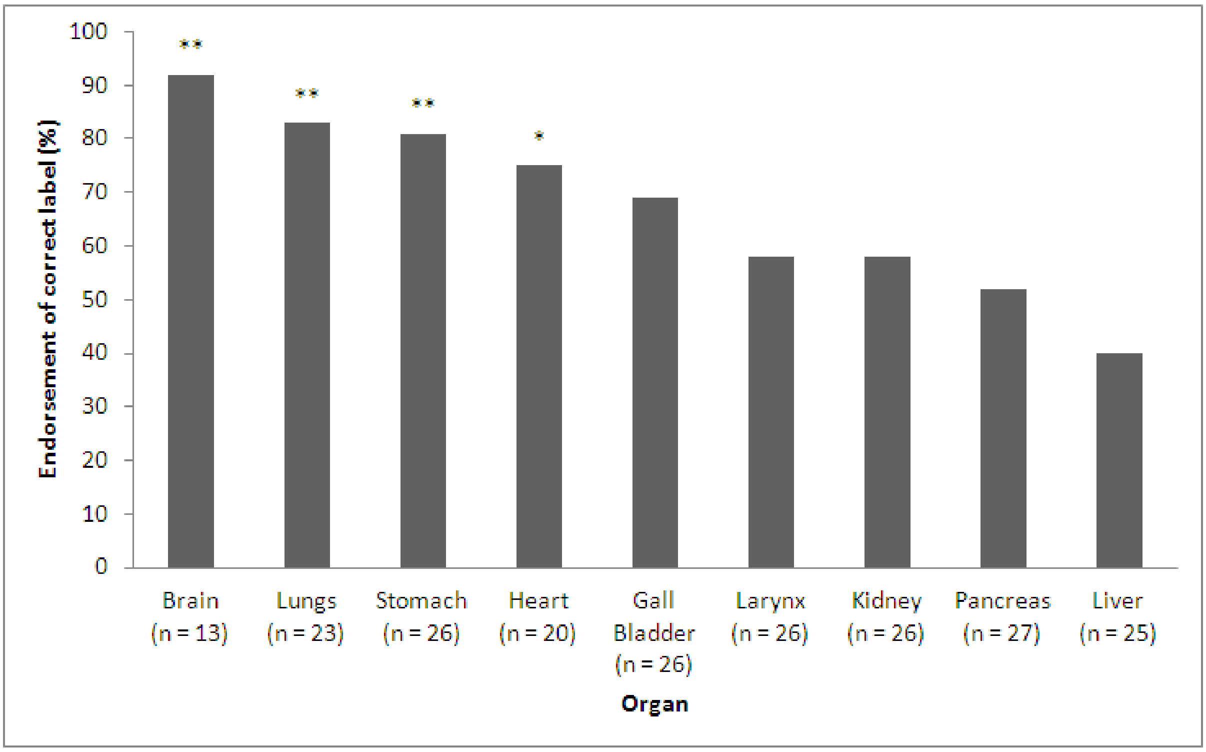

Figure 5.4. Percentage of children who chose the accurate label over the novel label in the two-choice alternative question, in descending order.

* *p* < .05. ** *p* < .01.

In considering children who labelled correctly, with and without prompting, accuracy is above chance for all external body parts as well as the following organs: brain, lungs, heart and stomach. This finding is presented in Figure 5.5. Responses did not differ from chance for the gall bladder, kidney, larynx, pancreas and liver.

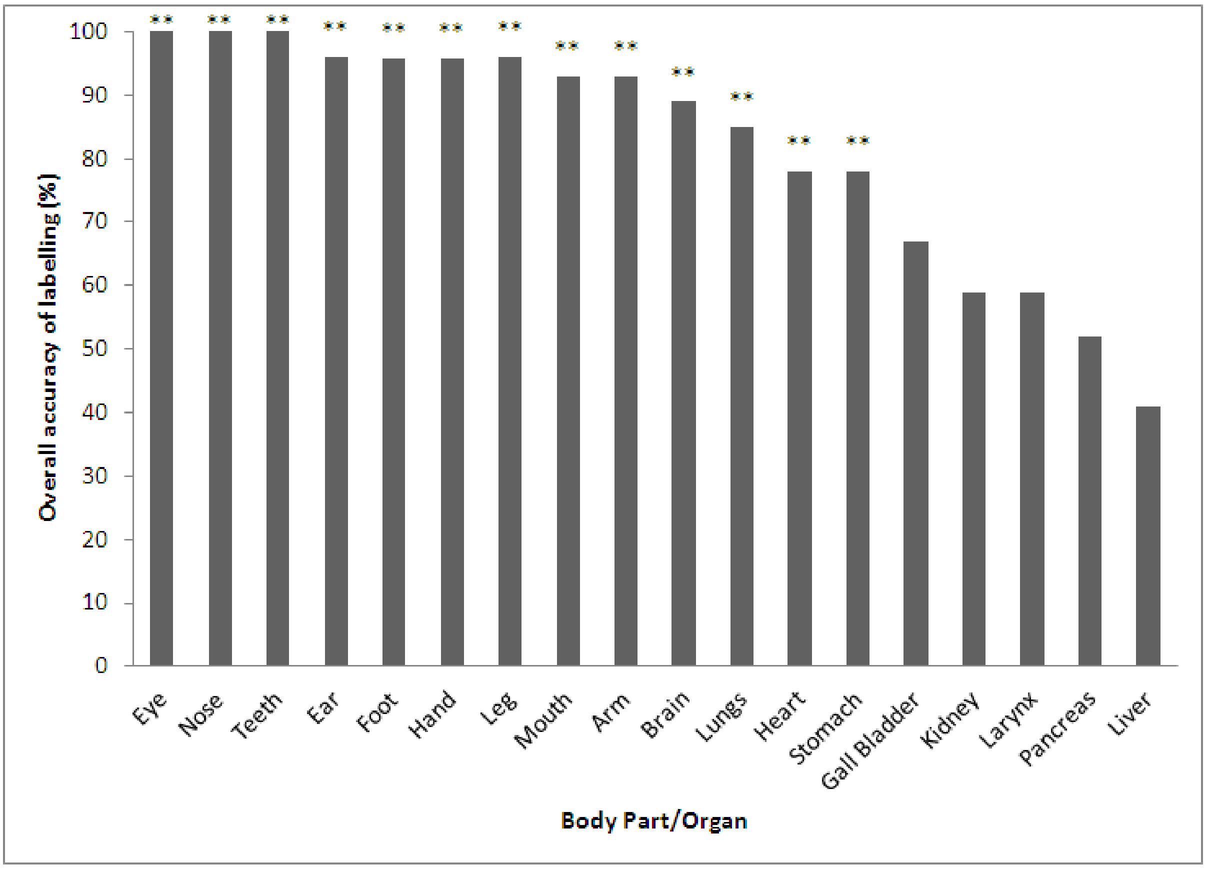

Figure 5.5. Overall accuracy of children's labelling of body part/organs, in descending order.
* *p* <.05. ** *p* <.01.

Accuracy of Location

Correct responses for location are based on definitions used by Jaakkola and Slaughter (2002). The percentage of children who responded with the correct location of each body part/organ is shown in Figure 5.6. All children could accurate locate the arm, eye, foot, hand, leg, nose and teeth. Further, children were more able to correctly locate external body parts than internal organs.

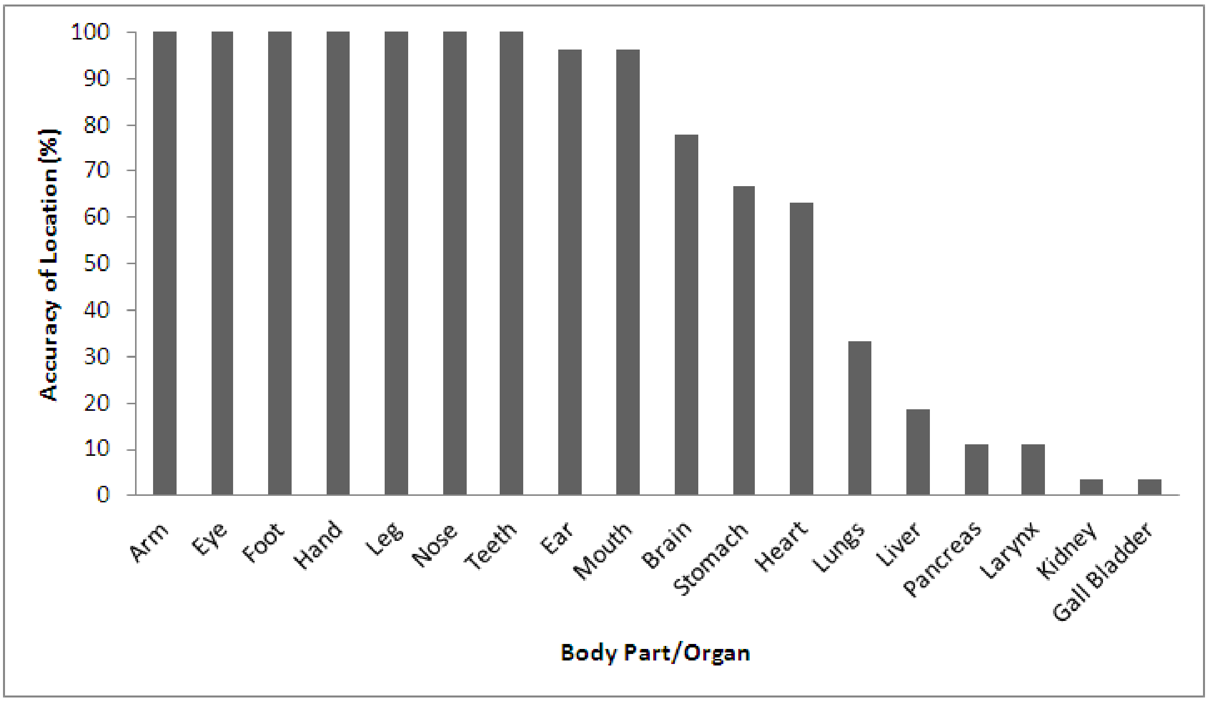

Figure 5.6. Percentage of children providing the correct location of each body part/organ, in descending order.

Forms of Explanation

Children's explanations were classified into four different categories: *Core Function, Peripheral Function, Characteristic* and *Incorrect/Irrelevant*. If children gave multiple descriptions for a body part/organ, which fit in more than one category, each description was individually coded. The categories are described as follows.

- Core Function: a primary function of the body part/organ which is important for interacting with the world and/or sustaining life. Responses for this category are based on definitions used by Jaakkola and Slaughter (2002). General remarks such as, "it keeps you alive/healthy" were not coded.
- Peripheral function: an action or function of the body part/organ which is appropriate to the body part/organ, but is not vital for interacting with the world or sustaining life.
- Characteristic: a property or feature of the body part/organ which is not directly associated with its core or peripheral function, such as a description of its external appearance or the names of parts which make up the body part/organ.
- Incorrect/Irrelevant: coded if children made no correct responses, or provided irrelevant information. If children made any responses which could be coded under any of the categories listed above, any other remarks were ignored.

Examples of the first three categories for all body parts/organs, based on children's responses, are shown in Table 5.2.

Table 5.2

Examples of Children's Core Function, Peripheral Function and Characteristic Responses for each Body Part/Organ.

Body Part/Organ	Core Function	Peripheral Function	Characteristic
Arm	Hold objects	Bend, move	Fingers, muscles, put stamps/tattoos on
Ear	Listen, hear	Wiggle	Medicine goes in
Eye	Look, see	Blink	Different colours, eyelashes
Foot	Walk, run	Kick	Nail polish, shoes, has bones
Hand	Hold, touch	Shake, wave	Five fingers, has little bumps
Leg	Walk, run	Hop	Knee, long, straight
Mouth/Lips	Eat, talk	Kiss, smile	Lipstick, tongue
Nose	Smell, breathe	Sniff	Bump nose and it hurts, blocked nose
Teeth	Chew, bite	Brush, wiggle	It grows
Brain	Think	Dream	Squishy, blood inside, there are holes
Gall Bladder	*	*	*
Heart	Pump blood	Beat, make noise	These bits are the pumping bits
Kidney	Do wees	*	Kidney stones
Larynx	*	*	*
Liver	*	*	*
Lungs	Breathe		Looks like butterfly
Pancreas	*	*	*
Stomach	Store food	Rumbles	Call it tummy

Note. * signifies that no relevant responses were given.

The percentage of children who demonstrated knowledge of the body part/organ in at least one of the categories (i.e. Core Function, Peripheral Function or Characteristic) is shown in Figure 5.7. Children were more able to provide information about external body parts than internal organs. Further, they did not provide any information about the gallbladder and liver. A summary of four- and five-year-olds' explanations is shown in the Appendix D.

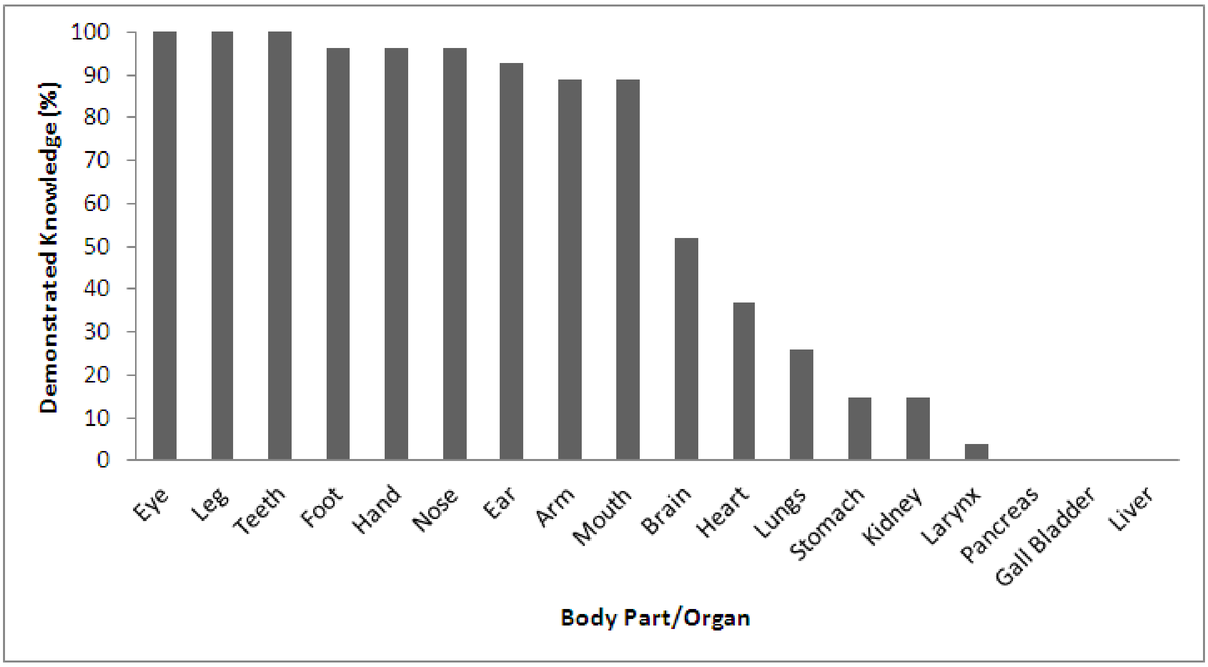

Figure 5.7. Percentage of children who gave at least one plausible explanation for each body part/organ, in descending order.

The number of children who provided various forms of explanation for external body parts are shown in Table 5.3. With the exception of the arm and hand, the majority of children's descriptions related to a core function of the body part. For the arm and hand, most responses were related to a peripheral function of the body part. No irrelevant or incorrect responses were given for the eye, leg and teeth.

Table 5.3

Numbers of Children's Forms of Explanation for External Body Parts.

Body part	Irrelevant/none	Core function	Peripheral Function	Characteristic
Arm	3	10	20	10
Ear	2	23	2	5
Eye	0	20	10	9
Foot	1	20	13	11
Hand	1	19	18	5
Leg	0	23	15	13
Mouth	3	15	13	9
Nose	1	20	10	3
Teeth	0	26	11	8

The forms of children's explanation for internal organs are shown in Table 5.4. Some children demonstrated knowledge of the brain, heart, lungs and stomach. However, most children were unable to provide a knowledgeable description for the organs. All children were unable to give any information about the gall bladder, liver and pancreas.

Table 5.4

Numbers of Children's Forms of Explanation for Internal Organs.

Organ	Irrelevant/none	Core function	Peripheral Function	Characteristic
Brain	11	10	5	4
Gall Bladder	27	0	0	0
Heart	17	3	6	3
Kidney	24	1	0	2
Larynx	26	1	0	0
Liver	27	0	0	0
Lungs	20	6	0	1
Pancreas	26	0	0	0
Stomach	23	3	1	1

Discussion

The aim of this study was to explore children's existing knowledge of the labels and functions for various body parts and organs. Results show that four- and five-year-olds were more familiar with external body parts than internal organs, and they have exceptional knowledge of the eye, nose, and teeth. Children also demonstrated extensive knowledge of the foot, hand, leg, mouth, arm and ear. With regards to the internal organs, children provided the most information about the brain, heart, lungs, and stomach after being prompted with its label. However, children provided very little information about the label, location and function of the kidney, gall bladder, larynx, liver and pancreas.

Regarding external body parts, children's explanations generally referred to core functions, peripheral functions and characteristics. References to core functions were most frequent for all body parts except for two, arm and hand, which were most frequently described in terms of peripheral functions. For internal organs, the brain, heart, stomach and lungs were also described in terms of core functions, peripheral functions and characteristics; but at a much lower frequency than for external body parts. Explanations relating to core and peripheral functions typically contained many verbs and children often demonstrated those actions using their own bodies. For instance, when asked about the function of the eye, most children would blink rapidly before verbally reporting, "blinking". Further, when children mentioned characteristics of body parts, their statements were usually related to external and observable features, such as having nail polish on the fingers, or the fact that eyes can have different colours. In general, children speak of external body parts in terms of actions and observable properties.

This study sought to determine which body parts and organs would be presented in the subsequent studies presented in this thesis. For familiarisation trials, the body parts which were well-recognised by children and had been given explanations relating to core functions, peripheral functions, and characteristics were chosen. Therefore, from the current results, the eye and nose were the most apparent choices for familiarisation trials. Explanations for the ear, on the other hand, generally related to its core function (e.g. hearing, listening) with little mention of any peripheral functions. This may be due to the fact that children were knowledgeable of the importance of the ear in the auditory system, but had less awareness of other inherent functions. In addition, while the teeth were also widely recognised and understood by children, it was not selected because it could only be referred to using a collective noun (i.e. "Those are teeth"), which does not conform to the typical manner in which items are presented during familiarisation trials as reported in the literature, (e.g.

"That's a ball"). Hence, to maintain consistency across all trials, only body parts/organs which could be presented in the form, "That's an X" were selected. Finally, based on children's overall knowledge of the label, location, and function of body parts, the hand and the foot were chosen for the remaining familiarisation trials. The arm and leg were not chosen because they contained smaller parts to which children's attention was also drawn. For instance, when children were shown the arm and leg, many were inclined to name other parts, including foot, hand, fingers, knees, and toes.

Children's responses when shown the mouth were unexpected as they more often referred to the picture as "lips", rather than "mouth". In addition, two children responded incorrectly in the first instance and chose the novel label, "philtrum", when prompted with the two-choice alternative question. The reason for these unexpected findings could be due to the stimulus itself. The picture of the mouth presented to children was a closed and slightly smiling mouth, which could be interpreted as referring to "lips". However, 96.3% of children successfully indicated the location of the mouth/lips and 88.9% of children were able to demonstrate some knowledge of the body part. In fact, the explanations offered by children often referred to functions which were more relevant to the interior of the mouth, such as, talking and eating. Further, when shown the picture for teeth, which was an open mouth, seven children responded with "mouth" when asked for a label, and four children stated that teeth could be found "in your mouth" when asked to locate the teeth. That is, while there were multiple answers for the picture of the mouth, children still recognised and provided correct information about the body part, suggesting that they had clear knowledge of the mouth. Therefore, "mouth" was assigned as an inaccurate label used by the inaccurate informant; for example, when labelling a picture of a foot. The labels for the other external body parts (i.e. leg, ear and arm) were assigned as inaccurate labels during familiarisation trials. To avoid confusion and to increase the strangeness of the inaccurate informant's labelling, accurate and inaccurate labels were matched appropriately such that the hand was never called an "arm" and the foot was never called a "leg" by the inaccurate informant.

For test trials, the least recognised internal organs were selected to be the most suitable stimuli as most children were unable to label, locate and describe them. Because the organs will be labelled using novel terms (e.g. "slod", "linz"), it was anticipated that the organs chosen would be unfamiliar to children and that there would be no interference between the novel labels and their existing knowledge. In taking into account children's overall understanding of the internal organs in this study, the gall bladder, liver, pancreas and larynx were selected as the novel objects presented in the test trials. The kidney was also a potential candidate but, as shown in the results, some children were able to label and offer explanations; in this study, one child recognised the kidney and another mentioned kidney stones.

In the subsequent chapters, I present a series of experiments that utilise the findings of Study 1 to investigate whether children demonstrate selective trust in the biological domain in the same way that they do in the artifacts domain. The body parts presented in the familiarisation trials pertained to the body parts that children showed most knowledge of (i.e., eye, hand, nose, foot), and the organs presented in the test trials pertained to the organs that children had no knowledge of (i.e., pancreas, larynx, liver, gall bladder). In Chapter 6, the question of interest was how children construe informants who provide *new* labels for parts of the body in contrast to informants who provide clearly accurate or inaccurate labels. In Chapters 7 to 9, I present children with informants who differ in the depth of the explanations they provide to determine whether children are discerning of informants' claims; specifically, one informant outlines the functions of the body parts/organs whereas the other informant simply describes their obvious appearance.

Chapter 6
Study 2

The results of the study presented in Chapter 5 revealed that children have more knowledge of the body when talking about external body parts (e.g., eye, hand) than about internal organs (e.g., pancreas, liver). Based on these results, the study presented in this chapter sought to capitalize on children's developing knowledge of the body. In a modification of the selective trust paradigm, children were presented with familiar and unfamiliar body parts/organs to investigate whether children demonstrate selective trust in the biological domain, as well as how children construe informants who provide new information (in the form of novel labels) when compared to informants who provide clearly accurate or inaccurate information. It is important to note that the use of novelty in research is not a new idea per se. In fact, there is extensive literature on children's early word learning that has manipulated the novelty of objects (Graham, Namy, Gentner, & Meagher, 2010; Jaswal, 2004) and the novelty of labels (Hollich, Golinkoff, & Hirsh-Pasek, 2007; Merriman & Schuster, 1991). For instance, Jaswal (2004) showed that, when presented with pictures of hybrid animals that varied in the degree of novelty, 3- and 4-year-olds' acceptance of a speaker's unexpected labels depended on their evaluations of the speakers' intent. In relation to studies that have featured novel labels, Merriman and Schuster (1991) found that children as young as two demonstrate a *disambiguation effect* by which they tend to select unfamiliar objects over familiar objects upon hearing a novel label. Hence, while novel labels have been widely used in the literature and it is well-established that young children are able to make sense of such labels, the questions put forward in this study relate how children construe informants who provide novel labels when compared to informants who provide accurate or inaccurate labels; such a question is yet to be explored. Further, it was investigated whether there is a developmental shift by which children come to consider informants who provides novel labels to be somewhat more reliable than informants who provide inaccurate labels given that there are apparent age-changes in children's evaluations of accurate and inaccurate informants between the ages of three and four. Hence, the motivations for this study largely derive from existing gaps in the selective trust literature as to the nature of children's selective trust in the context of novel labelling.

The following study was published in the *Journal of Experimental Child Psychology*.

Five-year-olds are willing but four-year-olds refuse to trust informants who offer new and unfamiliar labels for parts of the body

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Abstract

This study employed the selective trust paradigm to examine how children interpret novel labels when compared with labels they already know to be accurate or inaccurate within the biological domain. The participants—3-, 4-, and 5-year-olds (N = 144)—were allocated to one of three conditions. In the accurate versus inaccurate condition, one informant labeled body parts correctly, whereas the other labeled them incorrectly (e.g., calling an eye an "arm"). In the accurate versus novel condition, one informant labeled body parts accurately, whereas the other provided novel labels (e.g., calling an eye a "roke"). Finally, in the inaccurate versus novel condition, one informant labeled body parts incorrectly, whereas the other offered novel labels. In subsequent test trials, the two informants provided conflicting labels for unfamiliar internal organs. In the accurate versus inaccurate condition, children sought and endorsed labels from the accurate informant. In the accurate versus novel condition, only 4- and 5-year-olds preferred the accurate informant, whereas 3-year-olds did not selectively prefer either informant. In the inaccurate versus novel condition, only 5-year-olds preferred the novel informant, whereas 3- and 4-year-olds did not demonstrate a selective preference. Results are supportive of previous studies suggesting that 3-year-olds are sensitive to the errors of inaccurate informants, when contrasted with accurate informants, and that 4-year-olds privilege accuracy. However, 3- and 4-year-olds appear to be unsure as to how the novel informant should be construed. In contrast, 5-year-olds appreciate that speakers offering new information are more trustworthy than those offering inaccurate information, but they are cautious in judging such informants as being "better" at providing that information.

Key words: selective trust; epistemic trust; testimony; biological knowledge; past accuracy; new labels

Five-year-olds are willing but four-year-olds refuse to trust informants who offer new and unfamiliar labels for parts of the body

Children learn about the world not only through their own personal experiences but also via testimony, through what other people tell them. Therefore, it is important for children to be able to distinguish between trustworthy and untrustworthy sources of information to learn effectively. Harris (2007, 2012) proposed that, from an early age, children create a global impression or profile of an informant based on information they obtain about, for example, an informant's history of accuracy, ignorance, and degree of confidence. As a result, children consider some informants to be more epistemically trustworthy than others. Much of the research on epistemic trust has focused on children's evaluation of the ability of informants to provide accurate object labels. In various contexts, children from 3 years of age have shown a preference to learn labels for unfamiliar objects from previously accurate labelers rather than from previously inaccurate labelers (Corriveau & Harris, 2009; Corriveau et al., 2009, 2011; Koenig et al., 2004; Koenig & Harris, 2005; Pasquini et al., 2007).

Most of these studies have focused on children's evaluations of informants who label artifacts—observable common objects (e.g., balls, dolls)—and whether they do so accurately or inaccurately. However, children can and do acquire information about many other domains, and they frequently encounter people who offer new information (e.g., novel labels) that are not necessarily accurate or inaccurate. This study examines how children evaluate informants who differ in the reliability with which they provide biological information about the human body. Such information has a different character from those domains of knowledge that have dominated epistemic trust research, which has largely focused on (human-made) artifacts. Body knowledge is a domain in which children rapidly acquire new information from around 4 or 5 years of age as they start to learn about imperceptible structures and processes (Inagaki & Hatano, 2006; Jaakkola & Slaughter, 2002). In the current study, therefore, we examined how children vet new information in this domain, a topic hitherto largely neglected in the trust in testimony research literature.

Children can learn via testimony about domains that consist of objects, which are highly observable and can ultimately be examined firsthand. Artifacts are visible, and children can rapidly acquire labels and knowledge via observation, instruction, and demonstration. Nevertheless, children also learn a great deal via testimony about largely or entirely unobservable entities, things that they would have no means of easily examining for themselves, such as historical events and religious beings. For example, children come to learn about the existence of God, the presence of germs, and the shape of the earth (Harris & Koenig, 2006) despite not having firsthand experience of these entities. Furthermore, Harris, Pasquini, Duke, Asscher, and Pons (2006) showed that children between 4 and 8 years of age attest to the existence of entities that they cannot directly see for themselves but have heard about from others, and they endorse particular entities (e.g., real entities such as germs and oxygen) with more confidence than others (e.g., special beings such as Santa Claus and the Tooth Fairy).

There are, however, certain domains that ordinarily contain both observable and unobservable entities and within which objects and processes are often inferred by their results or outcomes. Such domains include the mental and the biological. For instance, in the mental domain, children are able to witness external indicators of mental states by observing others' intentional acts, but they also come to realize that people possess unobservable mental attitudes and traits that they learn about indirectly, often via others' self-reports. In the biological domain, although children are able to confirm the existence of external entities, such as body parts (e.g., eye, nose), many objects (e.g., internal organs) and processes (e.g., digestion) are generally unobservable despite children's direct access to their own bodies. Thus, the objects within the mental and biological domains are also distinctive because they are built into the individual and can sometimes be directly experienced; they are part of our self-knowledge. For example, people experience thoughts and desires of their own, and they quickly understand that there are structures and processes within their own bodies; they may feel the process of digestion, the breathing of the lungs, or the beating of the heart. Artifacts, on the other hand, are generally human-made and exist externally to individuals. Even though people can claim ownership of specific artifacts, such artifacts do not form part of the inherent makeup of those individuals. Therefore, given the differences between the strongly observable domain of artifacts and the less easily observable mental and biological domains, it is important to confirm whether children apply the same general principles, across different domains, when evaluating who is a trustworthy source of information. Evidence so far suggests that children's trust in accurate informants is pervasive in the domain of artifacts. Some recent studies have examined children's trust in the mental domain in relation to trait judgments (e.g., Boseovski, 2012; Lane et al., 2013) and suggest that children's selective trust is influenced by informants' traits. However, no studies have systematically examined children's trust in the biological domain.

As noted earlier, it is now widely accepted that children's knowledge of the body increases rapidly from around 4 years of age, which roughly coincides with the age at which children demonstrate a systematic preference for reliable labelers of artifacts in the current literature. Therefore, we sought to establish whether children differentially prefer accurate labelers over inaccurate labelers in a domain consisting of entities that children themselves possess but are not always readily observable. We were interested in the question of whether children apply the same epistemic strategies and trust accurate labelers of biological entities in a similar way to how they trust accurate labelers of artifacts. Given that the parts of the body and organs are real entities, like artifacts, we expected that children would use the same strategies and prefer informants who are accurate over those who are inaccurate.

By using entities from the biological domain, however, another interesting question emerges that has been largely neglected in the existing literature. In the biological domain, there exist many labels that are not learned by children until well into formal education. Children are continually exposed to new information and, thus, are required to make sense of this new information in light of their existing knowledge. Furthermore, such information may even pertain to objects of which children already have some knowledge (e.g., learning that "epidermis" also refers to the skin) or to parts of such objects (e.g., "nostril", "iris"). Indeed, Krogh-Jespersen and Echols (2012) showed that toddlers were more willing to accept new labels for familiar objects from an informant who appeared to be reliable than from an informant who appeared to be incompetent. Although much of the current selective trust research focuses on presenting informants who are either correct or incorrect when providing labels for objects, children are unlikely to encounter informants who are consistently inaccurate in the real world. A more plausible type of informant children are likely to encounter is one who provides information that is new and unfamiliar and that cannot be readily judged as accurate or inaccurate.

Several studies have introduced different types of informants whose value as a potential source of information cannot be easily determined. For instance, an informant can claim knowledge without necessarily providing accurate information (e.g., by simply stating that he or she *knows something* about the object). Alternatively, an informant can withhold information without necessarily appearing ignorant or inaccurate (e.g., by simply drawing attention to the object). Using a single-informant study, Krogh-Jespersen and Echols (2012) demonstrated that 24-month-olds were more likely to retain *second labels* (i.e., novel labels for familiar objects) from informants who were previously accurate, claimed knowledge (i.e., who said, "I know what that is!"), or were uninformative (i.e., who said, "Look at that") when identifying familiar objects, but not from informants who were previously inaccurate or acknowledged ignorance (i.e., who said, "I don't know what that is"). Therefore, it appears that reliable labeling trumps children's assumption that whole objects have only one category label (i.e., *mutual exclusivity*), and children have a *default trust*, such that they expect adults to be reliable labelers unless they have a history of inaccuracy or ignorance (see Koenig & Woodward, 2010). That is, even when an informant does not directly provide the accurate label but still appears to be knowledgeable, young children are willing to acquire new labels, even for objects that are known to them.

Studies with older children (3 and 4 years of age), featuring an informant whose accuracy cannot be directly verified, have presented a *neutral* informant similar to the *uninformative* informant mentioned above. For example, Koenig and Jaswal (2011) found that 3- and 4-year-olds preferred to learn new information from a neutral informant, who had simply made neutral remarks about the dogs (e.g., "That's a nice one"), over an *inexpert* informant, who had inaccurately labeled a series of dogs. Similarly, Corriveau and colleagues (2009) used a neutral informant, who made neutral remarks to draw attention to the object (e.g., "Let me take a look at that"), to examine age-related changes in children's tracking of accuracy and inaccuracy. Their results showed that 3-year-olds monitor for inaccuracy, preferring the neutral informant over the inaccurate informant, but not preferring the accurate informant over the neutral informant. In contrast, 4-year-olds selectively trusted an accurate informant over a neutral informant, and trusted a neutral informant over an inaccurate informant. The findings of Corriveau and colleagues served to consolidate earlier findings of Pasquini and colleagues (2007) in that 3-year-olds' performance in selective trust paradigms can be framed in terms of sensitivity to inaccuracy, whereas the performance of 4-year-olds fits squarely with the interpretation that although they are still sensitive to inaccuracy, they nevertheless privilege accuracy.

The single-informant studies discussed earlier (Koenig & Woodward, 2010; Krogh-Jespersen & Echols, 2012) suggest that children are willing to acquire novel labels for objects for which they possess preexisting labels. However, no studies to date have familiarized children with an informant who provides new labels for known objects and assessed whether children subsequently prefer learning from such an informant. The informant who provides new labels is distinct from informants who appear to be knowledgeable, uninformative, or neutral in that actual labels are provided. In the current study, children were presented with an informant who was informative in that she was able to provide labels, but (most importantly) such labels did not blatantly signal accuracy or inaccuracy. Specifically, we introduced a new type of informant who offered novel labels that were unfamiliar to children but were still plausible. Such novel labels are likely to be representative of what children encounter in real conversational and pedagogical interactions where they learn about entirely new things, encounter alternative labels for objects that are already known to them, or start to realize that known objects have special labels that refer to specific features or are used in certain contexts. Moreover, the domain of body knowledge is a suitable domain to examine children's construal of the novel informant because their knowledge of the body is burgeoning at this time and they are likely to encounter a range of new information about the body.

In sum, this study employed the selective trust paradigm to examine how children interpret a novel labeler of body parts in comparison with labelers who can be readily evaluated as accurate or inaccurate. We were interested in whether the novel labeler would be construed as unreliable, like the inaccurate informant, because of her failure to provide accurate labels. Alternatively, there was a possibility that children would consider the novel labeler to be informative, like the accurate informant, because she provided new labels that were not blatantly inaccurate. The focus was on 3-, 4-, and 5-year-olds because previous studies have shown that children from around 3 years of age systematically differentiate reliable informants from unreliable informants in various settings (Koenig & Harris, 2005a). Another motivation for including 3-year-olds was so that we could confirm whether they show a systematic preference for a novel informant over an inaccurate informant, just as they prefer a neutral informant over an inaccurate informant (as in Corriveau et al., 2009, and Koenig & Jaswal, 2011).

The procedure was adapted from previous studies of selective trust in testimony (most notably Corriveau et al., 2009) but with the inclusion of the novel informant, which resulted in three contrasts (henceforth conditions): *accurate versus inaccurate*, *accurate versus novel*, and *inaccurate versus novel*. During familiarization trials, each condition featured a pair of informants who differed in accuracy when labeling a series of body parts with which children would be strongly familiar. In subsequent test trials, children were first asked which informant they would ask to learn about the labels for unfamiliar organs, entities that they have no direct opportunity to observe and, hence, must rely on testimony to learn about. Informants then provided different labels for the organs, and children were asked whose label they would endorse.

Based on previous findings, it was predicted that children across all ages would prefer an accurate informant over an inaccurate informant. That is, children would rely on the same principles to evaluate the trustworthiness of informants in the domain of body knowledge as they do in the domain of artifacts. Next, in accordance with the findings of Corriveau and colleagues (2009), who showed that 3-year-olds are sensitive to inaccuracy but do not privilege accuracy, it was predicted that 4- and 5-year-olds would prefer the accurate informant over the novel informant, whereas 3-year-olds would not differentiate between them. Finally, it was anticipated that children across all age groups would prefer the novel informant over the inaccurate informant because they would consider the blatant errors of the inaccurate informant to signal untrustworthiness more than the new information provided by the novel informant.

Method

Participants

Participants were 144 children (71 girls and 73 boys): 48 3-year-olds (*M* = 42.98 months, *SD* = 2.90, *range* = 37–47), 48 4-year-olds (*M* = 52.83 months, *SD* = 3.89, *range* = 48–59), and 48 5-year-olds (*M* = 65.40 months, *SD* = 3.73, *range* = 60–71). All children lived in a metropolitan area and spoke fluent English. Most children were Caucasian, although a range of ethnicities was represented. Another 8 children were excluded from the main study due to fussiness (3), refusal to select an informant (2), interference by mother or day care staff (2), or initially stating that they would always select a particular informant because she wore a “prettier” color (1). Children were recruited from a database of interested parents and via parental invitation. Children were tested individually in a quiet room in their day care center or school or at the university laboratory. Stimuli were presented as video clips on a laptop.

Materials

There were three conditions (accurate vs. inaccurate, accurate vs. novel, and inaccurate vs. novel), each consisting of eight video clips: four clips for the familiarization trials and four clips for the test trials. In each video clip, two female informants (wearing either an orange or blue shirt) sat on either side of a table, and a male interviewer (wearing a black shirt) stood between them. The interviewer held up, at chest height, a white A3-sized sheet of cardboard with a colored picture of a body part or organ printed on it. The order of body parts and organs presented was the same for all children.

Design and procedure

Children were randomly allocated to conditions, with equal numbers of boys and girls in each condition. At the beginning of the session, the experimenter introduced a picture book about the human body as a way of familiarizing children with the items that were to be shown in the video clips. For instance, the experimenter said, “We’re going to learn some things about the body today. Look at this picture [points]. Did you know there are bones inside your body? Can you feel your bones? [demonstrates on self]. Have a look here. There are other things inside your body. Here’s your heart. Do you know where your heart is?” The experimenter never explicitly referred to any body parts and organs featured in the video clips.

Next, the experimenter introduced the task by saying, “We’re going to play a little game on the computer about the body.” The experimenter showed a still frame of the two informants sitting on either side of the table and the interviewer standing between them. The experimenter said, “First, you’re going to meet these three people. Do you see them? The boy in the black shirt is going to hold up some pictures of things from the body. Then, this girl in the orange shirt and this girl in the blue shirt are going to tell you the names of the things in the pictures. I want you to listen very carefully to what the girls say, and then I’m going to ask you some questions. Are you ready?” The order in which the informants were mentioned was varied across children, and no hints about the accuracy of the informants were provided.

Familiarization trials. In the first familiarization trial, the experimenter presented a picture of an eye and said, “I wonder what the girls think this is called. Let’s listen to what they say.” Children then watched the corresponding video clip in which the interviewer held up a picture of an eye and asked the informants, “Can you tell me what this is called?” Each informant then labeled the body parts in accordance with the accuracy role she had been assigned: accurate, inaccurate, or novel. For instance, in the accurate versus inaccurate condition, the accurate informant consistently said the correct label for the body part (e.g., “That’s an eye” for a picture of an eye), whereas the inaccurate informant consistently stated a clearly incorrect label (e.g., “That’s an arm”). In the accurate versus novel condition, the accurate informant labeled the body part correctly and the novel informant offered a novel but plausible label (e.g., “That’s a roke”). Finally, in the inaccurate versus novel condition, the inaccurate informant incorrectly labeled the body part, whereas the novel informant provided an unfamiliar label. Informants’ labels, according to accuracy role, are shown in Table 6.1.

Table 6.1

Familiarization Trials According to Informants' Accuracy Role.

Body part	Accurate Informant	Inaccurate informant	Novel Informant
Eye	That's an eye	That's an arm	That's a roke
Foot	That's a foot	That's a mouth	That's a cham
Nose	That's a nose	That's a leg	That's a dax
Hand	That's a hand	That's an ear	That's a wug

Before the end of each video clip, once both of the informants had provided different labels for the body part, the experimenter paused the clip and reiterated the labels used by the informants (e.g., "The girl wearing the blue shirt said it's a nose, and the girl wearing the orange shirt said it's a leg"). Children were not asked to choose between the two labels provided by the informants so as to allow them to freely interpret the informants' input without committing to the viability of the labels before the test trials. The next familiarization trial, with a different body part, was then presented. The informant who spoke first alternated among the four video clips, and the accuracy role assigned to each informant was systematically varied across children.

Test trials. After the four familiarization trials, children were given four test trials featuring organs they would have difficulty in identifying. The experimenter introduced the test trials by saying, "Now, you are going to see some pictures of things that are inside the body that you might not know the names of." The aim of these test trials was not to test whether children could correctly identify these organs but rather to assess whether children would make use of the informants' previous reliability when learning new information. Informants provided novel nonword labels for the organs, as in previous studies (Corriveau et al., 2009), so that children could not select an informant based on their recognition of the truly correct label. To confirm that children were not able to identify these organs, the experimenter presented children with an identical picture of the respective organ at the start of each test trial. None of the children correctly identified these organs. In each test trial, children were given an *ask* question and an *endorse* question. At the end of the four test trials, children were asked *explicit judgment* questions. The questions are described below.

Ask question. Children were shown a picture of the unfamiliar organ for that trial and were asked, "Do you know what this is called?" No child was able to supply the correct label. They were then shown a still frame of the two informants and were given the ask question: "I bet one of these girls can help you. Which girl would you like to ask, the girl in the orange shirt or the girl in the blue shirt?" However, if children offered their own label for the organ, the experimenter said, "Actually, I don't think that's what it's called," before giving the ask question. The order in which each informant was mentioned in the ask question alternated between trials. Children's verbal responses (e.g., "The girl in the blue shirt") or nonverbal responses (e.g., pointing) were recorded.

Endorse question. Regardless of which informant children selected for the ask question, the corresponding test trial video clip was played. The interviewer held up a picture of the organ and asked the informants, "Can you tell me what this is called?" The first informant offered a novel label (e.g., "That's a slod"), and the second informant offered a different novel label (e.g., "That's a linz"). The novel labels used in the test trials are shown in Table 6.2. Which informant spoke first alternated among the four video clips, and the novel labels provided by each informant were counterbalanced across informants' accuracy role.

After each informant provided a label, children were given the endorse question. The video clip was paused, showing the two informants and interviewer, and children were asked for the label of the organ (e.g., "The girl in the orange shirt said it's a slod, and the girl in the blue shirt said it's a linz. What would you say?"). The order in which the informants were mentioned in the endorse question was consistent with the order in which they were questioned by the interviewer. Children's verbal responses (e.g., "What the girl in orange said," "a slod") or nonverbal responses (e.g., pointing) were recorded.

Table 6.2

Test Trials (Unfamiliar Organs): Novel Labels.

Organ	Novel Label A	Novel Label B
Liver	That's a slod	That's a linz
Pancreas	That's a mogo	That's a nevi
Larynx	That's a sneg	That's a hoon
Gall Bladder	That's a yiff	That's a zazz

Explicit judgment questions. Following the four test trials, the experimenter showed a still frame of the two informants and asked children three explicit judgment questions about the reliability of informants' labeling. First, "Was the girl in the blue shirt very good or not very good at saying the names of these things?" Second, "Was the girl in the orange shirt very good or not very good at saying the names of these things?" Finally, "Which girl was better at saying the names of these things?" The order in which each informant was referred to was varied for the first two explicit judgment questions. Children's verbal responses (e.g., "Very good," "Not very good," "The girl in the orange shirt") or nonverbal responses (e.g., nodding, pointing) were recorded.

Results

Initial analyses were conducted to examine whether children's responses were consistent across different question types (ask, endorse, and explicit judgment). Although there were some small differences by question type, this initial analysis largely justified the creation of overall scores, which have been used previously (Corriveau & Harris, 2009; Corriveau et al., 2009). Next, these overall scores were examined by condition and age. Finally, children's performance for the different question types was examined in detail.

Comparison of Children's Performance Across Question Types

As in previous studies (e.g., Corriveau et al., 2009), children were given 1 point for an appropriate response for every ask question, endorse question, and explicit judgment question. In the accurate versus inaccurate and accurate versus novel conditions, selection of the accurate informant was considered appropriate. In the inaccurate versus novel condition, following predictions, selection of the novel informant was considered appropriate. Totals for each question type were created by summing children's appropriate responses, resulting in a total score from 0 to 4 for ask questions, from 0 to 4 for endorse questions, and from 0 to 3 for explicit judgment questions. Following Corriveau and colleagues (2009), scores for the explicit judgment questions were transformed linearly (multiplied by 4/3) to allow meaningful comparison with ask and endorse totals (see Table 6.3).

A 3 x 3 x 3 mixed ANOVA was conducted, with age (3-, 4-, and 5-year-olds) and condition (accurate vs. inaccurate, accurate vs. novel, inaccurate vs. novel) as between-subjects variables, and question type (ask, endorse, and explicit judgment) as the within-subjects variable. A significant main effect was found for question type, $F(2, 270) = 4.32$, $p = .014$, $\eta_p2 = .03$; age, $F(2, 135) = 12.90$, $p = .001$, $\eta_p2 = .16$; condition, $F(2,135) = 10.91$, $p = .001$, $\eta_p2 = .14$; and the age × condition interaction was also significant, $F(4, 135) = 3.00$, $p = .021$, $\eta_p2 = .08$. Importantly, question type did not interact with age or condition, strongly suggesting consistency in children's responding. A *post-hoc* LSD test revealed that children provided significantly more appropriate answers on explicit judgment questions than on ask questions (p = .006), which suggests that the explicit judgment questions more strongly reflected children's sensitivity to informant status. However, all question types performed in essentially the same manner (see Table 6.3). Thus, despite children's differential sensitivity to the questions, a total score was calculated, as is typical in this literature. This permitted a further insight into the age x condition interaction, as described in more detail below.

Table 6.3

Mean Numbers (and Standard Deviations) of Appropriate Responses (Maximum = 4) to Question Types as a Function of Age and Condition.

	3-year-olds	4-year-olds	5-year-olds
Accurate vs. Inaccurate			
Ask questions	2.69 (0.95)*	2.50 (0.97)[b]	3.31 (0.70)***
Endorse questions	2.88 (1.15)**	3.00 (1.03)**	3.19 (0.91)***
Explicit judgments[a]	3.08 (1.35)**	3.08 (1.52)*	3.75 (1.00)***
Accurate vs. Novel			
Ask questions	1.63 (0.96)	2.56 (0.89)*	2.81 (0.75)**
Endorse questions	1.75 (0.93)	2.75 (0.93)**	3.13 (0.81)***
Explicit judgments	1.50 (1.68)	3.33 (1.46)**	3.42 (1.19)***
Inaccurate vs. Novel			
Ask questions	1.94 (1.06)	2.06 (0.93)	2.56 (0.81)*
Endorse questions	1.94 (0.93)	2.06 (1.24)	2.81 (0.98)**
Explicit judgments	2.17 (1.53)	2.08 (1.68)	2.58 (1.72)

Note. Asterisks denote response patterns that are different from chance.
[a]Explicit judgment scores (/3) were transformed following Corriveau et al. (2009) by multiplying by 4/3 so that they were directly comparable with Ask and Endorse label probes.
[b]$p < .06$, *$p < .05$, **$p < .01$, ***$p < .001$.

Overall Scores

The total overall score was calculated by summing children's appropriate responses for ask questions; endorse questions, and the untransformed explicit judgment questions, resulting in a maximum score of 11 points. Children's overall pattern of responding, total overall scores, as a function of condition and age, are shown in Figure 6.1. To explore the age x condition interaction discussed above, three separate one-way ANOVAs and *post-hoc* LSD tests were conducted on age differences for each condition. In the accurate vs. inaccurate condition, there were no significant differences in children's appropriate responses across the different age groups, $F(2,45) = 2.45$, $p = .098$. In the accurate vs. novel condition, there was a main effect for age, $F(2,45) = 13.59$, $p = .001$, $\eta_p 2 = .38$, with 4- and 5-year-olds providing significantly more appropriate responses than 3-year-olds (*ps* = .001), but not differing from each other ($p = .407$). Finally, in the inaccurate vs. novel condition, the influence of age was only marginally significant, $F(2,45) = 2.90$, $p = .066$, $\eta_p^2 = .11$. However, follow-up analyses showed that 5-year-olds provided significantly more appropriate responses than 3-year-olds ($p = .034$) and marginally more appropriate responses than 4-year-olds ($p = .056$). Three- and 4-year-olds did not differ significantly from each other ($p = .822$).

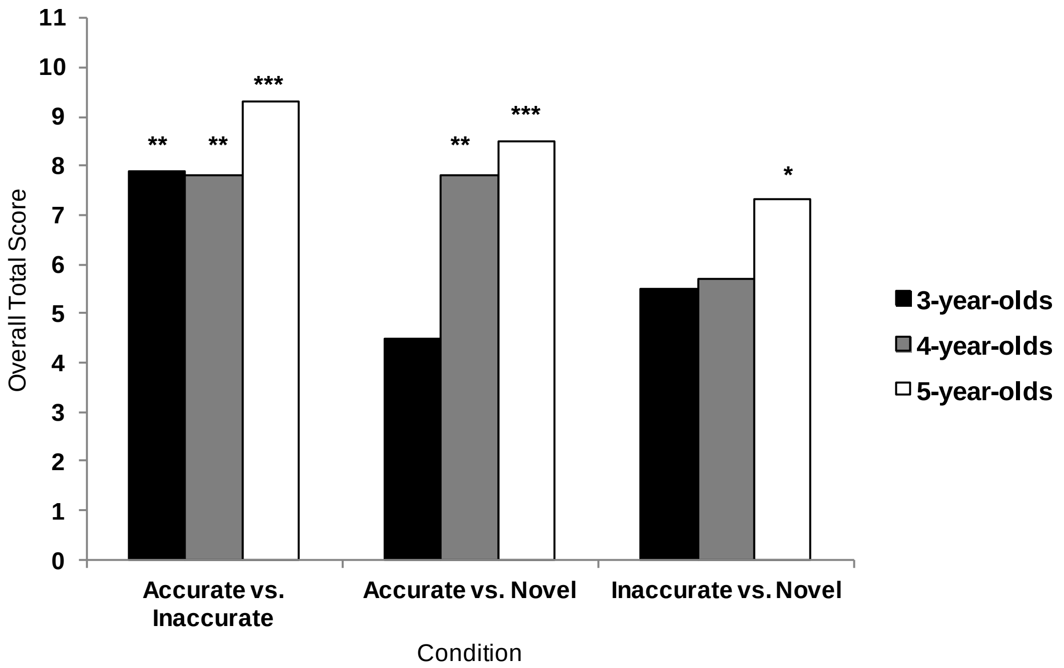


Figure 6.1. Total scores on test trials as a function of condition and age group.
* $p < .05$. ** $p < .01$. *** $p < .001$

To examine whether children systematically demonstrated overall trust in the appropriate informant, total overall scores for appropriate choices were first compared to a chance expectation of 5.5 using related samples *t*-tests. In the accurate vs. inaccurate condition, all age groups preferred the accurate informant at a rate above chance: 3-year-olds $M = 7.88$, $SD = 2.28$, $t(15) = 4.17$, $p = .001$, $d = 1.04$; 4-year-olds $M = 7.81$, $SD = 2.43$, $t(15) = 3.81$, $p = .002$, $d = .95$; 5-year-olds $M = 9.31$, $SD = 1.74$, $t(15) = 8.76$, $p = .001$, $d = 2.19$. In the accurate vs. novel condition, 3-year-olds performed at chance, $M = 4.50$, $SD = 2.45$, $t(15) = 1.63$, $p = .123$, whereas the two older age groups preferred the accurate informant at above chance levels: 4-year-olds $M = 7.81$, $SD = 2.46$, $t(15) = 3.77$, $p = .002$, $d = .94$; 5-year-olds *M* = 8.50, *SD* = 2.03, *t*(15) = 5.90, *p* = .001, *d* = 1.48. Finally, in the inaccurate vs. novel condition, 5-year-olds performed above chance, *M* = 7.31, *SD* = 2.54, *t*(14) = 2.84, *p* = .012, *d* = .71. However, younger children did not differ from chance: 3-year-olds *M* = 5.50, *SD* = 2.03, *t*(15) = 0.00, *p* = 1.00; 4-year-olds *M* = 5.69, *SD* = 2.41, *t*(15) = 0.31, *p* = .760.

Performance on Ask, Endorse, and Explicit Judgment Questions

Finally, to further examine how children responded to the separate question types, the mean number of appropriate responses to each of the question types, as a function of age and condition, is presented in Table 6.3. Using related samples *t*-tests, means for each question type were compared to a chance expectation of 2 (note that the explicit judgment scores were transformed, see above).

All age groups provided significantly more appropriate responses in the accurate vs. inaccurate condition across all question types: for 3-year-olds, ask questions, *t*(15) = 2.91, *p* = .011, *d* = .73, endorse questions, *t*(15) = 3.05, *p* = .008, *d* = .76, and explicit judgment questions, *t*(15) = 3.20, *p* = .006, *d* = .80; for 4-year-olds, ask questions, *t*(15) = 2.07, *p* = .056, *d* = .52, endorse questions, *t*(15) = 3.87, *p* = .002, *d* = .97, and explicit judgment questions, *t*(15) = 2.86, *p* = .012, *d* = .71; for 5-year-olds, ask questions, *t*(15) = 7.46, *p* = .001, *d* = 1.72, endorse questions, *t*(15) = 5.22, *p* = .001, *d* = 1.30, and explicit judgment questions, *t*(15) = 7.00, *p* = .001, *d* = 1.75.

In the accurate vs. novel condition, 4- and 5-year-olds provided significantly more appropriate responses across all question types: for 4-year-olds, ask questions, *t*(15) = 2.52, *p* = .023, *d* = .63, endorse questions, *t*(15) = 3.22, *p* = .006, *d* = .81, and explicit judgment questions, *t*(15) = 3.65, *p* = .002, *d* = .93; for 5-year-olds, ask questions, *t*(15) = 4.33, *p* = .001, *d* = .95, endorse questions, *t*(15) = 5.58, *p* = .001, *d* = 1.40, and explicit judgment questions, *t*(15) = 4.76, *p* = .001, *d* = 1.19. In contrast, 3-year-olds' did not discriminate based on informant status across the question types: ask questions, *t*(15) = 1.57, *p* = .138, endorse questions, *t*(15) = 1.07, *p* = .300, and explicit judgment questions, *t*(15) = 1.19, *p* = .252. Finally, in the inaccurate vs. novel condition, only 5-year-olds provided significantly more appropriate responses for the ask questions, *t*(15) = 2.76, *p* = .014, *d* = .69, and endorse questions, *t*(15) = 3.31, *p* = .005, *d* = .83, but not for the explicit judgment questions, *t*(15) = 1.36, *p* = .195. Overall, these analyses were largely consistent with the analysis of total overall scores.

It was interesting to note that 5-year-olds consistently selected the appropriate informant for the ask questions, endorse questions and explicit judgment questions in the accurate vs. inaccurate and the accurate vs. novel conditions. However, in the inaccurate vs. novel condition, although 5-year-olds preferred the appropriate informant for the ask and endorse questions, their selection of the appropriate informant for the explicit judgment questions did not reach significance. To put this difference in perspective, for the three explicit judgments considered simultaneously, 94% of 5-year-olds' decisions (transformed $M = 3.75$) favored the accurate informant over the inaccurate informant, and 86% (transformed $M = 3.42$) favored the accurate informant over the novel informant. By contrast, only 65% (transformed $M = 2.58$) favored the novel informant over the inaccurate informant, despite the fact that 5-year-olds significantly preferred the novel informant for the ask and endorse questions.

Discussion

There were two main aims of this study. First, we sought to establish whether 3-, 4-, and 5-year-olds apply the same epistemic strategies in the biological domain as they do for artifacts when evaluating the trustworthiness of accurate informants compared with inaccurate informants. Second, we investigated children's selective trust in informants who provide novel labels for familiar objects when compared with informants who provide accurate or inaccurate labels. The novel informant was introduced to examine how children construe a speaker who is helpful, in the sense that she provides an actual label, even though the label itself cannot be verified as correct or incorrect.

With respect to the first prediction, all age groups preferred the accurate informant over the inaccurate informant, thereby strongly replicating previous findings (Corriveau et al., 2009; Koenig et al., 2004; Koenig & Harris, 2005) despite profound differences in the epistemic domain of interest as well as minor differences in procedure (i.e., children were not asked to choose between the informants' labels during familiarization trials). This finding is important because it confirms that children's sensitivity to the accuracy of information is not domain specific and extends to body knowledge for which children must integrate information about observable and unobservable objects (and processes) into their *self-knowledge*. Children's ability to evaluate the trustworthiness of the informants who provided labels for body parts also sits comfortably with their rapidly developing body knowledge at this age (Jaakkola & Slaughter, 2002).

The second prediction was that 4- and 5-year-olds, but not 3-year-olds, would trust the accurate informant over the novel informant, a hypothesis that was fully supported. The 4- and 5-year-olds' preferences for the accurate informant in both the accurate versus inaccurate and accurate versus novel conditions lend support to the idea that from 4 years of age, children use a more advanced strategy than 3-year-olds, such that they give greater credence to informants who provide accurate information rather than simply discredit informants who are inaccurate. In contrast, 3-year-olds showed no differential preference between the accurate and novel informants. This finding supports the existing view that children under 4 years of age employ an *inaccuracy strategy*, such that they presume an informant is trustworthy unless that informant has made an error (Corriveau et al., 2009; Pasquini et al., 2007).

The third prediction was that all children would prefer the informant who had provided novel labels over the informant who had provided blatantly incorrect labels. Contrary to this expectation, only 5-year-olds showed a systematic preference for the novel labeler. Given the parity between 4- and 5-year-olds in previous trust in testimony research, as well as in the first two conditions of the current study, this difference alerts us to a possible developmental transition between 4 and 5 years of age. Furthermore, it alerts us to the fact that the assumptions made in the Introduction concerning children's willingness to entertain information from a novel labeler may be mistaken. There are various possible interpretations that can be put forward to explain this unexpected age change. However, here we outline only the most straightforward explanation for children's changing construal of the novel informant, that is, the finding that 5-year-olds, but not 3- or 4-year-olds, were able to properly evaluate the trustworthiness of the novel informant. The overall performance of 3- and 4-year-olds is first considered below before we consider the implications of 5-year-olds' pattern of results.

The failure of 3-year-olds to differentiate between the novel and inaccurate informants was surprising in light of (a) their systematic preference for the accurate labeler over the inaccurate labeler and (b) their failure to differentiate between the accurate and novel labelers. However, 3-year-olds' failure to differentiate the novel informant from either the accurate or inaccurate informant could be indicative of difficulties the youngest age group had in interpreting the behavior of the novel informant. In other words, 3-year-olds may be sensitive to inaccuracy, but only when it is presented alongside an accurate labeler (or a neutral labeler; see Corriveau et al., 2009; Koenig & Jaswal, 2011). When presented with an accurate labeler and an inaccurate labeler, they characterize the inaccurate labeler as unreliable. However, in the absence of that contrast (i.e., as in the inaccurate vs. novel and accurate vs. novel conditions), they make no determinate response. Hence, on this view, 3-year-olds are indeed alert to inaccuracy, but only under quite restricted conditions, namely, when it occurs alongside accuracy. In the case of 4-year-olds' performance, their preference for the accurate informant in the accurate versus novel condition can be explained in terms of the greater emphasis they place on informants who provide accurate information. That is, rather than take accuracy for granted like 3-year-olds, 4-year-olds strengthened their trust in the accurate informant and regarded her as more trustworthy than the novel informant. In contrast, in the inaccurate versus novel condition, where no accurate source of information was available, 4-year-olds, like 3-year-olds, may have become unsure and, hence, did not differentiate between informants.

Regarding 5-year-olds' performance in the inaccurate versus novel condition, their preference for the novel labeler stood in marked contrast to the behavior of younger children. Our results suggest that 5-year-olds treated the novel informant as significantly more credible than the inaccurate informant. A plausible interpretation of this finding is that, because children's biological knowledge increases rapidly at this age, 5-year-olds were more open to the possibility that biological objects possess more than one label. Markman and Wachtel (1988) observed that, at some stage, children eventually need to violate the assumption of mutual exclusivity in order to use multiple labels for objects. Furthermore, O'Neill (2005) suggested that children's ability to assess new information and to compare it with information that they already know should depend on their understanding of their own mind and others' minds—their theory of mind. Specifically, 5-year-olds, having a more nuanced or developed theory of mind than the younger children, may have been open to the possibility that the novel informant knew something they did not know and, hence, was providing them with information that was relevant and at least potentially credible. It is interesting to note that one 5-year-old spontaneously said that the novel informant was "like a scientist, and she's very clever." By implication, this child credited the novel informant with knowledge that she lacked. However, it is important to note that although 5-year-olds were willing to seek and endorse the labels provided by the novel informant, they held back from favoring the novel informant when asked to explicitly judge whether she was "very good" or "better" at providing the labels for the objects. In other words, 5-year-olds were still wary of placing their entire trust in the novel informant's testimony.

This study is a first attempt to examine whether children are willing to learn from informants who provide new and unfamiliar labels in comparison with informants who offer labels that children strongly know to be either accurate or inaccurate. As discussed above, 5-year-olds were more systematic in their interpretations of the novel informant than their younger counterparts. Questions still remain about how younger children construed the novel informant. Nevertheless, this study paves the way for further research to be conducted. For example, 4- and 5-year-olds' preference for the novel informant differed according to whether she had been paired with an accurate informant or an inaccurate informant. In contrast, 3-year-olds' trust in the novel informant was similar irrespective of the informant with whom she was paired. These results suggest that there may be emerging context effects, namely, the role of the contrasting informant. To explore these effects, in a future study, children could be initially familiarized with the novel informant, who is paired with either an accurate or inaccurate informant. In subsequent test trials, the novel informant could then be paired with a new informant whose reliability is completely unknown. The findings of such a study would demonstrate whether children selectively trust or distrust the novel informant in comparison with the new informant and whether their trust is tempered by the context in which she is presented (i.e., the familiarization trials). Future research could also use a single informant paradigm in which children decide whether to trust the information provided by a sole novel informant. Other research avenues could include contrasting the novel informant with different types of informants (e.g., neutral, knowledge able, ignorant) to clarify how children view the novel informant in light of sources they already know to be reliable or unreliable.

Overall, surveying the performance of the three age groups, it is clear that there were profound developmental changes in children's construal of the various informants, and these differences extend to the comparison between 4- and 5-year-olds when the novel informant was introduced. The extant literature on children's trust in testimony suggests that there is a fundamental shift in children's emphasis on accuracy and inaccuracy between 3 and 4 years of age, but much less attention has been given to the differences between 4- and 5-year-olds. Our results strongly suggest that 5-year-olds are better able to simultaneously consider the implications of both accuracy and inaccuracy than their 4-year-old counterparts, and it may be for this reason that they are more open to the new information provided by the novel informant. At the very least, it is clear that the novel informant is construed differently by each age group and is seen as informative by older children. Nevertheless, it remains possible that younger children could use explanations and other markers of plausibility (e.g., confidence, expertise) when evaluating the credibility of informants presenting new information. For example, Jaswal (2004) showed that 3- and 4-year-olds were more accepting of an unexpected label for a picture of a hybrid animal, which more closely resembled a cat than a dog, when a speaker signaled that the use of the label was deliberate by saying, "You're not going to believe this, but this is actually a dog," rather than when the speaker simply stated, “This is a dog.” In the current study, the novel informant was presented without any other contextual information, and yet 5-year-olds were still receptive to the informant’s credibility. Such receptivity might extend downward if the novel informant were to provide a justification for why a different (unfamiliar) label was used instead of the accurate label. Indeed, 5-year-olds might even explicitly judge the justified novel informant to be “very good” or “better” at providing information under such conditions, a possibility that could be directly tested.

In conclusion, the results of this study show that children’s monitoring of the accuracy of information is not exclusive to highly observable artifacts. Children apply the same epistemic principles when observing accurate and inaccurate labelers of objects from domains that consist of largely unobservable entities (i.e., body parts and organs). Furthermore, it appears that it is not until 5 years of age that children reliably trust informants who provide new and unfamiliar labels for objects for which they possess prior knowledge. That is, 5-year-olds begin to grasp the notion that people who offer new information are more trustworthy than those who offer blatantly incorrect information, and they will seek and endorse new information from such informants. At the same time, 5-year-olds continue to exhibit a degree of caution; they do not judge such informants as being more competent at providing the information.

Chapter 7
Study 3A and 3B

The results of Chapter 6 show that, using the traditional paradigms, children's epistemic trust extends to the biological domain. Hence, the subsequent studies presented in this thesis sought to establish the extent to which children's scepticism extends to explanations about objects of the human body. In keeping with the points raised in Chapter 3, I examined *explanatory depth* as a cue to an informant's (accuracy-independent) competence in the following study given that children receive testimony that extends beyond labels for objects. There has been some research into children's sensitivity to different types of explanations. For instance, Baum et al. (2008) investigated children's evaluations of explanations that were either circular or non-circular, and found that children by the age of five or six demonstrate a preference, albeit fragile, for non-circular explanations over circular explanations, which suggests that children have some capacity to monitor and evaluate the quality of explanations.

In relation to the human body and children's developing naive biology, Morris et al. (2000) investigated children's preferences for certain types of causal explanations for specific bodily processes, and found that five-year-olds preferred vitalistic explanations (e.g., "Because our chest takes in energy from the air we breathe"), over a physiological explanation (e.g., "Because our lungs take in oxygen and change it into carbon dioxide that we have no use for") and an intentional explanation (e.g., "Because we want to make ourselves feel fresh again"). However, no studies to date have directly examined how children evaluate explanations about body parts and organs which are obvious (e.g., external observable features), when compared to deeper functional explanations (e.g., internal functions).

In one study, which featured an internal-external distinction, Sobel and Corriveau (2010) showed that children from the age of four prefer learning labels from informants who are knowledgeable of objects' internal, rather than external, properties. In other words, children recognise the distinction between internal and external properties, and they consider informants who know about internal properties of objects to know more than informants who know about external properties. Such findings can be treated analogously to the internal-external distinction of the human body. For example, children's knowledge of the function and location of various organs increases between the ages of four and eight (Jaakkola & Slaughter, 2002). In Study 1 (presented in Chapter 5), four- and five-year-olds were very skilled at identifying external body parts and explaining their respective functions. In addition, several four- and five-year-olds made references to the core or peripheral functions of internal organs, which highlights their developing awareness of internal bodily processes: brain (*n* = 14), heart (*n* = 10), lungs (*n* = 7), stomach (*n* = 4), and kidney (*n* = 4). For instance, children referred to the brain as being "for thinking", the heart as being "for pumping the blood", and the lungs as being "for breathing". In summary, children may consider informants who offer additional information about internal processes of organs to be more trustworthy than informants who offer only obvious information. Certainly, as adults, we could conceive of an informant who offers functional explanations about the inner workings of the eye (or any other artifact for that matter) to be more knowledgeable than an informant who can only talk about external and observable characteristics (e.g., colour, parts).

In contrast to the typical design of existing studies, Study 3A omitted the initial four familiarisation trials. These trials were removed because the goal of the study was not to present children with informants who differed in the accuracy by which they labelled objects, but to examine whether children are aware of different types of explanations. In addition, it would be difficult for the informants to provide information about the functions of organs without making reference to what they were called, and it is possible that omitting their labels could be construed as a sign of ignorance by children. In the four test trials, informants provided different novel labels and additional information about internal organs which children would not be familiar with (i.e., pancreas, gall bladder, liver, larynx). At the end of each test trial, children were asked whose label they would endorse. There were two types of *functional* explanations; one that concerned the workings of the organ and its relevant processes (*process-oriented*), and one that concerned the "purposeful design" of the organ (*teleology-oriented*). The process-oriented and the teleology-oriented informants, who both provide functional explanations, were contrasted with a *surface* informant who provided obvious descriptions of the organ's outer characteristics. Based on Chouinard (2007), the surface informant provided descriptions of appearance (e.g., colour), property (e.g., smoothness, hardness), parts, and number. The two functional explanation types were presented to different subjects (between-groups) and they were contrasted with the same surface descriptions. Stimuli are shown in Tables 7.1 and 7.2.

The process-oriented explanations were made up of a function (e.g., "That part of the body makes energy") and a statement of the process that accompanies the function (e.g., "It sends out a message that tells your body to turn the food you eat into energy when you are moving around"). Such explanations were built upon the findings of Chouinard (2007), in which children are more likely to seek information about the functions and activities of objects rather than information about external observable properties. Further, as shown in Study 1 (Chapter 5), children frequently made references to the core or peripheral functions of body parts and organs when asked, "what do you use your X [body part/organ] for?"

In contrast, the teleology-oriented explanations were made up of a state which the body is striving for (e.g., “When you want to keep moving, your body needs to get energy from the food you eat”) and a statement of the organ's function that allows the body to reach its target state (e.g., “That part of the body is for getting energy”). The teleology-oriented explanations were devised based on the work of several researchers. For example, Jaakkola and Slaughter (2002) investigated children's teleological reasoning with respect to the biological goal of life and found that, between the ages of four and six, children make reference to the importance of bodily functions in maintaining life. Indeed, as found in Study 1, some of the four- and five-year-olds referred to the function of particular organs (e.g., brain, heart) as being for keeping a person alive. Further, Kelemen (1999a) showed that four- and five-year-olds, and adults, tended to view body parts and artifacts in teleological terms; that the entity is *for X* because they are *designed to do X*. Finally, in Keil (1992), five- to seven-year-olds preferred teleological explanations (e.g., plants are green "because it is better for plants to be green and it helps there be more plants") over mechanical explanations (e.g., "there are little tiny parts in plants that when mixed together give them a green colour").

In accordance with existing studies of selective trust, children were asked to endorse one of the novel labels provided by the informants (e.g., “The girl in the orange shirt said it’s a slod and the girl in the orange shirt said it’s a linz. What would you say?”). At the end of the four endorse trials, children were asked three explicit judgement questions. These questions deviate from those used in the existing selective trust research as they asked children to judge which informant was "very good", "not very good" and "better" at “talking about these things”, rather than “saying the names of these things”. The questions were asked in this way to pick up on children’s sensitivity to the competence of the informants. For instance, it is possible that children may fail to differentiate between informants when required to endorse novel labels. However, they may discriminate between informants when judging who is "very good" or "not very good" at providing information about the organs. A justification question (after the explicit judgement questions) also probed why children chose a particular informant as being "better" at talking about the organs. It was hoped that this would allow children to comment on the informants' underlying knowledge or ability.

Therefore, Study 3A assessed how children differentially trust informants on the basis of explanation type as a function of age. There were two independent variables: Age (four- or five-year-olds) and type of contrast for explanatory depth (i.e., Condition: process-oriented vs. surface OR teleology-oriented vs. surface). Four- and five-year-olds were tested in Study 3A given the verbally demanding nature of the task and the possibility that there is a developmental transition between these ages. The two dependent variables were: (1) number of test trials in which children endorsed the novel label provided by the functional informant, and (2) number of times children judged the functional informant as being "very good" and "better". It was predicted that children would be more likely to endorse the informant who provided functional explanations over the informant who provided surface explanations, as well as judge the functional informant to be a better source of information.

In addition, I also looked at individual differences in children's verbal ability and their theory of mind (ToM). My rational for doing this was simple. First, given the focus on explanations, which are syntactically and semantically much more demanding than labels, I thought that verbal ability might relate to trust (i.e., verbally more competent children are better able to evaluate the different explanation types) even if age did not. Second, and this was a long shot, I thought that children with better ToM might be more switched on to the *intent* of their interlocutor. So this is more than verbal ability per se, ToM here is used to assess the extent to which children are evaluating the purpose of their interlocutor's communicative efforts. Previous research has investigated the relation between children's ToM and selective trust (Diyanni et al., 2012; Fusaro & Harris, 2008; Pasquini et al., 2007), but such studies have yet to establish definitive links.

Method – Study 3A

Participants

Participants were 64 children (32 girls) in two age groups: four-year-olds (*M* = 53.59, *SD* = 3.36, *Range* = 48-59), and five-year-olds (*M* = 63.44, *SD* = 3.37, *Range* = 60-71). All children lived in the metropolitan area and spoke fluent English. Most children were Caucasian, although a range of ethnicities was represented. Children were recruited via parental invitation and tested individually in a quiet room in their school.

Materials and Procedure

Selective trust. Stimuli were presented as video clips on a laptop. There were four test trial video clips. In each clip, two female informants (wearing either an orange or blue shirt) sat on either side of a table and a male interviewer (wearing a black shirt) stood between them. The interviewer held up, at chest height, a white A3-sized sheet of cardboard with a colored picture of an organ printed on it. The order of organs presented was the same for all children.

Introduction to the task. The experimenter introduced the task, by saying, “We’re going to learn some things about the body today. Look at this [picture book]. Did you know that there are bones inside your body? Have a look here. There are other things inside your body. Here are your lungs. Do you know where your lungs are? How about your stomach? Etc. Okay, let’s put this book away. We’re going to play a little game on the laptop about the body. The game looks something like this [show still frame]. First, we’re going to meet these three people. Do you see them? The boy in the black shirt is going to hold up some pictures. Then, this girl in the orange shirt and this girl in the blue shirt are going to tell you what they know about the things in the pictures. The pictures are going to be things that are inside your body. It’s okay if you don’t know what some of these things are; that’s what we are going to learn about today. I want you to listen very carefully and then I’m going to ask you some questions. Are you ready?”

Endorse questions. At the beginning of each test trial, children were shown an unfamiliar organ and asked, “Do you know what this is called?” If they responded with something other than no, the experimenter said, “Actually, I don’t think that’s what it is called”. Then: "I bet these girls can help us. Let’s listen to what the girls say." In the video clip, the male interviewer stated, "Can you tell me what you know about this?" and the informants responded (see Tables 7.1 and 7.2 for stimuli). After each test trial, children were asked: “The girl in the blue shirt said it’s a ___, and the girl in the orange shirt said it’s a ___. What would you say?”

Explicit judgement questions. After all test trials, the experimenter asked three explicit judgement questions. The order in which the informants were referred to in the first two questions was counterbalanced. The questions were: (1) “Was the girl in the orange shirt very good or not very good at talking about these things?”, (2)“Was the girl in the blue shirt very good or not very good at talking about these things?”, and (3) “Which girl was better at talking about these things?”

Justification question. At the end of the study, children were asked, “Why did you say the girl in the [blue/orange] shirt was better at talking about these things?”

Table 7.1

Test Trials in the Processes-Oriented Condition.

Organ	Process-Oriented Informant	Surface Informant
Pancreas	That's a slod. That part of the body makes energy. It sends out a message that tells your body to turn the food you eat into energy when you are moving around.	That's a linz. It has a long lumpy yellow part and green lines going through it. There is a long pink tube at the front and it curls around.
Larynx	That's a yiff. That part of the body traps air to make noise. It opens up to let air pass through and helps you talk when air gets trapped inside.	That's a zazz. It has three yellow plates at the top and many blue discs near the bottom. The white parts are bones and they make it hard.
Gall Bladder	That's a mogo. That part of the body breaks down the fat that is in some of the foods you eat, like junk foods. It makes special stuff that mixes with the fat and breaks it into smaller pieces.	That's a nevi. It is a small green thing that is inside your body. There is a smooth round shape at the top and it is joined to two long green skinny tubes at the bottom.
Liver	That's a tark. That part of the body makes new blood. It takes the old blood, breaks it up and uses the parts to make new blood.	That's a chab. It has two red parts and the part on the left is bigger. There is a pink string in the middle and a blue hole at the top.

Table 7.2

Test Trials in the Teleology-Oriented Condition.

Organ	Teleology-Oriented Informant	Surface Informant
Pancreas	That's a slod. When you want to keep moving, your body needs to get energy from the food you eat. That part of the body is for getting energy.	That's a linz. It has a long lumpy yellow part and green lines going through it. There is a long pink tube at the front and it curls around.
Larynx	That's a yiff. When you have something to say, your body needs to make sound. That part of the body is for making sound and talking.	That's a zazz. It has three yellow plates at the top and many blue discs near the bottom. The white parts are bones and they make it hard.
Gall Bladder	That's a mogo. When you want to stay healthy, your body needs to break down the fat that is in some of the foods you eat, like junk foods. That part of the body is for breaking down fat.	That's a nevi. It is a small green thing that is inside your body. There is a smooth round shape at the top and it is joined to two long green skinny tubes at the bottom.
Liver	That's a tark. When you don't have enough blood inside, your body needs to make more blood. That part of the body is for making new blood.	That's a chab. It has two red parts and the part on the left is bigger. There is a pink string in the middle and a blue hole at the top.

Verbal Ability and Theory of Mind

Verbal ability. Verbal ability was assessed using the WPPSI-III *information, vocabulary* and *word reasoning* subtests. In the information subtest, children were asked various general knowledge questions (e.g., “How many legs does a bird have?” or “How many days make a week?”). In the vocabulary subtest, children were asked to define or describe given words (e.g., “What is a train?” or “What does swing mean?”) Finally, in the word reasoning subtest, children listened to a series of clues about an object and were required to guess what the object was (e.g., “This is something you chew... and it can make bubbles”). In each subtest, the questions became progressively more difficult. Verbal ability was scored by adding each correct response and creating a raw score for each subtest. Each raw score was then standardized and then added to create a total standardized verbal ability score.

Theory-of-mind tasks. Children's ToM was assessed using three tasks: (1) a first-order reasoning unexpected contents task, (2) a first-order reasoning unexpected transfer task, (3) a first-order reasoning unexpected transfer task, with a second-order false belief question. All tasks were presented in a storybook format with coloured pictures. The script and pictures used for these ToM tasks are presented in Appendix E.

In Task (1), children were shown a box of Pringles which, unexpectedly, held crayons inside. After being introduced to a protagonist (Lily), children were asked a false belief question, "Lily has never seen inside this box of Pringles before. What does Lily think is inside the box?" and a memory question, "What's really inside the box?" Children were scored as passing this task if they were able to correctly answer the false belief question (i.e., "chips/Pringles") and the memory question (i.e., "crayons").

In Task (2), children were introduced to a boy (Luke) who had initially placed his ball inside a pink box. While Luke is absent, another boy (Sean) moves the ball from the pink box to a blue box. After being told that Luke returns for his ball, children were asked a false belief question, "Where will Luke look for his ball?" and a memory question, "Where is the ball really?" Children were scored as passing this task if they were able to correctly answer the false belief question (i.e., "pink box") and the memory question (i.e., "blue box").

In Task (3), children were introduced to two siblings (Mary and Simon), who were told by their father to place a bar of chocolate in the fridge. While Mary is absent, Simon decides to keep the chocolate for himself and hides the chocolate in his bag. Children were first given the first-order reasoning component of this task, in the form of a *false belief* question, "Where does Mary think the chocolate is?" and a *memory* question, "Where has Simon really put the chocolate?" Children were scored as passing this task if they were able to correctly answer the false belief question (i.e., "fridge") and the memory question (i.e., "bag"). It was subsequently revealed to children that Mary was playing by the kitchen window and had witnessed Simon hiding the chocolate in his bag. Children were then given the second-order reasoning component of this task, in the form of a *false belief* question, "Where does Simon think Mary will look for the chocolate?" and a *memory* question, "Where was the chocolate first of all?" Children were scored as passing this task if they were able to correctly answer the false belief question (i.e., "fridge") and the memory question (i.e., "bag").

From these tasks, two separate ToM scores were derived: a first-order reasoning score with a minimum of 0 and a maximum of 3, created by adding up the number of first-order reasoning tasks passed; and a second-order reasoning score with a minimum of 0 and a maximum of 1, based on whether children passed the second-order reasoning task.

Results

Results will be presented in the following order. First, children's responses in the selective trust paradigm as a function of age are described. Second, relations between children's selective trust and ToM are outlined. Finally, differences in children's selective trust based on level of ToM understanding are further elaborated.

Children's Selective Trust as a Function of Age

Children were given a point for an *appropriate* response in each endorse trial and explicit judgement question: i.e., selection of the informant who provided functional explanations was considered to be appropriate. Separate total scores were created by summing children's appropriate responses, resulting in a total score from 0-4 for endorse trials, and 0-3 for explicit judgement questions. To allow meaningful comparison with endorse totals, scores for the explicit judgement questions were linearly transformed (i.e., multiplied by 4/3). An overall total score was also created by summing the endorse total and the (transformed) explicit judgement total, resulting in a total score from 0-8.

Table 7.3 presents the mean number of appropriate responses to each of the question types, as well as total scores, as a function of age and condition. Using related samples *t*-tests, means for the endorse trials and explicit judgement trials were compared to a chance expectation of 2, and means for the overall total score was compared to a chance expectation of 4.

Analyses revealed that children's selective trust for each age group did not significantly differ from chance for any of the endorse trials and explicit judgement questions, nor for the overall total scores. The only exceptions were two marginally significant results. In the teleology vs. surface condition, five-year-olds tended prefer the surface informant for the explicit judgement questions, $t(15) = 2.00$, $p = .064$, and the overall total, $t(15) = 2.10$, $p = .054$.

Table 7.3

Mean Number (and SD) of Appropriate Responses to Question Types, and Total Scores, as a Function of Age and Condition.

	4-year-olds (n = 32)	5-year-olds (n = 32)
Process vs. Surface		
Endorse trials (/4)	1.69 (1.40)	2.06 (1.18)
Explicit judgements (/4)	1.83 (1.81)	1.58 (1.63)
Overall Total (/8)	3.52 (2.99)	3.65 (2.41)
Teleology vs. Surface		
Endorse trials (/4)	2.38 (1.02)	1.56 (1.09)
Explicit judgements (/4)	2.25 (1.87)	1.25 (1.50)[a]
Overall Total (/8)	4.63 (2.44)	2.81 (2.27)[b]

[a] p = .064 [b] p = .054

A 2 x 2 x 2 mixed ANOVA was conducted with age (four- and five-year-olds) and condition (process vs. surface and teleology vs. surface) as between-subjects variables, and question type (endorse trials and explicit judgement questions) as the within-subjects variable. No significant main effects or interactions were found (all *ps* > .05), indicating that children's selective trust did not differ across the three age groups, conditions, and question types.

Given the parity in performance between the process vs. surface and teleology vs. surface conditions, children's responses were collapsed across conditions, such that higher scores indicate greater preferences for the functional informant. By doing so, statistical power was also increased, which assisted in the analysis of children's selective trust based on their verbal ability and ToM performance. These analyses are detailed in the next sections.

Correlations Between Children's Selective Trust, Verbal Ability, and ToM

Correlations between children's selective trust, ToM (first-order and second-order reasoning scores) and verbal ability are presented in Table 7.4. There were no indications that children's selective trust was related to verbal ability. However, there was a modest relation between children's first-order false belief reasoning and their tendency to endorse, across the whole sample ($r = .255$, $N = 64$, $p < .05$). Specifically, children who performed better on the first-order ToM tasks tended to select the appropriate informant in the endorse trials; that is, the functional informant. In the next section, we look at this result more closely, specifically focussing on age.

Table 7.4

Correlations Between Children's Selective Trust, ToM and Verbal Ability.

	Endorse trials	Explicit judgements	Overall total	Verbal Ability	1st-order false belief	2nd-order false belief
Endorse trials	1	.542**	.867**	.054	.255*	-.046
Explicit judgements		1	.886**	-.014	.095	-.139
Overall total			1	.021	.193	-.099
Verbal Ability				1	.392**	.233
1st-order false belief					1	.365**
2nd-order false belief						1

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the .01 level (2-tailed).

Children's Selective Trust as a Function of ToM Performance

Children were classified into two groups according to their performance on the first-order reasoning tasks: those who successfully passed all tasks, and those who did not pass all tasks. Table 7.5 outlines children's selective trust according to their performance on the ToM tasks, collapsed across conditions.

Table 7.5

Mean Number (and SD) of Appropriate Responses to Question Types, and Total Scores, as a Function of Age and ToM performance.

	Did not pass all ToM tasks	Successfully passed all ToM Tasks
Four-year-olds	n = 25	n = 7
Endorse trials (/4)	2.04 (1.27)	2.00 (1.29)
Explicit judgements (/4)	2.19 (1.80)	1.52 (1.95)
Overall total (/8)	4.23 (2.71)	3.52 (3.01)
Five-year-olds	n = 20	n = 12
Endorse trials (/4)	1.35 (1.04)*	2.58 (0.90)*
Explicit judgements (/4)	1.07 (1.41)**	2.00 (1.66)
Overall total (/8)	2.42 (2.19)**	4.58 (1.98)

Note. Asterisks denote response patterns that are different from chance * $p < .05$ ** $p < .01$

Using related samples *t*-tests, means for the endorse trials and explicit judgement trials were compared to a chance expectation of 2, and means for the overall total score was compared to a chance expectation of 4. It was found that five-year-olds who successfully passed all ToM tasks endorsed the functional informant at a rate significantly above chance, $t(11) = 2.24$, $p = .046$. On the other hand, five-year-olds who did not pass all ToM tasks were significantly below chance in their endorsement of the functional informant, $t(19) = 2.80$, $p = .012$, their explicit judgements of the functional informant as being a better source of information, $t(19) = 2.96$, $p = .008$, as well as their overall total scores, $t(19) = 4.58$, $p = .004$.

Independent samples *t*-tests were conducted to examine whether children's endorsements, explicit judgements and overall totals differed as a function of success on first-order ToM tasks (did not pass vs. passed all). For four-year-olds, analyses revealed no significant results, indicating that their selective trust in the informants did not differ according to ToM. However, for five-year-olds, selective trust significantly differed depending on ToM for endorse trials, $t(30) = 3.40$, $p = .002$, and for overall totals, $t(30) = 2.80$, $p = .009$. In other words, five-year-olds who were more skilled at ToM were more likely to trust the informant who provided functional explanations. Post-hoc analyses showed that this was true in both conditions. However, there was not enough power to look at them separately. To sum, it appears that five-year-olds who are highly skilled in ToM are more likely to trust an informant who provides functional explanations.

Discussion

The aim of this study was to examine whether four- and five-year-olds differentiate between informants who offer explanations that differ in explanatory depth. It was anticipated that children would be more likely to trust an informant who provided functional explanations about organs, rather than an informant who provided only obvious descriptions of observable characteristics. Overall, this core manipulation was largely unsuccessful. Four- and five-year-olds do not differentially trust informants who differ in level of explanatory depth when it comes to information provided about internal organs. That is, children do not consider functional explanations, whether process- or teleology-oriented, to be more informative than surface descriptions. Several reasons are put forward to explain why this manipulation did not work, as well as alternative approaches.

First, it is possible that the information offered by the informants is too detailed and complex for children to monitor and understand. In contrast to previous studies on children's selective trust, which feature one-word labels or very brief descriptions (e.g., object functions), both informants in this study gave lengthy descriptions/explanations. It is possible, therefore, that children perhaps had difficulty attending to the differential explanatory depth of the informants because they were unable to adequately process the large amount of information. However, such an explanation is unlikely because children's verbal mental ability was assessed and no relations were found between verbal mental ability and selective trust. Nevertheless, it is possible that older children (e.g., eight-year-olds) need to be tested to examine whether they are better able to differentiate between the information offered by the informants. This possibility is explored in Study 3B, presented in the next section.

Second, children's inability to differentiate between informants may be due to the complexity of the domain of biological knowledge. As mentioned earlier, children's knowledge of the body increases markedly between the ages of four and eight (Jaakkola & Slaughter, 2002). However, in terms of functional explanations, internal organs are usually described in terms of *what they do* rather than *how people use them*. For example, it is more appropriate to say that the heart "beats and pumps blood around the body", rather than to say that "you use your heart to beat and pump blood around the body". In contrast, functional information provided about common artifacts tend to be explained in terms of *how people use them* (e.g., "you use a hammer to drive nails into wood") rather than *what they do* without reference to an agent's act upon the artifact (e.g., "hammers drive nails into wood" sounds less suitable). In this study, it may have been difficult for children to conceptualise organs as performing the activities mentioned because the explanations were largely about *what they do*. To address this potential issue, a follow-up study could present novel objects (i.e., artifacts, as done in existing literature) and informants who offer information which differs in explanatory depth; in particular, the functional informant would describe *how people use* the artifact. It is possible that children may be better able to judge which informant provides adequate explanations for objects when it is framed in terms of its intended use by people, rather than when it is framed in terms of what they do.

Finally, children may have been unable to differentiate between informants because they were perplexed by the unfamiliar internal organs presented. In this study, none of the children could correctly identify any of the internal organs. As a result of their lack of knowledge, they may have been more inclined to select the novel label which they thought sounded *more right* for the organ presented, rather than attend to the differential explanatory depth in the additional information presented. Under this interpretation, it is also possible that the trend for five-year-olds to prefer the labels provided by the surface informant was because they were better able to verify the claims of the surface informant, since her claims matched the picture of the unfamiliar organs presented, whereas the claims of the functional informant did not. Therefore, to rectify this issue of unfamiliarity, it may be necessary to re-introduce the familiarisation trials, featuring familiar body parts (e.g., eye, hand). In doing so, children may be better able to attend to different levels of explanations because they possess the pre-existing knowledge to evaluate what informants say about the body parts. For example, they may consider an informant who talks about what the eye is used for and does as being more informative than an informant who simply describes the outward appearance of the eye. Interestingly, the functions of external body parts are often described in terms of *how people use them*, rather than *what they do* (e.g., you use your hand for touching, your feet for walking), so children may be better able to differentiate between functional and surface informants if explanations are framed in terms of how they are used by people. In subsequent test trials, after being exposed to different levels of explanatory depth, children would be asked who they prefer learning about internal organs from. As demonstrated in Study 2, children were willing to learn labels of internal organs from previously accurate labellers of body parts. Therefore, they may be just as likely to prefer learning about internal organs from informants who are good at explaining the functions of external body parts. On a related note, familiarisation trials featuring familiar artifacts could also be used to assess whether children prefer learning about novel artifacts from informants who previously offered functional explanations about familiar artifacts. This possibility is further investigated in Chapter 8.

Despite the absence of systematic relations between age and selective trust, the finding that selective trust was related to ToM was surprising. In previous research, links between children’s trust in an accurate labeller and ToM have not been established. For instance, Pasquini et al. (2007) found no relation between three- and four-year-olds’ false belief understanding, assessed using an unexpected contents task, and their selective trust in reliable informants. However, the findings of Fusaro and Harris (2008) suggested that the two abilities are related; at least for four-year-olds. It is important to note that the selective trust paradigm in Fusaro and Harris was slightly different because the informants were not presented as either accurate or inaccurate. Instead, in the familiarisation trials, the comparison was made between an informant, whose labelling elicited cues of assent (e.g., nods and smile) from two bystanders, and another informant, whose labelling elicited cues of dissent (e.g., headshakes and frowns) from the same bystanders. Further, four-year-olds completed a battery of mental state understanding (MSU) tasks, rather than a single false belief task, which assessed diverse desires, diverse beliefs, perceptual access and knowledge, false belief, and hidden emotion. Results revealed that children classified to be high in MSU systematically favoured the informant who previously invoked bystander assent (even when the bystanders were no longer present in the test trials), whereas children classified as being low in MSU did not reliably differentiate between the informants.

In the present study, an interesting relation between five-year-olds' trust in the functional informant and their ToM emerged. Further, the finding that children's selective trust was unrelated to their verbal ability strongly suggests that preference for the informant who offered functional explanations was simply not due to how verbally competent they were. While children's ToM does not relate to their trust in accurate labellers, the complexities of the information provided by informants in the present study may have allowed the relations between ToM and selective trust to emerge. In other words, children who had better ToM may have been better attuned to the *intent* of their interlocutor. Drawing upon the findings of Fusaro and Harris (2008), children who were higher in ToM may have been better able to identify the enduring knowledge state of the functional informant, and that the explanations provided by the functional informant was more informative, whereas those children who were lower in ToM considered the surface informant to be more trustworthy because she was providing information that could be directly confirmed using the picture of the internal organs presented.

In conclusion, it seems that four- and five-year-olds do not differentiate between informants who offer functional or surface information about unfamiliar internal organs. Various modifications to the procedure have been suggested to rectify existing issues, as well as to further investigate children's selective trust in informants who differ in explanatory depth. Nonetheless, there appears to be a relationship between five-year-olds' ToM and their selective trust in that children who are better skilled at ToM are more likely to trust an informant who provides functional explanations of internal organs. On the other hand, five-year-olds who are lower in ToM are more likely to trust an informant who provides descriptions of the observable characteristics of internal organs.

Study 3B

Study 3B was conducted as a follow-up study to Study 3A, which examined four- and five-year-olds' sensitivity to *explanatory depth* as a cue to informants' (accuracy-independent) competence. The rationale behind the original study was to directly examine whether children differentiate between obvious explanations (which refer to features that are highly observable) and deeper functional explanations (which refer to non-observable internal functions) for parts of the body. In contrast to the typical design of existing selective trust studies, Study 3A omitted the initial four familiarisation trials. In the four test trials, informants provided a novel label and followed it up with explanations for the internal organ which children would not be familiar with (i.e., pancreas, gall bladder, liver, larynx). At the end of each test trial, children were asked whose novel label they would endorse. There were two types of *functional* explanations; one that concerned the workings of the organ and its relevant processes (*process-oriented*), and one that concerned the "purposeful design" of the organ (*teleology-oriented*). The process-oriented and the teleology-oriented informants, who both provided functional explanations, were contrasted with a *surface* informant who provided obvious descriptions of the organ's outer characteristics.

The results of Study 3A revealed that four- and five-year-olds did not systematically differentiate between informants who provide functional explanations or surface descriptions of unfamiliar internal organs. However, there appeared to be a relationship between five-year-olds' first-order ToM and their selective trust, particularly in relation to their endorsements of informants. With such findings in mind, the next step was to test a group of older children (i.e., eight-year-olds) to see whether they would be better able to differentiate between the functional and surface informants. Children's first- and second-order ToM were also assessed to see whether the relation between ToM and selective trust was still evident. Finally, to obtain a better sense of how children construed the two informants, children were asked a series of structured questions at the end of the testing session. Such questions assessed the extent to which children could remember which informant provided a particular type of explanation, as well as whether they thought that both informants were equally knowledgeable or whether one informant was more knowledgeable than the other.

If eight-year-olds were found to differentiate between the two types of explanation offered by the informants, it could then be concluded that children are sensitive to the depth of explanations (at least about entities which are unfamiliar and not directly observable), but only when they are much older. If, however, eight-year-olds were still unable to differentiate between the two types of explanation, it could then be concluded that the manipulation is probably ineffective and does not warrant further examination.

Method

Participants

Participants were 32 eight-year-olds (16 girls): *M* = 98.34, *SD* = 3.05, *Range* = 93-107. All children lived in the metropolitan area and spoke fluent English. Most children were Caucasian, although a range of ethnicities was represented. Children were recruited via parental invitation and tested individually in a quiet room in their school.

Materials and Procedure

Materials and procedure were identical to Study 3A. However, a series of follow-up questions presented after the selective trust paradigm were included, as detailed below.

Additional questions. Children were asked a series of follow-up questions to further examine their interpretations of the informants. The order in which each informant was referred to, the order of memory questions, and the order by which *function* and *appearance* were referred to in the final question were counterbalanced.

Knowledge comparison questions. Children were asked: (1) “Did the girl in the orange shirt know lots of things about the body or not so many things?” (2) “Did the girl in the blue shirt know lots of things about the body or not so many things?” and (3) “Which girl knew more things about the body?”

Memory-functional questions. Children were asked: (1) “Did the girl in the orange shirt talk a lot about what the things inside the body are for or not so much?” (2) “Did the girl in the blue shirt talk a lot about what the things inside the body are for or not so much?” and (3) “Which girl talked more about what the things inside the body were for?”

Memory-surface questions. Children were asked: (1) “Did the girl in the orange shirt talk a lot about what the things inside the body look like or not so much?” (2) “Did the girl in the blue shirt talk a lot about what the things inside the body look like or not so much?” and (3) “Which girl talked more about what the things inside the body look like?”

Function vs. Appearance question. Children were asked, “Do you think someone is smarter if they know what something is for or if they know what something looks like?”

Verbal ability. In contrast to Study 3A with four- and five-year-olds, verbal ability was assessed using the Test of Language Development (TOLD) *picture vocabulary* and *oral vocabulary* subtests because it is developmentally appropriate for eight-year-olds. In the picture vocabulary subtest, children were shown a series of four pictures and asked to point to the picture that best represented the target word spoken by the experimenter. In the oral vocabulary subtest, children were asked to define or describe given words (e.g., “What’s a bird?” or “What does sad mean?”). In each subtest, the questions became progressively more difficult. Verbal ability was scored by adding each correct response and creating a raw score for each subtest. Each raw score was then standardized and then added to create a total standardized verbal ability score.

Theory-of-mind tasks. Children’s ToM was assessed using the same tasks used in Study 3A, with the addition of a fourth vignette. In this new task, children were introduced to a boy named Joe, who is unaware that his mother has bought him a new bike and hidden it in the garage. Joe expresses his desire for a new bike to his mother. However, in her attempt to surprise Joe, she informs him that she has bought him a toy instead. Children were given the first-order reasoning component of this task, in the form of a *false belief* question, “What does Joe think he’s getting for his birthday?” and a *memory* question, “What is he really getting?” Children were scored as passing this task if they were able to correctly answer the false belief question (i.e., “toy”) and the memory question (i.e., “bike”). It was then subsequently revealed that Joe found the bike in the garage while looking for a ball to play with. Children are then shown Joe’s parents having a conversation. Joe’s father asks Joe’s mother whether their son knows what present he is getting. Children are asked a second-order ignorance question, “What does Joe’s mum say?” and to provide a justification, “Why does she say that?” Next, Joe’s dad asks, “What does Joe think you got him for his birthday?” Children were then given the second-order reasoning component of this task, in the form of a *false belief* question, “What does mum say?” and to provide a justification, “Why does she say that?” Next, children were given two additional questions: a *reality control* question, “What does Joe really know he is getting for his birthday?” and a *memory* question, “What did Joe’s mum pretend he was getting first of all?” Children were scored as passing this task if they were able to correctly answer the false belief question (i.e., “toy”) and the reality control and memory questions (i.e., “bike” and “toy” respectively).

From these tasks, two separate ToM scores were derived: a first-order reasoning score with a minimum of 0 and a maximum of 4, created by adding up the number of first-order reasoning tasks passed; and a second-order reasoning score with a minimum of 0 and a maximum of 2, created by adding up the number of second-order reasoning tasks passed.

Results

Results will be presented as follows. First, eight-year-olds' responses in the selective trust paradigm and to the follow-up questions will be described. Second, children's performance on the ToM tasks and verbal ability assessments, and its relations to selective trust will be outlined. Finally, differences in children's selective trust as a function of age (i.e., comparing results to that of Study 3A) will be further examined.

Eight-Year-Olds' Selective Trust

Children were given a point for selecting the functional informant in each endorse question and explicit judgement question. Separate total scores were created by summing children's appropriate responses, resulting in a total score from 0-4 for endorse questions, and 0-3 for explicit judgement questions. To allow meaningful comparison with endorse totals, scores for the explicit judgement questions were linearly transformed (i.e., multiplied by 4/3). An overall total score was also created by summing the endorse total and the (transformed) explicit judgement total, resulting in a total score from 0-8.

A mixed ANOVA was conducted with condition (process vs. surface and teleology vs. surface) as the between-subjects variable, and question type (endorse, explicit judgement) as the within-subjects variable. No significant main effects for condition were found, $F(1,30) = .73$, $p = .401$, and the condition x question type interaction was also not significant, $F(1,30) = .57$, $p = .458$. There was a marginally significant effect for question type, $F(1,30) = 3.76$, $p = .062$, with eight-year-olds tending to select the functional informant more often for endorse questions ($M = 1.93$, $SD = .83$) than for explicit judgement questions ($M = 1.42$, $SD = .1.55$).

Table 7.6 presents the mean number of appropriate responses to each of the question types, as well as total scores. Using related samples *t*-tests, means for the endorse questions and explicit judgement questions were compared to a chance expectation of 2, and means for the overall total score was compared to a chance expectation of 4. Analyses revealed that, in the process-oriented condition, children's selective trust did not differ significantly from chance for the endorse questions, $t(15) = .104$, $p = .919$; explicit judgement questions, $t(15) = .81$, $p = .432$; nor for the overall total scores, $t(15) = .68$, $p = .506$. In the teleology-oriented condition, children's selective trust also did not differ significantly from chance in the endorse questions, $t(15) = .57$, $p = .580$. However, children's performance was significantly different from chance in the explicit judgement questions, $t(15) = 2.30$, $p = .036$; and the overall total score was marginally significant, $t(15) = 1.98$, $p = .066$. These results suggest that eight-year-olds preferred the surface informant over the teleology-oriented informant, at least when judging which informant was "very good" or "better" at providing information.

Table 7.6

Mean Number (and SD) of Appropriate Responses to Question Types, and Total Scores for Eight-Year-Olds.

	Eight-year-olds (n = 32)
Process vs. Surface	
Endorse questions (/4)	1.98 (.79)
Explicit judgements (/4)	1.67 (1.65)
Overall Total (/8)	3.65 (2.08)
Teleology vs. Surface	
Endorse questions (/4)	1.88 (.89)
Explicit judgements (/4)	1.17 (1.45)*
Overall Total (/8)	3.04 (1.93)[a]

Note. Asterisks denote response patterns that are different from chance.
[a]$p = .066$, $*p < .05$

Performance on Follow-up Questions

Children's justifications for deciding that one of the informants was "better" were examined. Responses were coded as: (1) "don't know" or uncodable responses, (2) general references to informant's accuracy or competence, or (3) specific references to informant's knowledge of functions or obvious features. Overall, 75% of the eight-year-olds made general references to the accuracy or competence of the informant they selected as "better" (e.g., "she said the right things", "she knows more", "she was always right, she was smart"). Only four children (12.5%) specifically referred to the informant's knowledge of organs' function or outward appearance (e.g., "when she was saying the last picture, it was small and big and there was a pink string," "she told us what they look like and what they are," "the girl in orange was only saying what the colours were", "she was right, she said there was a hole"). Note that, out of the four children who provided a specific justification, only one favoured the functional informant.

To examine their responses to the other follow-up questions, children were given a point for selecting the functional informant in each trial. Separate total scores were created by summing children's responses, resulting in a total score from 0-3 for knowledge comparison, memory-functional, and memory-surface questions, and a total score from 0-1 for the function vs. appearance question. To allow meaningful comparison with the other totals in this study, scores for the knowledge and memory questions were linearly transformed (i.e., multiplied by 4/3). An overall total memory score was also created by summing the memory-functional and memory-surface totals, resulting in a total score from 0-8.

A 2 x 5 mixed ANOVA was conducted with condition (process vs. surface and teleology vs. surface) as the between-subjects variable, and question type (endorse, explicit judgement, knowledge questions, memory-functional questions, memory-surface questions) as the within-subjects variable. Analyses revealed no significant main effects for condition, $F(1,30) = .30$, $p = .587$, or question type, $F(4,120) = 2.07$, $p = .089$. The condition x question type interaction was also not significant, $F(1,30) = .29$, $p = .773$.

Table 7.7 presents the mean number of appropriate responses to the follow-up questions, as well as total scores. Using related samples *t*-tests, means for the follow-up questions were compared to a chance expectation of 2, and means for the overall total score was compared to a chance expectation of 4. Analyses revealed that eight-year-olds' performance in the knowledge and memory questions did not differ significantly from chance in either condition. Overall, it appears that children had difficulties with these follow-up questions as they could not accurately recall which informant talked the most about "what the parts of the body look like" or "what the parts of the body were for".

Table 7.7

Mean Number (and SD) of Appropriate Responses to Knowledge and Memory Questions for Eight-Year-Olds.

	Eight-year-olds (n = 32)
Process vs. Surface	
Knowledge questions (/4)	1.67 (1.79)
Memory-functional questions (/4)	1.83 (2.00)
Memory-surface questions (/4)	2.42 (1.77)
Memory Total (/8)	4.25 (3.35)
Teleology vs. Surface	
Knowledge questions (/4)	1.33 (1.61)
Memory-functional questions (/4)	2.00 (2.07)
Memory-surface questions (/4)	2.08 (2.00)
Memory Total (/8)	4.08 (3.79)

For the function vs. appearance question, children were required to select whether they thought a person was smarter if they knew “what something is for” or if they knew “what something looks like”. In the process-oriented condition, 63% of children selected that a person who knew “what something is for” was smarter than a person who knew “what something looks like”. However, a binomial test revealed that this difference was not significant (p = .454). Similarly, in the teleology-oriented condition, 56% of children selected that a person who knew “what something is for” was smarter than a person who knows “what something looks like”, but again, this difference was not significant (p = .804).

ToM, Verbal Ability and its Relations to Selective Trust

Given their age, the performance of eight-year-olds on the ToM tasks was expected to be at ceiling, and this expectation was confirmed. For first-order ToM reasoning, with the exception of two children, all children obtained a maximum score of 4. For second-order ToM reasoning, with the exception of eight children, all children obtained a maximum score of 2. Correlations between children’s selective trust, ToM (first-order, second-order reasoning, and total scores) and verbal ability are presented in Table 7.8.

Table 7.8

Correlations Between Children's Selective Trust, ToM and Verbal Ability (n = 32).

	Endorse questions	Explicit judgements	Overall total	1st-order false belief	2nd-order false belief	Verbal Ability
Endorse questions	1	.351*	.751*	.452**	.398*	.093
Explicit judgements		1	.882**	.240	.242	.152
Overall total			1	.396*	.371*	.154
1st-order false belief				1	.612**	.255
2nd-order false belief					1	.295
Verbal Ability						1

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the .01 level (2-tailed).

There were no indications that children's selective trust was related to verbal ability. However, there were modest relations between children's performance on endorse questions and their first-order ToM reasoning (r = .452, N = 32, p = .009), as well as their second-order ToM reasoning (r = .398, N = 32, p = .024). In other words, children who performed better on the ToM tasks tended to select the functional informant in the endorse questions. No relations were found between children's performance on explicit judgement questions and their ToM reasoning. However, children's overall total scores significantly correlated with both their first-order ToM reasoning (r = .396, N = 32, p = .025), and second-order ToM reasoning (r = .371, N = 32, p = .036).

Children's Selective Trust as a Function of ToM Performance

Children were then classified into two groups according to their performance on the first- and second-order ToM tasks: those who successfully passed all tasks, and those who did not pass all tasks. Table 7.9 outlines children's selective trust according to their performance on the ToM tasks, collapsed across conditions. It should be noted that a large majority of children passed the ToM tasks, so there was not enough power to look at differences in selective trust as a function of ToM within each condition.

Table 7.9

Mean Number (and SD) of Appropriate Responses to Question Types, and Total Scores, as a Function of ToM performance.

	Did not pass all tasks	Successfully passed all tasks	*t*-value comparing between groups
First-order ToM	n = 2	n = 30	
Endorse questions (/4)	0.50 (0.71)	2.02 (0.75)	2.78**
Explicit judgements (/4)	0.00 (0.00)	1.51 (1.56)	1.35
Overall total (/8)	0.50 (0.71)	3.53 (1.91)	2.20*
Second-order ToM	n = 8	n = 24	
Endorse questions (/4)	1.38 (0.74)*	2.11 (0.78)	2.33*
Explicit judgements (/4)	0.83 (0.99)*	1.61 (1.67)	1.24
Overall total (/8)	2.21 (1.65)*	3.72 (1.99)	1.94[a]

Note. Asterisks denote response patterns that are different from chance * $p < .05$ ** $p < .01$
[a]$p = .062$

Independent samples *t*-tests were conducted to examine whether children's endorsements, explicit judgements and overall totals differed as a function of success on the ToM tasks (i.e., did not pass vs. passed all). Analyses revealed that children who passed all first-order ToM tasks more often endorsed the functional informant, $t(30) = 2.78$, $p = .009$, and had higher overall total scores, $t(30) = 2.20$, $p = .035$, than children who did not pass all first-order ToM tasks. However, there were no significant differences in performance on explicit judgement questions as a function of first-order ToM, $t(30) = 1.35$, $p = .186$.

For second-order ToM, children who successfully passed all tasks more often endorsed the functional informant than children who did not pass all tasks, $t(30) = 2.33$, $p = .027$. The difference in children's overall scores as a function of second-order ToM was marginally significant, $t(30) = 1.94$, $p = .062$, but no differences in performance on explicit judgement questions as a function of second-order ToM were found, $t(30) = 1.24$, $p = .225$. To sum, eight-year-olds who were more skilled at ToM were more likely to trust the informant who provided functional explanations.

Related samples *t*-tests were then used to determine whether children's performance was above chance within the groups of children who either passed all or did not pass all ToM tasks. Means for the endorse and explicit judgement questions were compared to a chance expectation of 2, and means for the overall total score was compared to a chance expectation of 4. Analyses revealed that performance was not significantly different from chance for children who answered all first-order ToM tasks correctly or did not answer all first-order ToM tasks correctly (*ps* > .05). However, for children who did not answer all second-order ToM tasks correctly, their tendency to selected the functional informant was significantly below chance: for endorse questions, $t(7) = 2.38$, $p = .049$; for explicit judgements, $t(7) = 3.33$, $p = .013$; and for overall scores, $t(7) = 3.07$, $p = .018$. The performance of children who correctly answered all second-order ToM tasks correctly did not exceed chance expectations (*ps* > .05).

Comparisons to the Performance of Younger Children in Study 3A

A 3 x 2 x 2 mixed ANOVA was conducted with age (four-, five-, and eight-year-olds) and condition (process vs. surface and teleology vs. surface) as between-subjects variables, and question type (endorse, explicit judgement) as the within-subjects variable. No significant main effects or interactions were found (*ps* > .05), indicating that children's selective trust did not differ across the three age groups, conditions, and question types.

Discussion

The aim of this study was to follow up on the null results of Study 3A, which consisted of four- and five-year-olds, to examine whether eight-year-olds would be better able to differentiate between informants who provide explanations that differ in explanatory depth. It was anticipated that eight-year-olds would be more likely to trust an informant who provided functional explanations over an informant who provided only obvious descriptions of observable characteristics. Overall, this core manipulation was, once again, largely unsuccessful. Eight-year-olds did not systematically trust informants who provide functional explanations for the processes of internal bodily organs. That is, there was little evidence to suggest that eight-year-olds consider functional explanations, whether process- or teleology-oriented, to be more informative than surface descriptions. In the sections below, I briefly discuss continuities between the results of Studies 3A and 3B, and suggest future avenues of research, which have been implemented in Study 4.

First, one of the few indications of systematic preferences for an informant emerged in the teleology-oriented condition. In this condition, both five- and eight-year-olds tended to favour the surface informant in the explicit judgement questions and in the overall trust score.

Such a result suggests that children construed the teleology-oriented informant as less credible than the surface informant, and the process-oriented and surface informant as equally credible. However, children's lack of preference for the teleology-oriented informant is not consistent with the results of previous studies (e.g., Jaakola & Slaughter, 2002; Keil, 1992), which demonstrate that children as young as four do prefer teleological explanations. In addition, what is surprising is children's failure in the knowledge and memory questions, which casts further doubt on how capable children were of interpreting the informants. The eight-year-olds in this study were verbally competent and performed very well in the ToM tasks. However, their inability to accurately recall which informant provided a specific type of explanation suggests that they had difficulties in making a distinction between the two types of explanations. Finally, when analysing the performance of children across Studies 3A and 3B, no systematic differences in children's selective trust as a function of age were found. In other words, there were no indications that preferences for the functional informant over the surface informant improved with age.

Another possible explanation for the null findings is that children in Studies 3A and 3B considered both informants to be credible. Given the unfamiliarity of the organs presented, children may have construed both informants as providing useful information. In other words, they may have noticed that the surface informant provided information which was relevant and could be verified using the pictures of the organs. Similarly, they may have noticed that the functional informant also provided relevant information about the organs and its functions. Hence, since children did not make a distinction between the explanation types, they did not differentially prefer one informant's label over the other. At present, it is not known which of these possible explanations better account for children's performance in this study. However, as will be argued below, it is likely that this core manipulation is ineffective and does not require further investigation.

Second, in relation to individual differences, children's selective trust was not related to their verbal ability, as was found in Study 3A. Thus, it is not the case that children who are verbally more competent are better able to evaluate the different types of explanations. However, consistent with the findings of Study 3A, relations between children's selective trust and ToM were revealed. In Study 3A, five-year-olds who were less skilled in first-order ToM tended to favour the surface informant for the endorse question, explicit judgements, and the overall scores. On the other hand, five-year-olds who were more skilled in ToM more often endorsed the functional informant. In this study, eight-year-olds who were less skilled in second-order ToM tended to favour the surface informant, but those who were more skilled did not systematically endorse the functional informant. It is surprising that these links between children's selective trust and ToM emerged since the existing research has not definitively established such links (Pasquini et al., 2007). It is possible that the sophistication of the explanations provided by informants in the present study may have allowed the relations between ToM and selective trust to emerge. In the Discussion of Study 3A, based on the findings of Fusaro and Harris (2008), I speculated that children who were lower in ToM may have considered the surface informant to be more trustworthy because she provided information that could be directly verified from the pictures of the internal organs.

General Discussion

Overall, the results of Study 3A and 3B do not provide convincing evidence of children's ability to differentiate between explanations which differ in explanatory depth, at least in relation to objects that are non-observable and unfamiliar to children. Below, I briefly summarise possible reasons for why this manipulation did not work, as well as outline approaches to address these issues, which were implemented in a subsequent Study 4.

As noted in the Discussion of Study 3A, I speculated as to whether children's null performance was because the explanations were too detailed and complex for children to understand. As a result, I proposed utilising a sample of older children (i.e., eight-year-olds) to see whether they would be better able to comprehend the explanations. The results of Study 3B showed that even eight-year-olds did not differentiate between the two types of informants. However, it is unlikely that their failure to comprehend the detailed explanations is the primary reason for their lack of systematic trust. As noted in the results, children's verbal ability was assessed and no relations were found between verbal ability and selective trust.

Another reason put forward was that the internal organs were described in terms of *what they do* rather than *how people use them*. For example, it is more appropriate to say that the heart "beats and pumps blood around the body", rather than to say that "you use your heart to beat and pump blood around the body". In contrast, functional information provided about common artifacts tend to be explained in terms of *how people use them* (e.g., "you use a hammer to drive nails into wood") rather than *what they do* without reference to an agent's act upon the artifact (e.g., "hammers drive nails into wood" sounds less suitable). In this study, it may have been difficult for children to conceptualise organs as performing the activities mentioned because the explanations were largely about *what they do*. On a related note, children may have been unable to differentiate between informants because they were perplexed by the unfamiliar internal organs presented. In this study, none of the eight-year-olds correctly identified any of the internal organs. Due to their lack of knowledge, they may have been less inclined to attend to the differential explanatory depth in the additional information presented, perhaps because they were more occupied with attending to the novel labels.

To conclude, the results of Studies 3A and 3B did not show that four- to eight-year-olds differentiate between informants who offer functional or surface information about unfamiliar internal organs. There were some indications of a relationship between five- and eight-year-olds' ToM and their selective in that children who are less skilled at ToM are more likely to trust an informant who provides surface explanations of internal organs. However, this relation does not appear to be consistent and robust across ages. Overall, the core manipulation was not effective in examining whether children are sensitive to differences in explanatory depth. Modifications to the procedure were suggested to rectify existing issues, as well as to further investigate children's selective trust in informants who differ in explanatory depth in a subsequent Study 4.

Chapter 8
Study 4

The results of Study 3A and 3B showed that four-, five-, and eight-year-olds do not systematically endorse labels for unfamiliar internal organs from an informant who gave explanations about the function of organs over an informant who simply gave descriptions of the outward appearance of those organs. However, it should be noted that none of the children were able to correctly identify the organs. As a result, one of the reasons put forward for children's inability to show selective trust was because they were confused by the unfamiliar internal organs presented and, hence, were not able to make a distinction between the two types of explanations. Another plausible explanation was that children considered both explanations to be equally credible because in each case they were being provided with relevant information about organs they were not familiar with.

The findings of Studies 3A and 3B are inconsistent with recent studies which have investigated children's sensitivity to explanations which differ in quality; in particular, explanations which are either circular or non-circular in nature. These studies suggest that children are quite capable of evaluating different types of explanations. For example, Kurkul and Corriveau (2014) showed that children from the age of five are able to evaluate explanations which differ in circularity and prefer learning from informants who provided non-circular explanations. However, it is important to note that Kurkul and Corriveau investigated children's sensitivity to the *circularity* of explanations, whereas Studies 3A and 3B investigated children's sensitivity to the *depth* of explanations. Circular explanations, in comparison to noncircular explanations, are inherently flawed because they do not provide information that could be considered helpful. On the other hand, both functional and surface explanations are providing truthful and relevant information; so it may come as no surprise that children do not necessarily distinguish between them when deciding whom to trust. One other major difference is that Kurkul and Corriveau featured initial training trials with familiar objects, an aspect which was omitted in Studies 3A and 3B. It is perhaps important that children are first familiarised with information they are knowledgeable about (e.g., concerning familiar objects, events) before they can decide whom to trust when learning about things they do not know about. Hence, to examine the role of unfamiliarity, familiarisation trials featuring familiar external body parts (e.g., eye, hand), were re-introduced in Study 4. By doing so, children's ability to differentiate between the explanations might improve for two reasons. First, children might be better able to evaluate the explanations because the informants provide information about body parts which are well known to them. For example, since children already know about the eye, they may consider the informant who talks about what the eye is used for and what it does as more informative than the informant who simply describes the outward appearance of the eye. Second, the use of external body parts allows for functions to be described in terms of *what they are used for* (e.g., you use your hand for touching, your feet for walking), rather than *what they do*. As discussed in Studies 3A and 3B, the internal organs were described in terms of *what they do*, rather than *what they are used for*. For instance, it was more appropriate to say that the liver "makes new blood", rather than to say that "you use it make new blood". That is to say, internal organs differ from external body parts in that there is not a great deal of conscious voluntary control in their functioning. Therefore, in reinstating the familiarisation trials in Study 4 with external body parts, it was possible to examine whether children are better able to differentiate between functional and surface explanations when the functions are presented in terms of what the objects (i.e., body parts) are used for.

On a related note, another reason given for children's inability to differentiate between informants in Studies 3A and 3B was because of the complexity of the biological domain and because children are not able to grapple with the notion that internal organs *do things* rather than *are used to do things*. Children may find it easier to distinguish different levels of explanation if the objects presented are common artifacts. Therefore, to further examine the role of familiarity, a comparison condition was included, which featured informants who provided functional or surface explanations for familiar artifacts (e.g., toothbrush, spoon). Given children's familiarity with artifacts, it was expected that this would facilitate their ability to attend to the different types of explanations. It was also interesting to examine whether they would be better able to differentiate between informants in the artifact domain, but not in the biological domain. That is, in the biological domain, in which their knowledge is still developing (Jaakkola & Slaughter, 2002), children may not yet be prepared to attend to different forms of explanations; but they may be more capable in the artifact domain.

In subsequent test trials, after being exposed to different levels of explanatory depth for familiar objects (i.e., body parts or familiar artifacts), children were asked whom they preferred to learn labels for unfamiliar objects from (i.e., organs or novel artifacts). Children's preferences were assessed using the ask, endorse and explicit judgement questions from existing studies (e.g., Corriveau et al., 2009; Pasquini et al. 2007). Children have been shown to be willing to learn labels from informants who provide accurate information about the functions of objects (e.g., Birch et al., 2008; Kurkul & Corriveau, 2014; Sobel & Corriveau, 2010). Therefore, they may be just as likely to seek labels for internal organs from informants who are competent in explaining the functions of external body parts. It would be informative to examine whether children generalise their trust in informants who provide competent explanations about body parts when learning labels for unfamiliar organs. As already discussed, it has been well-established in the literature that children are discerning when presented with informants who provide labels. Such an approach has already been shown to be fruitful when examining how children's epistemic trust is influenced by manner. However, there is little research on how children consider informants who provide explanations. Further, by adhering to the traditional paradigm, in which children are required to select an informant they would prefer to learn labels from, the results of this study will shed light on whether there are limits to children's willingness to generalise their trust. In Kurkul and Corriveau, children did show a preference to learn labels from informants who provided noncircular explanations, whereas in Kushnir et al. (2013) did not systematically prefer learning labels from informants who demonstrated greater causal knowledge. Hence, it remains to be seen whether children consider informants who provide functional explanations to be a better source for object labels than informants who provide obvious descriptions.

In this study, it was possible to implement a within-subjects design to increase power. Consistent with Study 3B, eight-year-olds were tested in Study 4. Eight-year-olds participated in both the *artifacts* paradigm and the *body parts* paradigm, and the paradigm which they participated in first was counterbalanced. Such a design allowed for an increase in the sample size, as well as an opportunity to examine whether there were order effects. In Studies 3A and 3B, the functional explanations had been separated into two forms: process-oriented and teleology-oriented. The process-oriented explanations were concerned with the workings of the organ and its relevant processes, whereas the teleology-oriented explanations were concerned with the "purposeful design" of the organ. However, it was apparent that the children in Studies 3A and 3B did not respond differently to either type of functional explanation. Therefore, to create a more complete sense of what the objects are used for, the functional information in Study 4 combined these two types of explanations. It was also hoped that the manipulation would be strengthened as a result. For example, the eye was described as: "That's an eye. When you need to watch where you're going, you use your eyes for seeing and looking. Things inside your eyes send messages to your brain so you can know what you're looking at". On the other hand, the information provided by the surface informant was largely similar to that presented in Studies 3A and 3B in that the informant made reference to the object's appearance (e.g., colour), property (e.g., smoothness, hardness), parts, and number. Such characteristics were selected based on the work of Chouinard (2007) on the nature of children's questions. In Study 4, the eye was described as follows: "That's an eye. You have an eyebrow on top and eyelashes around it. There is a small black circle in the middle. You have two eyes. They can be different colours; like blue, green or brown".

Finally, to examine whether there were consistencies between the findings of Studies 3A, 3B and 4, children's ToM and verbal ability were assessed. It was anticipated that, if there were improvements in children's selective trust as a result of reintroducing familiarisation trials and implementing the artifacts condition, younger children (e.g., five-year-olds) could then be tested to see whether they also demonstrate selective trust.

Method

Participants

Participants were 32 eight-year-olds (16 girls): *M* = 100.34, *SD* = 4.50, *Range* = 92-111. All children lived in a metropolitan area and spoke fluent English. Most children were Caucasian, although a range of ethnicities was represented. Children were recruited via parental invitation and tested individually in a quiet room in their school. Children were tested across two sessions, and the delay between sessions ranged from 4-7 days. In the first session, children participated in one paradigm (e.g., body parts), and were given verbal ability and ToM assessments. In the second session, children participated in the alternative paradigm (e.g., artifacts).

Materials

Selective trust. Stimuli were presented as video clips on a laptop. Each child participated in two types of selective trust paradigm: a *body parts* paradigm and an *artifacts* paradigm.

Body parts paradigm. Children watched eight video clips (combining familiarization and test trials). In each clip, two female informants (wearing either an orange or blue shirt) sat on either side of a table and a male interviewer (wearing a black shirt) stood between them. In each video clip, the interviewer held up, at chest height, a white A3-sized sheet of cardboard with a colored picture of a body part or organ printed on it. The order of body parts and organs presented was the same for all children.

Artifacts paradigm. Children watched eight video clips (again combining familiarization and test trials). In each clip, two female informants (wearing either a green or red shirt) sat on either side of a table and a male interviewer (wearing a black shirt) stood between them. The informants and interviewer in the artifacts procedure were different from those featured in the body parts procedure. In each video clip, the interviewer held up, and then placed a familiar or novel artifact on the table. The order of artifacts presented was the same for all children.

Other measures. Measures of individual differences were also obtained. Children's verbal ability was assessed using the Test of Language Development (TOLD) *picture vocabulary* and *oral vocabulary* subtests, and their ToM was assessed using four tasks presented in a storybook format with coloured pictures. Testing and scoring of eight-year-olds' verbal ability and ToM was identical to Study 3B.

Design and Procedure

Selective trust. The within-subjects variable was type of paradigm: body parts or artifacts. Half the children (equal numbers of boys and girls) participated in the body parts paradigm first, followed by the artifacts paradigm. The other half participated in the artifacts paradigm first, followed by the body paradigm. Within each paradigm, children were initially familiarized with two informants who provided different types of explanations for familiar objects. One informant provided explanations which referred to the functions of the body parts/artifacts and how they could be used, whereas the other informant provided explanations which referred to the obvious and observable characteristics of the body parts/artifacts. In subsequent test trials, children were introduced to unfamiliar organs/artifacts and asked to seek and endorse novel labels from one of the informants, as well as to judge which informant was more competent at providing information.

Introduction to the tasks. For the body parts paradigm, the experimenter introduced the task by first showing a picture book about the human body and highlighting that there were parts which were on the "outside of the body" as well as on the "inside of the body" and that the children were "going to play a little game on the laptop about the body". For the artifacts paradigm, the experimenter introduced the task by first placing all of the familiar and novel artifacts on the table, and children were given the opportunity to examine the artifacts before being told they were "going to play a little game on the laptop about objects".

Children were then shown a still frame of the informants and interview. The experimenter said, "The game looks something like this. First, we're going to meet these three people. Do you see them? The boy in the black shirt is going to hold up some pictures/objects. Then, this girl in the [colour] shirt and this girl in the [other colour] shirt are going to tell you what they know about those things. Some of the pictures/objects are things you might have seen before and already know about. And some of the pictures/objects are things that you might not have seen before. I want you to listen very carefully and then I'm going to ask you some questions. Are you ready?"

Familiarisation Trials. The experimenter presented a picture of the body part (in the body parts paradigm) or the actual artifact (in the artifacts paradigm) and pointed to a still frame of the video clip, in which the interviewer was holding the same picture/artifact. The experimenter said, "I wonder what the girls will say about this?" and played the video. At the start of each familiarisation trial, the interviewer presented the body part/artifact and stated, "Can you tell me what you know about this?" The informants correctly labelled the object, but provided different explanations. The familiarisation trials for the body parts and artifacts paradigms are presented in Tables 8.1 and 8.2. The informant who spoke first alternated between the familiarization video clips and the explanation assigned to each informant was systematically varied between children.

Table 8.1

Familiarisation Trials in the Body Parts Paradigm.

Body Part	Functional informant	Surface informant
Eye	That's an eye. When you need to watch where you're going, you use your eyes for seeing and looking. Things inside your eyes send messages to your brain so you can know what you're looking at.	That's an eye. You have an eyebrow on top and eyelashes around it. There is a small black circle in the middle. You have two eyes. They can be different colours; like blue, green or brown.
Foot	That's a foot. When you need to go somewhere, you use your feet for standing and moving. There are muscles inside your feet that stretch and tighten so you can walk, run and jump.	That's a foot. You have five toes on each food and you have nails on the ends of your toes. It is part of your leg and there is a bone sticking out. You have two feet.
Nose	That's a nose. When you need to get air inside your body, you use your nose for breathing and smelling. There are little hairs inside that trap dust from the air so it makes you sneeze.	That's a nose. It is long and bony at the top and soft at the bottom. There are two black holes. Your nose is in the middle of your face and you only have one nose.
Hand	That's a hand. When you need to know what something feels like, you use your hands for touching and feeling. There are bones inside your fingers that bend so you can pick up and hold things.	That's a hand. It has four fingers and one thumb. There are little lines on your hand and those are the folds of your skin. It is part of your arm, and you have two hands.

Table 8.2

Familiarisation Trials in the Artifacts Paradigm.

Familiar artifact	Functional informant	Surface informant
Spoon	That's a spoon. When you need to eat runny or soft foods, you use it to eat with. You hold the handle and scoop food up with the round bit so you can put food in your mouth.	That's a spoon. It's made of metal and is very smooth. It feels cold to touch but warms up after you hold it. It has a long handle and a short round bit at the bottom.
Toothbrush	That's a toothbrush. When you need to clean your teeth, you use it to brush your teeth. You put toothpaste on the bristles and hold the long part in your hand so you can brush your teeth.	That's a toothbrush. It's made out of plastic and a little bit of rubber. It's light to hold and feels bumpy to touch. At the top, it has little, thin pieces of plastic bunched together.
Shoe	That's a shoe. When you need to keep your feet warm and clean, you wear it to protect your feet. You put your feet inside and tie the shoelaces up tightly so it doesn't fall off.	That's a shoe. It's made out of fabric, rubber and plastic. This one is white and blue. It has long pieces of string which zig-zag through the holes, and an empty space inside.
Bottle	That's a bottle. When you need to bring water to drink, you use it to carry water. You open the lid and fill it up with water so you can you drink from it if you are thirsty.	That's a drink bottle. It's skinny at the top and wider at the bottom. It's made of metal, but the lid on top is plastic. It's shiny and light. It makes a noise when you knock on it.

Test trials. After the four familiarisation trials, children were given four test trials featuring organs (e.g., pancreas, larynx) or artifacts (e.g., tea strainer, cord organizer) they would have difficulty identifying. The experimenter introduced the test trials by saying, "Now we are going to see some things that you might not know the names of." Test trials consisted of three types of questions: (1) *ask*, (2) *endorse*, and (3) *explicit judgement*. There were additional follow-up questions at the end of the procedure. Further details about these questions are presented below.

At the start of each test trial, children were presented with the picture of the unfamiliar organ or artifact and asked, “Do you know what this is called?” With the exception of three children, two who correctly identified the liver, and one who correctly identified the orange hose peg, no child was able to correctly identify the unfamiliar organs/artifacts. Children were then shown a still frame of the two informants and given the ask question, “I bet one of these people can help. Which person would you like to ask, the girl in the [colour] shirt or the girl in the [other colour] shirt?” If children said they knew what the organ was called or gave an incorrect label, the experimenter said, “Actually, I don’t think that’s what it’s called. I bet one of these people can help. Which person would you like to ask, the girl in the [colour] shirt or the girl in the [other colour] shirt?” Children were then asked to select one of the informants for the ask question. The order in which each informant was mentioned in the ask question alternated between trials. Children’s verbal responses (e.g., “The girl in the blue shirt”) or nonverbal responses (e.g., pointing) were recorded. For the three children who made correct identifications, the test trial was discontinued, and they were presented with the next test trial with a different organ/artifact.

Next, regardless of which informant children selected for the ask question, the video clip was played. The interviewer held up the picture of the organ or the novel artifact and stated, “Can you tell me what this is called?” The first informant offered a novel label (e.g., “That’s a slod”), and the second informant offered a different novel label (e.g., “That’s a linz”). The test trials for the body parts and artifacts paradigms are presented in Tables 8.3 and 8.4. Which informant spoke first alternated between the four test trial video clips, and the novel labels provided by each informant were counterbalanced across children.

After each informant provided a label, children were given the endorse question. The video clip was paused, showing the two informants and interviewer, and children were asked for the label of the unfamiliar organ or artifact (e.g., “The girl in the orange shirt said it’s a slod and the girl in the blue shirt said it’s a linz. What would you say?”). The order in which the informants were mentioned in the endorse question was consistent with the order they were questioned by the interviewer in the video clip. Children’s verbal responses (e.g., “What the girl in orange said”, “a slod”) or nonverbal responses (e.g., pointing) were recorded.

Table 8.3

Test Trials in the Body Parts Paradigm.

Organ	Novel Label A	Novel Label B
Pancreas	That’s a slod	That’s a linz
Gall Bladder	That’s a mogo	That’s a nevi
Liver	That’s a tark	That’s a chab
Larynx	That’s a yiff	That’s a zazz

Table 8.4

Test Trials in the Artifacts Paradigm.

Artifact	Novel Label A	Novel Label B
Orange hose peg	That’s a roke	That’s a cham
Figure of 8 object	That’s a danu	That’s a toma
Sink/tea strainer	That’s a larp	That’s a crut
Cord organiser	That’s a joob	That’s a thaf

After all test trials, the experimenter asked three explicit judgement questions about the two informants. The order in which the informants were referred to in the first two questions was counterbalanced. The questions were: (1) “Was the girl in the [colour] shirt very good or not very good at talking about these things?”, (2) Was the girl in the [other colour] shirt very good or not very good at talking about these things?”, and (3) “Which girl was better at talking about these things?”

Follow-up questions. Children were then asked a series of follow-up questions to further examine their interpretations of the informants. The order in which each informant was referred to, the order of memory questions, and the order by which *function* and *appearance* were referred to in the final question were counterbalanced.

The *justification* question was presented after the final explicit judgement question. Children were asked to justify their choice from the last explicit judgement question, “Why did you say the girl in the [colour] shirt was better at talking about these things?”

Knowledge comparison questions asked children: (1) “Did the girl in the [colour] shirt know lots of things about the body or not so many things?” (2) “Did the girl in the [other colour] shirt know lots of things about the body or not so many things?” and (3) “Which girl knew more things about the body?”

Memory-functional questions asked: (1) “Did the girl in the [colour] shirt talk a lot about what the parts of the body are for or not so much?” (2) “Did the girl in the [other colour] shirt talk a lot about what the parts of the body are for or not so much?” and (3) “Which girl talked more about what the parts of the body are for?”

Memory-surface questions asked: (1) “Did the girl in the [colour] shirt talk a lot about what the parts of the body look like or not so much?” (2) “Did the girl in the [other colour] shirt talk a lot about what the parts of the body look like or not so much??” and (3) “Which girl talked more about what the parts of the body look like?”

Finally, in the *function vs. appearance* question, children were asked, “Do you think someone is smarter if they know what something is for or if they know what something looks like?”

Results

Results will be presented as follows. First, children’s selective trust and their responses to the follow-up questions as a function of paradigm will be examined. Second, relations between children’s responses to the follow-up questions and their selective trust will be detailed. Finally, children’s performance on the ToM tasks and verbal ability assessments, and its relations to selective trust will be summarised.

Children’s Selective Trust

Children were given a point for favouring the functional informant in each ask, endorse, and explicit judgement question. Separate total scores were created by summing children’s appropriate responses, resulting in a total score from 0-4 for ask questions, 0-4 for endorse questions, and 0-3 for explicit judgement questions. To equate the scores for the three children who correctly identified one of the novel objects, their ask and endorse totals were multiplied by 4/3. In addition, to allow meaningful comparison with ask and endorse totals, scores for the explicit judgement questions were linearly transformed (i.e., multiplied by 4/3). An overall total score was also eventually created by summing the endorse total and the (transformed) explicit judgement total, resulting in a total score from 0-12.

To first assess whether there were differences across the question types and the order of paradigms, a 2 x 3 x 2 mixed ANOVA was conducted with paradigm order (body parts paradigm first or artifacts paradigm first) as the between-subjects variable, and question type (ask, endorse, explicit judgement) and task (first task, second task) as the within-subjects variable. Analyses revealed that there was no significant main effect for question type, *F*(2,60) = 0.84, *p* = .436. More importantly, question type did not interact with any of the other variables, suggesting consistency in children's response across paradigm order and task. Paradigm order was not significant, *F*(1,30) = 2.59, *p* = .118. However, there was a marginally significant task x paradigm order interaction, *F*(1,30) = 3.78, *p* = .061. This interaction is illustrated in Figure 8.1.

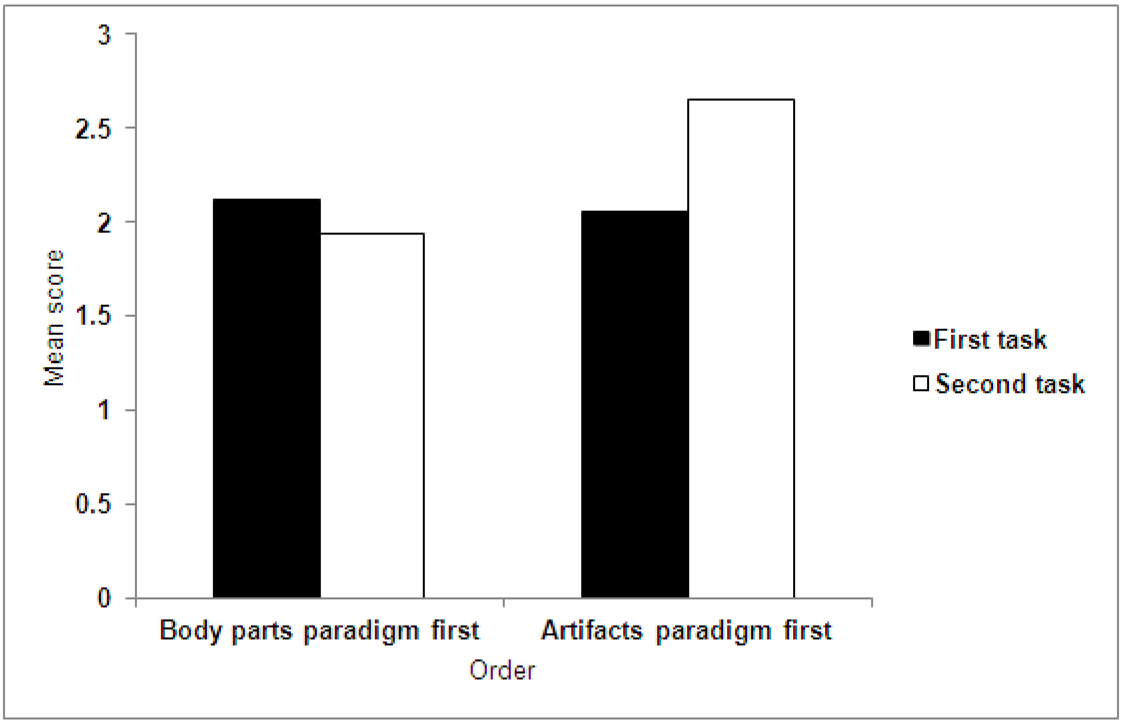


Figure 8.1. Mean scores on test trials as a function of task and paradigm order, collapsing across question types.

Inspection of Figure 8.1 shows that although children were not very systematic in their replies, they did perform quite well in the body parts paradigm if they received it second. To better understand the interaction, simple effects analyses were conducted. Analysis of the simple effect of paradigm order for the first task revealed no differences in children's preference for the functional informant whether they first received the body parts paradigm or the artifacts paradigm (*p* = .823). However, analysis of the simple effect of paradigm for the second task revealed that children more often selected the functional informant in the body parts paradigm than in the artifacts paradigm (*p* = .021). Next, analysis of the simple effect of task (first task versus second task) for children who participated in the body parts paradigm first revealed no differences in children's performance across tasks (*p* = .528). In contrast, analysis of the simple effect of task for children who participated in the artifacts paradigm first revealed greater preferences for the functional informant in the second task (i.e., the body parts task) that they completed as compared to the first task (i.e., the artifacts task) that they completed (p = .043).

Next, given that there was a near-significant effect of task x paradigm order, it was important to analyse how children's performance compared to chance as a function of these two variables. Using related samples *t*-test, means for the ask, endorse and explicit judgement questions were compared to a chance expectation of 2, and means for the overall score were compared to a chance expectation of 6. Means for children's performance as a function of task and paradigm order are shown in Table 8.5.

Table 8.5

Mean Number (and SD) of Selection of Functional Informant as a Function of Task and Paradigm Order for Question Types and Overall Scores.

	Body parts paradigm first	Artifacts paradigm first
First task		
Ask questions (/4)	2.06 (.62)	1.94 (.44)
Endorse questions (/4)	2.04 (.98)	2.06 (1.00)
Explicit judgements (/4)	2.25 (1.35)	2.17 (1.75)
Overall scores (/12)	6.35 (2.36)	6.17 (2.34)
Second task		
Ask questions (/4)	2.23 (.66)	2.44 (.89)[a]
Endorse questions (/4)	1.83 (1.15)	2.44 (.96)
Explicit judgements (/4)	1.75 (1.67)	3.08 (1.35)**
Overall scores (/12)	5.81 (2.61)	7.96 (2.34)**

Note. Asterisks denote response patterns that are different from chance.
[a] $p = .069$, *$p < .05$, ** $p < .01$

These analyses revealed that, when children participated in the body parts paradigm first, children's selective trust did not differ significantly from chance for any of the scores in the body parts paradigm or in the subsequent artifacts paradigm (all *ps* > .05). Similarly, for children who participated in the artifacts paradigm first, children's selective trust in that first task did not differ significantly from chance for any of the question types (all *ps* > .05). However, their performance in the subsequent body parts paradigm was systematic. Although children's preferences for the functional informant was only marginally above chance for the ask questions, $t(15) = 1.96$, $p = .069$, children's preference for the functional informant was significantly above chance for the explicit judgement questions, $t(15) = 3.20$, $p = .006$, and for the overall scores, $t(15) = 3.35$, $p = .004$. Children's preferences for the functional informant in the endorse questions did not reach significance, $t(15) = 1.82$, $p = .089$.

To sum, eight-year-olds preferred the informant who provided functional explanations rather than surface descriptions for parts of the body, but this preference was apparent only if children had been previously exposed to informants who provided different types of explanations for artifacts. That is, eight-year-olds showed no preference for the informant who provided functional explanations for parts of the body if this was the first task that they received. Moreover, children did not demonstrate a preference for the informant who provided functional explanations for artifacts, whether or not they had been previously exposed to informants who provided different types of explanations for parts of the body.

Performance on Follow-up Questions

Recall that immediately following the final explicit judgment question, children were asked a series of follow-up questions starting with a question in which children were invited to justify their claim that one of the informants was "better" at providing explanations. Children's justifications were examined as a function of task and paradigm order. Responses were coded as: (1) "don't know" or uncodable, (2) general references to the informant's accuracy or competence, or (3) specific references to the content of the informant's explanations, such as their knowledge of functions or obvious features.

For children who participated in the body parts paradigm first, 81.3% of children (n = 13) made general references to the accuracy or competence of the informant they selected as "better" (e.g., "she explained it more", "I thought most of them were correct"). Only one child made specific references to the content of the informant's explanations (e.g., "she said there were eyelashes around and there was your eyebrow, and different colours"); a statement which favoured the surface informant. In the subsequent artifacts paradigm, 68.8% of children (n = 11) made general references to the accuracy or competence of the informant they selected as "better", and five children made specific references to the content of the informant's explanations. Of these five children, three favoured the functional informant (e.g., "she told what it's used for", "she said you could use a spoon for all sorts of foods"), and two favoured the surface informant (e.g., "she was saying what you use it for and what it's made out of", "for the spoon she said it was metal and had a long bit with a circle at the bottom"). It is interesting to note that the justification provided by one child who favoured the surface informant stated that she was knowledgeable about both artifact function ("she was saying what you use it for") and appearance ("...and what it's made out of"), suggesting some possible confusion or overgeneralisation of knowledge.

For children who participated in the artifacts parts paradigm first, 81.3% of children (*n* = 13) made general references to the accuracy or competence of the informant they selected as "better" (e.g., "she explained it more", "I thought most of them were correct"). Three children made specific references to the content of the informant's explanations, all of which favoured the surface informant (e.g., "she said how they looked like and what they're made of", "for the sneakers she said the materials and laces and stuff. The other girl just talked about protecting your feet", "she told more and told what it was made of"). In the subsequent body parts paradigm, 68.8% of children (*n* = 11) made general references to the accuracy or competence of the informant they selected as "better", and four children made specific references to the content of the informant's explanations. Of these four children, three favoured the functional informant (e.g., "she actually told you what they do and what they are, and what part of the body they take place in", "she was describing the body parts and telling what you can do with them", "she said what you use it for"), and one favoured the surface informant (e.g., "she told us what they look like"). Thus, in response to the first follow-up question, children mostly referred to the accuracy or competence of the chosen informant in general terms – few children commented on the particular content of the explanation.

To examine their responses to the other follow-up questions, children were given a point for selecting the functional informant in each trial. Separate total scores were created by summing children's responses, resulting in a total score from 0-3 for each of the knowledge, memory-functional, and memory-surface questions, and a total score from 0-1 for the function vs. appearance question. To allow meaningful comparison with the other totals in this study, totals for the knowledge and the two types of memory questions were linearly transformed (i.e., multiplied by 4/3) such that all total scores now ranged from 0-4. In addition, an overall total memory score was created by summing the memory-functional and memory-surface totals, resulting in a total score from 0-8. These mean scores are presented in Table 8.6.

A 2 x 3 x 2 mixed ANOVA was conducted with paradigm order (body parts first, artifacts first) as the between-subjects variable, and follow-up question type (knowledge, memory-functional, memory-surface) and task (first task, second task) as within-subjects variables. Analyses revealed that there was a significant main effect for follow-up question type, $F(2,60) = 3.76$, $p = .029$, but not for task, $F(1,30) = 0.24$, $p = .631$, or for paradigm order, $F(1,30) = 1.42$, $p = .243$. *Post-hoc* LSD tests revealed that, for the follow-up questions, children performed significantly better on the memory-functional questions ($p = .014$) than on the knowledge questions, whereas performance on the memory-surface questions and the knowledge questions ($p = .148$) and on the two memory questions did not significantly differ from each other ($p = .202$). Significant interactions were also found between follow-up question type and paradigm order, $F(2,60) = 4.07$, $p = .023$, between follow-up question type and task, $F(2,60) = 3.57$, $p = .034$, and the follow-up question type x paradigm x paradigm order interaction was also significant, $F(2,60) = 6.17$, $p = .004$.

Given that children’s responses differed across the knowledge and memory follow-up questions and, to better understand the interactions which all included question type, two separate mixed ANOVAs were carried out. First, a 2 x 2 mixed ANOVA was conducted on children’s knowledge scores with paradigm order (body parts first, artifacts first) as the between-subjects variable, and task (first task, second task) as the within-subjects variable. Analysis revealed that there was a significant main effect for task, $F(1,30) = 5.41$, $p = .027$, with children favouring the functional informant more often in their second task than in their first task. Paradigm order, however, did not reach significance, $F(1,30) = 2.32$, $p = .138$, and neither did the task x paradigm order interaction, $F(1,30) = 3.04$, $p = .091$. However, given the prior near-significant interaction observed for the selective trust questions, this interaction was further explored and is illustrated in Figure 8.2.

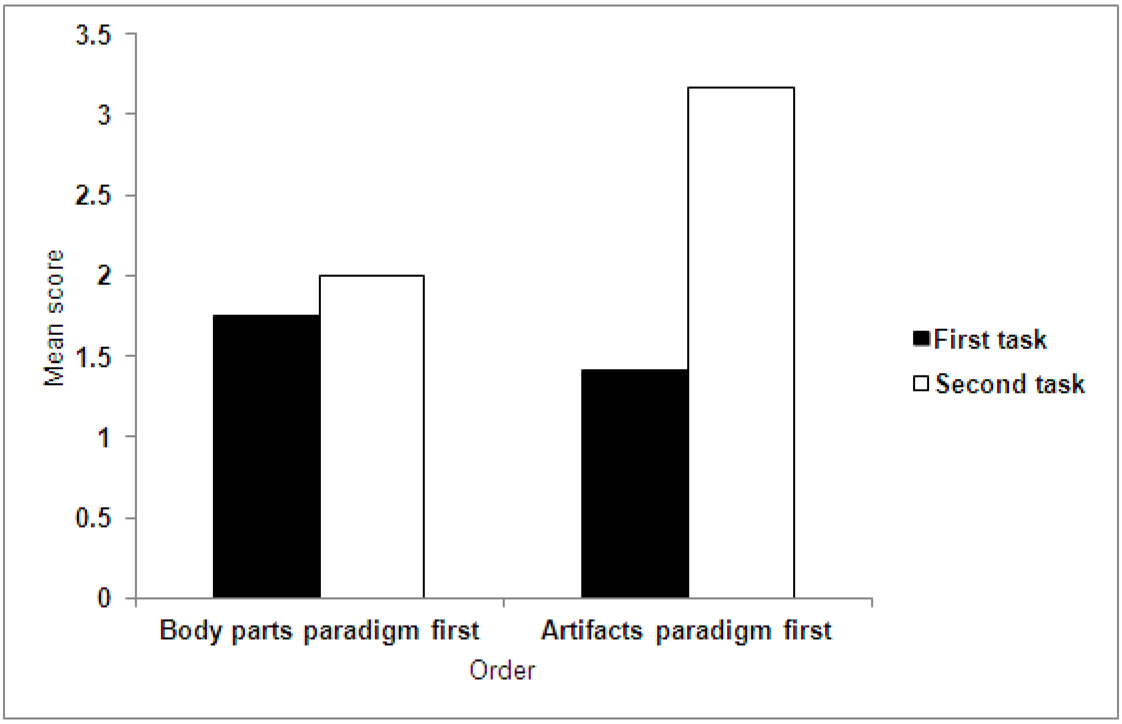
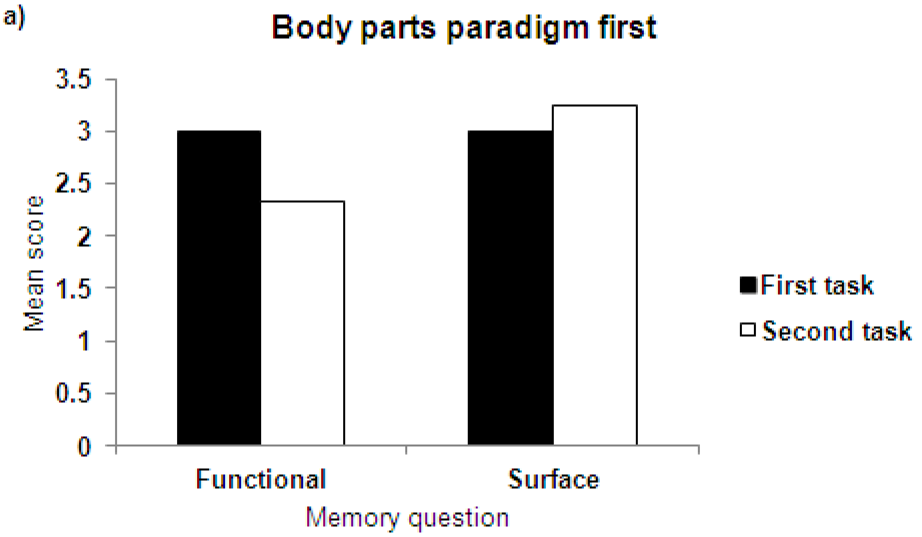


Figure 8.2. Mean knowledge scores as a function of task and paradigm order.

Inspection of Figure 8.2 shows that although children were not very systematic in their replies to the knowledge question, they did perform quite well in the body parts paradigm if they received it second. To better understand the interaction, analyses of simple effects were conducted. Analysis of the simple effect of paradigm order for the first task revealed no differences in children's performance for the knowledge question across the two paradigms (p = .537). However, analysis of the simple effect of paradigm for the second task revealed that children more often favoured the functional informant for the knowledge question in the body parts paradigm than in the artifacts paradigm (p = .023). Next, analysis of the simple effect of task for children who participated in the body parts paradigm first revealed no differences in children's performance in the knowledge question across the first and second tasks they completed (p = .684). In contrast, analysis of the simple effect of task for children who participated in the artifacts paradigm first revealed greater preferences for the functional informant for the knowledge question in the second task (i.e., body parts paradigm) than in the first task (i.e., artifacts paradigm) that they completed (p = .007).

Second, a 2 x 2 x 2 mixed ANOVA was conducted with paradigm order (body parts first, artifacts first) as the between-subjects variable, and task (first task, second task) and memory question (memory-functional, memory-surface) as within-subjects variables. Analysis revealed a marginally significant effect of paradigm order, $F(1,30) = 3.62$, p = .067, with children's memory scores tending to be higher for those who participated in the body paradigm first than for those who participated in the artifacts paradigm first. The interaction of paradigm order x task was significant, $F(1,30) = 4.51$, $p = .042$, and the 3-way interaction of paradigm order x task x memory question was marginally significant, $F(1,30) = 3.42$, $p = .074$. This interaction is illustrated in Figure 8.3. Inspection of Figure 8.3 suggests that children only did well on the memory questions if they had just received the artifacts paradigm having initially received the body parts paradigm. To assess this conclusion, analyses of the simple effect of paradigm order for each of the four combinations of task and memory question were conducted. The simple effect of paradigm order was significant only for the memory-surface question in the second task ($p = .002$). That is, in the second task they completed, children performed significantly better on the memory-surface question if they had first completed the body parts paradigm and then the artifacts than if they had first completed the artifacts paradigm and then the body parts paradigm. The simple effect of paradigm order for the three other combinations of task and memory question did not reach significance ($ps > .05$).

a)



b)

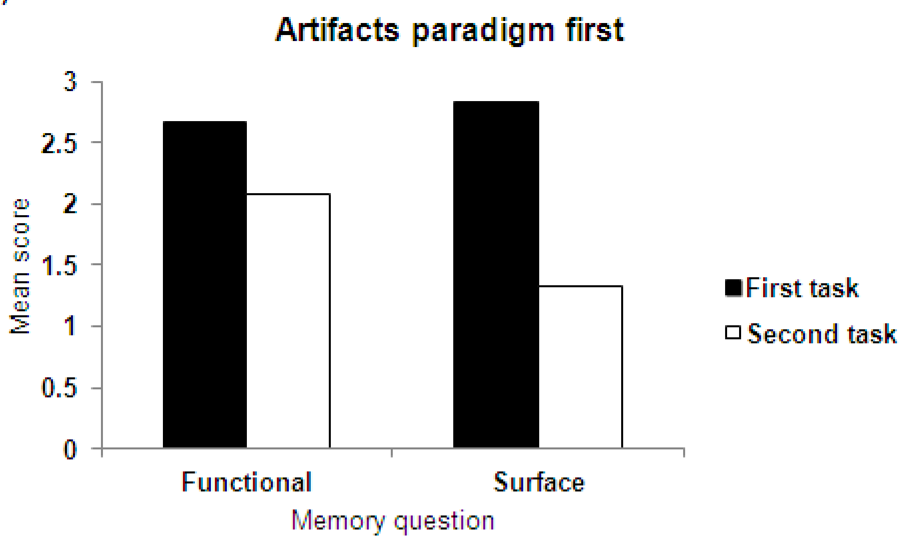


Figure 8.3. Mean scores on memory-functional and memory-surface questions as a function of task and paradigm order.

To further examine children's responses to the follow-up questions as a function of paradigm order and task, related samples *t*-tests were conducted. Scores for the knowledge and memory questions were compared to a chance expectation of 2, and scores for the memory total were compared to a chance expectation of 4 (see Table 8.6).

Table 8.6

Mean Number (and SD) of Selection of Functional Informant as a Function of Paradigm Order and Task for Follow-up Questions.

	Body parts paradigm first	Artifacts paradigm first
First task		
Knowledge (/4)	1.75 (1.35)	1.42 (1.65)
Memory-functional (/4)	3.00 (1.79)*	2.67 (1.76)
Memory-surface (/4)	2.33 (1.98)	2.83 (1.45)*
Memory total (/8)	5.33 (3.37)	5.50 (2.28)*
Function vs. appearance (/1)	0.56 (0.51)	0.75 (0.45)*
Second task		
Knowledge (/4)	2.00 (1.38)	3.17 (1.37)**
Memory-functional (/4)	3.00 (1.14)**	2.08 (1.88)
Memory-surface (/4)	3.25 (1.19)**	1.33 (1.89)
Memory total (/8)	6.25 (1.67)***	3.42 (3.51)
Function vs. appearance (/1)	0.81 (0.40)**	0.81 (0.40)**

Note. Asterisks denote response patterns that are different from chance.
*$p < .05$, ** $p < .01$, ***$p < .001$

Analyses revealed that for the knowledge questions, children were generally unsystematic in identifying either informant as particularly knowledgeable. However, there was one notable exception to this pattern. Children who participated in the artifacts paradigm first, and then proceeded to the body parts paradigm systematically judged the functional informant to be more knowledgeable in that latter paradigm. Recall that this pattern echoes what emerged with respect to the earlier analysis of children's selective trust. A comparison of Figures 8.1 and 8.2 underlines this similarity which will be considered in more detail below.

Turning to the memory questions, among children who participated in the body parts paradigm first, their responses in that paradigm were above chance for the memory-functional questions, $t(15) = 2.24$, $p = .041$. Further, their performance in the subsequent artifacts paradigm were above chance for the memory-functional questions, $t(15) = 3.50$, $p = .003$, the memory-surface questions, $t(15) = 4.20$, $p = .001$, and for the memory total score, $t(15) = 5.40$, $p < .001$. For children who participated in the artifacts paradigm first, their responses in the artifacts paradigm were above chance for the memory-surface questions, *t*(15) = 2.30, *p* = .036, and for the memory total score, *t*(15) = 2.64, *p* = .019. Their responses in the subsequent body parts paradigm were above chance for the knowledge questions only, *t*(15) = 3.42, *p* = .004. Overall, then, these comparisons to chance for the memory question confirm that children had some ability to recall which informant gave either functional information, or surface information, or both. On the other hand, when children participated in the body parts paradigm after the artifacts paradigm, they displayed no memory for how the informants differed – even though, as noted above, these same children judged the functional informant to be more knowledgeable.

For the function vs. appearance question, children were required to select whether they thought a person was smarter if they knew "what something is for" or if they knew "what something looks like". Given the demonstrated effects of task and paradigm order found above, children's responses to this final question were examined as a function of these two variables. A mixed ANOVA was conducted on children's responses to the function vs. appearance question, with paradigm order (body parts paradigm first, artifacts paradigm first) as the between-subjects and task (first task, second task) as the within-subjects variable. There was a marginally significant effect of task, *F*(1,30) = 3.95, *p* = .056, with children selecting the option, "what something is for" more often in the second task than in the first task. The effect of paradigm order was not significant, *F*(1,30) = .48, *p* = .495, and the paradigm order x task interaction was also not significant, *F*(1,30) = 1.42, *p* = .243.

Children's responses to the function vs. appearance question, as a function of task and paradigm order, were also compared to chance using binomial tests. Analysis showed that, for children who completed the body parts paradigm first, in their first task, 56% of children selected that a person who knew "what something is for" was smarter than a person who knew "what something looks like". However, this difference was not statistically significant (*p* = .804). In the subsequent artifacts paradigm they completed, 81% of children selected that a person who knew "what something is for" was smarter than a person who knew "what something looks like", and this difference was significant (*p* = .021). For children who completed the artifacts paradigm first, in their first task, 75% of children more often selected that a person who knew "what something is for" was smarter than a person who knew "what something looks like", and this difference was marginally significant (*p* = .077). In the subsequent body parts paradigm they completed, 81% of children selected that a person who knew "what something is for" was smarter than a person who knew "what something looks like", and this difference was significant (*p* = .021). In summary, children tended to favour a person who could provide explanations about functions over a person who could provide explanations about obvious features, but their preferences for this person were more systematic after they had participated in both paradigms.

Relations Between Responses to Follow-up Questions and Selective Trust

Because there were differences in children's performance as a function of task, relations between children's responses to the follow-up questions and their selective trust in both paradigms were examined. In addition, because the follow-up questions of the first paradigm explicitly referred to the distinction between functional and surface, it was possible that this prompted some of the children to systematically favour the functional informant in the second paradigm they participated in. First, bivariate correlations were carried out between children's performance on the follow-up questions (knowledge, memory-functional, memory-surface, memory total, function vs. appearance) and their responses to ask, endorse, and explicit judgement questions and total trust scores in the first and second paradigms they completed.

In relation to their performance on the first paradigm, children who preferred the functional informant in the knowledge questions for the first paradigm were more likely to favour the functional informant in the endorse questions ($r = .444$, $N = 32$, $p = .011$), explicit judgement questions ($r = .476$, $N = 32$, $p = .006$), and in the total trust scores ($r = .578$, $N = 32$, $p = .001$). The relation between children's knowledge scores and their ask scores was also marginally significant ($r = .323$, $N = 32$, $p = .071$). However, children's performance on the memory questions and the function vs. appearance question did not relate to their selective trust (all *ps* > .05). These results suggest that, in the first paradigm, children's trust in the functional informant was related to their construal of that informant as knowledgeable. The more children judged the functional informant to be knowledgeable, the more they favoured that informant in the selective trust test phase. To further examine these effects within the first paradigm, children were classified into two groups, depending on their knowledge scores for the first paradigm: (1) children with higher knowledge (HK) scores of 2.67 and above (i.e. 2 or 3 out of 3 in terms of raw score on the knowledge questions), and (2) children with lower knowledge (LK) scores below 2.67. A mixed 3 x 2 ANOVA for children's selective trust was conducted separately for each of the paradigm orders, with ask, endorse, and explicit judgement scores as within-subjects variables, and the knowledge score classification variable as the between-subjects variable. Analyses revealed HK children more often trusted the functional informant than LK children for both paradigm orders: body parts paradigm first, $F(1,14) = 8.62$, $p = .011$; artifacts paradigm first, $F(1,14) = 9.50$, $p = .008$. In comparing children's performance to chance, one-sample *t*-tests revealed that, while LK children selected the functional informant at chance levels for all test questions (all *ps* > .05), HK children were significantly above chance in selecting the functional informant for the ask questions, $t(10) = 2.35$, $p = .041$, the endorse questions, $t(10) = 2.67$, $p = .024$, the explicit judgement questions, $t(10) = 4.25$, $p = .002$, and for the total trust scores, $t(10) = 5.30$, $p < .001$. Hence, despite the overall unsystematic performance of children in the first task they participated in, it appears that children who deemed the functional informant to be a knowledgeable source of information were more likely to have initially demonstrated selective trust in her.

In relation to children's performance on the second paradigm, children who preferred the functional informant in the knowledge questions for the second paradigm were more likely to favour the functional informant in the ask questions ($r = .449$, $N = 32$, $p = .010$), endorse questions ($r = .427$, $N = 32$, $p = .015$), explicit judgement questions ($r = .489$, $N = 32$, $p = .004$), and in the total trust scores ($r = .605$, $N = 32$, $p < .001$). In contrast, children's performance on the memory questions and the function vs. appearance question did not relate to their selective trust (all *ps* > .05). Consistent with the correlations found for the first paradigm above, children who trusted the functional informant were more likely to judge that informant as knowledgeable in the second paradigm. Again, children were classified into two groups, based on their knowledge scores for the second paradigm: (1) children with higher knowledge (HK) scores of 2.67 and above, and (2) children with lower knowledge (LK) scores below 2.67. A mixed 3 x 2 ANOVA for children's selective trust was conducted separately for each of the paradigm orders, with ask, endorse, and explicit judgement scores as within-subjects variables, and the knowledge score classification variable as the between-subjects variable. Analyses revealed HK children more often trusted the functional informant than LK children in their second task when they participated in the artifacts paradigm first, $F(1,14) = 16.19$, $p = .001$, but not when they participated in the body parts paradigm first, $F(1,14) = 2.47$, $p = .139$. In other words, children who construed the functional informant in the body parts paradigm as being a knowledgeable source of information more often trusted her, but only after they had participated in a preceding artifacts paradigm. The reverse pattern did not emerge; children who construed the functional informant in the artifacts paradigm as being a knowledgeable source of information were not more likely to trust her, even after they had participated in a preceding body parts paradigm. In comparing children's performance to chance, one-sample *t*-tests revealed that, as in the first task, LK children performed at chance levels for all test questions (all *ps* > .05). In contrast, HK children were above chance in selecting the functional informant for the ask questions, $t(19) = 3.56$, $p = .002$, the explicit judgement questions, $t(19) = 3.31$, $p = .004$, and in the total trust scores, $t(19) = 4.36$, $p < .001$, but marginally above chance in the endorse questions, $t(19) = 1.90$, $p = .072$. To sum, in line with the findings of the first task, children who classified the functional informant as knowledgeable also tended to trust her in the second task.

Finally, when considering children's performance on the follow-up questions in the first paradigm, and their selective trust in the subsequent paradigm, children who favoured the functional explanation in the final functional vs. appearance question of their first task were more likely to endorse the functional informant in their second task ($r = .459$, $N = 32$, $p = .008$). However, no other correlations were significant (all *ps* > .05). That is, children's selective trust in their second task was not related to their knowledge or memory scores from the first task. To further examine the relation between children's responses to the functional vs. appearance question of the first task and their selective trust in the second task, children were classified into two groups: (1) children who decided that a person was smarter if they knew "what something is for", and (2) children who decided that a person was smarter if they knew "what something looks like". A mixed 3 x 2 ANOVA for children's selective trust was conducted separately for each of the paradigm orders, with ask, endorse, and explicit judgement scores from the second task as within-subjects variables, and response to the functional vs. appearance question from the first task as the between-subjects variable. Analyses revealed children who selected the functional option in their first task were more likely to trust the functional informant in their second task than children who selected the surface option when they participated in the body parts paradigm first, $F(1,14) = 4.64$, $p = .049$, but not when they participated in the artifacts paradigm first, $F(1,14) = .01$, $p = .907$. Further attempts to split children into separate groups based on their performance on the knowledge and memory questions of their first task and examining differences in their selective trust in their second task as a function of these classification variables revealed no other significant findings.

ToM, Verbal Ability, and its Relations to Selective Trust

Given their age, the performance of eight-year-olds on the ToM tasks was expected to be at ceiling, and this expectation was confirmed. For first-order ToM reasoning, with the exception of seven children, all children obtained a maximum score of 4. For second-order ToM reasoning, with the exception of nine children, all children obtained a maximum score of 2.

Bivariate correlations between children's selective trust variables, ToM (first-order, second-order reasoning, and total scores) and verbal ability were conducted. There were no indications that children's selective trust was related to verbal ability. In addition, no relations were found between children's responses in the body parts paradigm to any of the individual differences variables (all *ps* > .05). However, for the artifacts paradigm, children's performance on the memory-surface question was related to first-order ToM reasoning (r = .366, N = 32, p = .040), to second-order ToM reasoning (r = .413, N = 32, p = .019), and to the total ToM score (r = .432, N = 32, p = .014). Further, children's overall memory performance was related to first-order ToM reasoning (r = .505, N = 32, p = .003), to the total ToM score (r = .450, N = 2, p = .010), and marginally to second-order ToM reasoning (r = .322, N = 32, p = .072). To sum, it appears that children who are more skilled at ToM were better able to recall which informant provided a particular type of explanation in the artifacts paradigm. No other significant relations were found between children's selective trust in the artifacts paradigm and the individual differences variables (all *ps* > .05). Hence, further analysis of children's selective trust as a function of ToM was not carried out.

Discussion

The aim of this study was to follow up on the null results of Studies 3A and 3B to investigate whether eight-year-olds are better able to differentiate between informants who provide functional or surface explanations for highly familiar body parts. Moreover, the body parts were described in terms of *what they are used for*, rather than *what they do*, which could improve children's understanding given existing findings that children and adults tend to view body parts in teleological terms: an entity is *for X* because they are *designed to do X* (Kelemen, 1999a). In addition to the inclusion of these familiarisation trials, a comparison artifacts paradigm was introduced to examine whether children are better able to differentiate between common everyday artifacts, which are generally also described in terms of *what they are used for*, rather than *what they do.* It was anticipated that eight-year-olds would be more likely to trust an informant who provided functional explanations over an informant who provided obvious descriptions of observable characteristics. Overall, it appears that this core manipulation had a mixed level of success.

Contrary to predictions, eight-year-olds generally did not prefer learning about novel labels for unfamiliar objects from the informant who provided functional explanations for familiar objects. However, there was one exception. Given the within-subjects design of this experiment, order effects emerged such that children's preferences for the functional informant depended on the order in which the paradigms were presented. It is important to note that it is likely that the task x paradigm interactions observed in this study failed to reach significance due to low power. Nevertheless, the marginal order effects that emerged were informative for interpreting the results, and it can be seen that analyses of simple effects yielded important information about the influence of paradigm order. Specifically, children systematically preferred the informant who provided functional explanations in the body parts paradigm, but only after they had participated in the artifacts paradigm first. However, the reverse did not apply: children did not systematically prefer the informant who provided functional explanations in the artifacts paradigm if they had participated in the body parts paradigm first. To sum, it appears that children are able to differentiate between informants who provide functional or surface explanations, at least for body parts, in certain contexts; namely, when preceded by a paradigm with informants who provide differing explanations for artifacts. However, children's responses to the follow-up questions were not wholly consistent with their selective trust. For instance, in the first follow-up question, the majority of children's justifications for which informant was "better" referred to the general accuracy or competence of the informant. Few children provided specific justifications which referred to the informant's ability to provide information about the functions or appearance of the objects. Although the number of children who made specific justifications in this study is greater than that found in Study 3B, it is not a substantial number. Hence, despite children systematically preferring the functional informant in the body parts paradigm when it was presented as the second task, few children explicitly stated that their preferences were due to the functional informant providing information about the functions of the body parts.

Although few children provided specific justifications, their responses to the knowledge follow-up questions suggest that their trust in the functional informant hinged on their construal of that informant as being knowledgeable. In the first task they completed, across both paradigms, even though children's selective trust was generally not systematic, the children who judged the functional informant as more knowledgeable were more likely to have demonstrated selective trust for the functional informant. Similarly, in the second task they completed, especially in the body parts paradigm, children who judged the functional informant as being more knowledgeable were more likely to have demonstrated selective trust for the functional informant. On the other hand, in both tasks, children who did not judge the functional informant to be knowledgeable did not differentiate between the informants during the selective trust trials. Overall, children who believed that the functional informant was more knowledgeable preferred to learn novel labels from her, rather than from the informant who provided surface explanations. This finding suggests that some children were able to attend to the different types of explanations offered and that they considered the functional explanation to be, in some way, superior to the surface explanation.

In terms of children's responses to the memory questions, for the most part, children successfully recalled which informant provided a particular type of explanation. In the first task they completed, children successfully associated at least one of the types of explanation with the appropriate informant. In the artifacts paradigm, children demonstrated better overall memory for what the informants said and they systematically recalled which informant provided information about what the artifacts *looked like*. On the other hand, in the body parts paradigm, children systematically recalled which informant provided information about what the body parts *were for*. The order effects observed in the selective trust paradigm were also apparent in children's responses to the memory questions in their second task. That is, while the children who participated in the artifacts paradigm second were capable of remembering which informant provided a particular type of explanation, the children who participated in the body parts second were unable to successfully answer the memory questions. This finding is perplexing given that children had been able to respond appropriately to the memory questions in the preceding artifacts paradigm. Further, children had systematically trusted the informant who provided functional explanations in this particular context (i.e., when the body parts paradigm was presented second). Hence, it is intriguing as to how children would be able to demonstrate selective trust but an inability to successfully recall what each particular informant had said that led to that differentiation. Possible explanations for this perplexing finding will be considered in further detail below.

Given the order effects apparent in the results of this study, it was necessary to investigate what factors may be driving such effects. However, further analyses did not provide strong indications that a specific response in one of the follow-up question in the first task was related to selective trust in the second task. There were some evidence that, in the final follow-up question of the first task, children who rated a person as being smarter if they "knew what something was for" rather than if they "knew what something looks like" were more likely to trust the functional informant in the second task. However, these effects were not consistent across the paradigm orders. The link between children's response to the function vs. appearance question in the first task and their subsequent selective trust in the second task was more evident for children who were assigned to the body parts paradigm first, which is not consistent with the systematic performance observed for the children who were assigned to the artifacts paradigm first. To sum, the results do not shed light on what particular aspects of the first task motivated children's selective trust in the second task.

Finally, with regards to individual differences, consistent with the findings of Studies 3A and 3B, children's selective trust was not related to their verbal ability. Thus, it is not the case that children who were verbally more competent were better able to evaluate the different types of explanations. Further, consistent relations between children's selective trust and ToM were not found. In accordance with the conclusions of Studies 3A and 3B, there is little evidence for the stability and robustness of the link between children's selective trust and ToM.

The findings of this study are informative in two ways. First, they suggest that the re-introduction of familiarisation was effective in allowing children to evaluate the different types of explanations. Although children's preference for the functional informant in this study was not as systematic as that demonstrated in existing studies of children's selective trust in accurate labellers (Corriveau et al., 2009; Koenig & Harris, 2005) or informants who provide noncircular explanations (Kurkul & Corriveau, 2014), the findings suggest that the familiarisation trials, featuring objects well-known to children, was effective in helping them attend to the different types of explanations. This is evident when examining children's responses to the follow-up memory questions. In contrast to the null findings of the memory questions in Study 3B, the eight-year-olds in this study were generally better able to recall which informant provided explanations about the functions of body parts/artifacts and which informant provided explanations about the surface appearance of body parts/artifacts.

It is not known whether the improved performance of children was merely due to the increased familiarity of the body parts, or because the functions of the body parts were described in terms of *how they are used*, rather than *what they do*. To address this question, a future study could present explanations for familiar body parts/organs in terms of *what they do*. Children could be familiarised with informants who provide explanations for familiar external parts of the body (e.g., skin, nails, hair, eyelashes), which are better described in terms of *what they do* rather than *what they are used for*. For instance, it is more appropriate to say that the skin "protects the inside of your body" than to say that "you use your skin to protect the inside of your body". Another way to approach this question would be to modify the familiarity of the body parts and describe them in terms of *what they are used for*. For example, children could be presented with familiar internal organs (e.g., heart, lungs, stomach, brain), which are described in terms of *what they are used for* (e.g., "you use your brain for thinking"). Because children are not as familiar with these organs as they are with external body parts, they might attend to information which relates to their functions because they are perhaps more likely to hear others refer to these specific organs as performing certain functions. Further, they would already be able to verify the surface explanations from the pictures presented in the experiment, so the use of these internal organs may make explanatory depth a more salient cue.

Another way in which the current study has improved over Studies 3A and 3B is reflected in children's responses to the follow-up questions. It is apparent that there were improvements in children's recall of which informant provided a particular type of informant, particularly in the artifacts paradigm, which will be discussed below. In addition, children's responses to the knowledge questions and the function vs. appearance question in this study were more systematic than those in Study 3B, and relations were found between children's responses to the follow-up questions and their selective trust. For instance, children who regarded the functional informant as knowledgeable more often preferred to learn novel labels from that informant. Further, whereas the eight-year-olds in Study 3B did not differentiate between the two options in the function vs. appearance question, the eight-year-olds in this study systematically claimed that a person who knew "what something is for" was smarter than a person who knew "what something looks like", at least by the end of the second paradigm. Hence, it appears that the re-introduction of familiarisation trials, in some ways, facilitated children's sensitivity to the different types of explanations.

Second, the results of Study 4 are important because they examine whether children's differentiation between functional and surface explanations differ across the biological and artifact domains. The findings of this study initially suggest that children show selective trust in the biological domain but not in the artifact domain. However, the order effect found does not lend support to a straightforward story. In the section below, I attempt to provide an explanation for such perplexing results.

As discussed earlier in the Introduction, children's lack of selective trust in Studies 3A and 3B may have two explanations: (1) failure to recall what each informant said and, hence, an inability to distinguish between the explanations, resulting in random selection of informants in the test trials; or (2) construal of both informants as credible and relevant and, hence, no demonstrated selective trust. In applying these previous explanations to the results of this study, it appears that the second reason is more plausible. In this study, children generally had no difficulty recalling what each informant had said. For example, in the follow-up questions of the artifacts paradigm, children responded systematically to the memory-surface questions and were above chance in their memory totals, regardless of paradigm order. Moreover, when children were presented with the body parts paradigm first (i.e., when there was no preceding paradigm), they were at least able to systematically recall which informant provided functional explanations. Hence, children's performance was not likely due to an inability to recall what each informant had said. Further, the results suggest that there was a subset of children who were likely to demonstrate selective trust in the functional informant. These children tended to attribute more knowledge to the functional informant. On the other hand, children who attributed less knowledge to the functional informant were likely to have performed at chance when required to seek and endorse novel labels from one of the informants. Therefore, the lack of selective trust observed in this study is unlikely due to children being random and unsystematic. Instead, their selective trust emerges under particular conditions (e.g., if they believed the functional informant was knowledgeable). In summary, it is plausible that children's overall lack of selective trust stemmed from their construal of the explanations as both being equally credible and relevant. At the very least, it appears that some children carefully consider the explanations offered by the informants and do not simply respond randomly.

An indication for why children may consider both explanations to be equally credible is apparent when closely inspecting the stimuli, especially for the artifacts paradigm. In general, both types of explanations appear to be elaborate and detailed. For the functional explanations, there is substantial information about how the artifacts are to be used. Similarly, for the surface explanations, there is a great deal of description, and some references to what materials the artifact is made out of as well as tactile aspects of the artifact (e.g., temperature, "bumpy to touch"), which could be interpreted as being distinct from mere knowledge of obvious characteristics. In this study, the few children who did provide specific justifications for their selection of a particular informant made references to material and appearance to explain why they favoured the surface informant. In order to address this issue and ensure that children's lack of selective trust is not due to the possibility that the surface informant demonstrated some level of knowledge beyond obvious appearance, a future study could simplify the explanations and remove references to materials and tactile sensations in the surface explanations such that they refer only to that which can be externally observed. This possibility is further explored in the next chapter.

With regards to the order effect found in this study, presentation of the artifacts paradigm first appears to benefit children's selective trust in the body parts paradigm presented second. While children did not differentiate between the explanations offered in the first artifact paradigm, the references to the distinction between function and appearance in the follow-up questions to the first paradigm may have served as a prompt for the children who participated in the subsequent body parts paradigm. Indeed, children systematically favoured the functional informant in the test trials and the follow-up knowledge questions of the subsequent body parts paradigm. However, despite children's increased selective trust in this second paradigm, their responses to the memory questions were at chance. The combination of these two findings is puzzling. It does not make sense for children to be able to demonstrate selective trust but, at the same time, be unable to recall which informant provided a particular type of explanation, which is assumed to be the basis of their evaluations of trustworthiness.

In further exploring children's responses to the memory questions, it was found that, in their second task, children who participated in the artifacts paradigm first more often responded incorrectly to the memory-surface question than children who participated in the body parts paradigm first. These effects were not observed when considering children's responses to the memory-functional questions in the first and second tasks, as well as to the memory-surface question in the first task. In other words, children who participated in the body parts paradigm after completing a preceding artifacts paradigm were answering incorrectly to the memory-surface question, which asked them to select which informant provided more information about what parts of the body look like. They were selecting the functional informant and stating that she knew more about what the parts of the body look like, despite not having offered that type of explanation in the familiarisation trials. Such a finding suggests that there was some level of transfer from the first paradigm they completed. It is possible that the prompting from the first set of follow-up questions led them to believe that they were expected to continually favour the functional informant in the second paradigm, even when it was evident that this informant had not provided information about the appearance of the body parts. Therefore, children's trust in the functional informant may be due to task demands, and the results of the second paradigm should be interpreted with caution. Further scrutiny of the data did not prove fruitful in clarifying how children's responses to the follow-up questions on the first task relate to their selective trust on their second task. It is not known what aspect of the first artifacts paradigm is driving the effects found in the subsequent body parts paradigm. Nevertheless, the results of this study suggest that some level of prompting may facilitate children's selective trust. In a future study, the experimenter could state at the start of the experiment that the informants are going to use the correct label for the objects, but that the children need to "pay special attention to the other things the girls says and try to find out what makes them different". Such prompting might lead children to give more attention to the differences between explanations.

Another plausible explanation for children's lack of differentiation between the explanations relates to the type of test trials used. In this study, children were required to seek and endorse novel labels for unfamiliar organs/artifacts from informants who previously provided explanations about familiar body parts/artifacts. Therefore, when learning about novel labels, children may not have necessarily generalised their trust to the informant who had provided functional explanations. In other words, they did not consider an informant's ability to give a particular type of explanation to be indicative of their subsequent ability to provide labels for the unfamiliar organs/artifacts. As discussed earlier, both types of explanations could have been construed as equally plausible. It should be highlighted that the explanations featured in this study are different from the circular and noncircular explanations presented in Kurkul and Corriveau (2014). That is to say, while there are inherent logical flaws in the nature of circular explanations when compared to noncircular explanations, both informants in this study provided explanations which were accurate, relevant and coherent. For this reason, children may not have believed one informant would be more knowledgeable about labels than the other. In a future study, test trials could be modified such that they refer to novel explanations (as in Kurkul & Corriveau). Alternatively, children could be presented with a confederate who either wishes to learn about how a novel object works or wishes to learn about what it looks like, and then be asked to direct the confederate to the appropriate informant to learn from. Since the results of this study demonstrate that children were generally competent in recalling which informant provided a particular type of explanation in the memory questions, it is likely they would be capable of attributing knowledge based on the depth of the explanations. However, in the scope of this thesis, this option was not examined further for various reasons. First, it was necessary to explore the possibility that the lengthy explanations supplied by the informants might be interfering with children's ability to differentiate between the functional and surface explanations. Second, it was possible that children's trust in the informants might alter if the surface explanations were modified so that they had greater emphasis on observable characteristics, as discussed above. Finally, it would also be informative to adhere to the traditional paradigm to determine whether there are limits to children's tendency to generalise their trust between functions and labels. Of course, if it is shown that simplifying and shortening informants' explanations did not influence the readiness by which children distinguish between the different types of explanations, the next logical step would be to attend to modifying the questions asked in the test trials.

To conclude, the results of Study 4 suggest that the re-introduction of the familiarisation trials was effective in improving children's understanding because they were better able to recall which informant provided a particular type of explanation. At first glance, it appears that children were able to differentiate between explanations about body parts, but not between explanations about artifacts. However, the presence of an order effect, in which performance in the first paradigm interfered with performance in the second paradigm, suggests that the interpretation of such results warrant caution. Overall, if we consider only the findings of the unaffected first tasks, eight-year-olds did not differentially prefer functional explanations over surface explanations, unless they considered the informant who provided functional explanations to be knowledgeable. However, their general lack of selective trust is not likely due to their inability to comprehend the information provided by the informants or because they are responding randomly. Instead, they could recall that the two types of explanations focus on different aspects (i.e., function vs. appearance), but they perhaps did not consider functional explanations to be superior to surface explanations.

Chapter 9
Study 5A and 5B

The findings of Study 4 revealed that eight-year-olds did not prefer learning from informants who provided functional explanations over surface explanations, unless they considered the functional informant to be more knowledgeable. However, it was not the case that children were unable to differentiate between the informants; they were generally able to recall which informant had provided a particular type of explanation (i.e., whether the explanation focused on function or appearance). Hence, it was suggested that children might have considered both informants to be equally credible. Closer consideration of the stimuli suggests some reasons as to why children may have treated both informants in equivalent terms in Study 4. Both functional and surface explanations were lengthy and detailed; averaging 36 words per explanation and presenting multiple pieces of information. For example, in the functional explanations, there was substantial information about how body parts or artifacts could be used. Further, in the surface explanations, particularly with respect to the artifacts paradigm, objects were described in great detail and there were references to material and tactile properties of objects; characteristics which extend beyond immediately observable properties. For instance, when providing a surface explanation for a spoon, the informant stated that it was “made of metal”, “very smooth”, and “cold to touch”. As a result, children might have interpreted both informants to be informative and knowledgeable, even if the surface informant had only described perceptible characteristics.

Study 5 thus addressed two issues raised by Study 4. First, to ensure that children’s lack of selective trust was not due to the surface informant demonstrating knowledge beyond visible appearances, references to materials and tactile properties were removed, such that only properties which could be externally observed were stated. Second, the functional and surface explanations were simplified and shortened to ensure that children understood and could recall what each informant had said. In addition, because the explanations were briefer, it was anticipated that the distinctiveness of each informants’ explanations would be clearer, thus leading children to favour the informant who provided functional information. Overall, this study examined whether children are capable of differentiating between informants who provide shorter functional or surface explanations, which appear conversational in nature, and, subsequently, whether they prefer learning from functional informants. Eight-year-olds were presented with either a body parts or an artifacts paradigm. Consistent with the predictions of Study 4, it was anticipated that children would show greater trust in the functional informant over the surface informant. A between-subjects design was implemented in this study given the complications with interpretation that arose in the within-subjects design of Study 4. Five-year-olds were also included in the sample; these findings are outlined in Study 5B.

Method – Study 5A

Participants

Participants were 32 eight-year-olds (25 girls). Children were allocated to receive either the body parts paradigm (*M* = 103.03, *SD* = 2.95, *Range* = 96-112) or the artifacts paradigm (*M* = 102.88, *SD* = 3.46, *Range* = 96-110). All children lived in a metropolitan area and spoke fluent English. Most children were Caucasian, although a range of ethnicities was represented. Children were recruited via parental invitation and tested individually in a quiet room in their school. Children participated in one session, lasting approximately 20 minutes, where they were presented with the selective trust paradigm and given verbal ability assessments. In contrast to Study 4, eight-year-olds' ToM was not assessed in this study given that their performance would likely be at ceiling levels.

Materials and Procedure

Materials and procedure were identical to Study 4, with the exception of the amount of information provided in the familiarisation trials, which is detailed in Tables 9.1 and 9.2.

Table 9.1

Familiarisation Trials in the Body Parts Paradigm.

Body Part	Functional informant	Surface informant
Eye	That's an eye. You use it when you need to see and look at things.	That's an eye. It has a small black circle and an eyebrow on top.
Foot	That's a foot. You need it for standing and walking around.	That's a foot. There are five toes and a nail on the end of each toe.
Nose	That's a nose. You use it when you need to breathe and smell things.	That's a nose. It has two holes and is long and skinny at the top.
Hand	That's a hand. You need it for touching and picking things up.	That's a hand. There are four fingers, a thumb, and it's part of your arm.

Table 9.2

Familiarisation Trials in the Artifacts Paradigm.

Familiar artifact	Functional informant	Surface informant
Spoon	That’s a spoon. You use it when you need to eat runny or soft foods.	That’s a spoon. It’s long and shiny, and has a round part at the top.
Toothbrush	That’s a toothbrush. You use it when you need to clean your teeth.	“That’s a toothbrush. It’s long and skinny, and has bumps in the middle.
Shoe	That’s a shoe. You use it when you need to protect your feet.	That’s a shoe. It’s blue, and is soft on top but hard underneath.
Bottle	“That’s a bottle. You use it when you need to carry water with you.	“That’s a bottle. It’s skinny at the top, wider at the bottom, and shiny.

Results – Study 5A

Results will be presented in three parts. First, children’s selective trust and their responses to the follow-up questions as a function of paradigm are examined. Second, relations between children’s responses to the follow-up questions and their selective trust are examined. Finally, children’s performance on the verbal ability assessment and its relations with selective trust are presented.

Children’s Selective Trust

Scoring of children’s responses was identical to Study 4. That is, children were given a point for favouring the functional informant in each ask, endorse, and explicit judgement question. Separate total scores were created by summing children’s appropriate responses, resulting in a total score from 0-4 for ask questions, 0-4 for endorse questions, and 0-3 for explicit judgement questions. To equate the scores for the three children who correctly identified one of the novel objects, their ask and endorse totals were multiplied by 4/3. In addition, to allow meaningful comparison with ask and endorse totals, scores for the explicit judgement questions were linearly transformed (i.e., multiplied by 4/3). An overall total score was also eventually created by summing the endorse total and the (transformed) explicit judgement total, resulting in a total score from 0-12. Mean scores are presented in Table 9.3. To first assess whether there were differences by paradigm (body parts or artifacts) and question type (ask, endorse, and explicit judgement), a 2 x 3 mixed ANOVA was conducted with paradigm as the between-subjects variable and question type as the within-subjects variable. Analyses revealed that there was a significant main effect for question type, $F(2,60) = 4.39$, $p = .017$, but not for paradigm, $F(1,30) = 1.29$, $p = .265$. To examine the differences between the question types, post-hoc *LSD* tests revealed that children were more likely to favour the functional informant on the explicit judgement questions than on the ask questions ($p = .047$) or on the endorse questions ($p = .013$), but there were no differences between ask and endorse questions ($p = .684$). Importantly, question type did not interact with type of paradigm, indicating that children responded consistently in both paradigms, $F(2,60) = 0.15$, $p = .858$.

To examine whether children performed above chance on each of the question types in each paradigm, using related samples *t*-test, means for the ask, endorse and explicit judgement questions were compared to a chance expectation of 2, and means for the overall score were compared to a chance expectation of 6. Means for children's performance as a function of task and paradigm order are shown in Table 9.3.

Table 9.3

Mean Number (and SD) of Choices Directed at the Functional Informant by Paradigm.

Question type	Body parts paradigm	Artifacts paradigm
Ask questions (/4)	2.08 (0.59)	2.25 (0.93)
Endorse questions (/4)	1.94 (0.65)	2.25 (1.18)
Explicit judgements (/4)	2.50 (1.37)	2.92 (1.31)*
Overall scores (/12)	6.52 (1.61)	7.42 (2.71)[a]

Note. Asterisks denote response patterns that are different from chance.
[a]$p = .054$, *$p < .05$

Analyses revealed that children's selective trust in the body parts paradigm did not differ significantly from chance for any of the measures (*ps* > .05). Similarly, in the artifacts paradigm, children's selective trust did not differ from chance for the ask and endorse questions (*ps* > .05). However, children were above chance for the explicit judgement question, favouring the functional informant, $t(15) = 2.80$, $p = .013$. Finally, children's overall trust in the functional informant in the artifacts paradigm reached marginal significance, $t(15) = 2.09$, $p = .054$. To sum, eight-year-olds did not systematically prefer informants providing functional explanations when learning about labels for unfamiliar objects (i.e., body parts or artifacts), but, when asked about which informant was "very good" or "better" at talking about the artifacts, children did favour the informant who had provided functional explanations. In contrast, children presented with the body parts paradigm were at chance when deciding which informant was “very good” or “better” at talking about body parts.

Performance on Follow-up Questions

Immediately following the explicit judgment questions, children were asked a series of follow-up questions in which they had to justify why they decided that one of the informants was “better” at providing explanations. For children who were presented with the body parts paradigm, 56.3% of children (*n* = 9) made specific references to the content of the informant’s explanations. Of these nine children, 5 favoured the functional informant (e.g., “she told me what it is for”, “she wasn't describing it, she was saying what it does”), and 4 favoured the surface informant (e.g., “she made a description of it”, “she told me what is on it”). In contrast, 31.3% of children (*n* = 5) made general references to the accuracy or competence of the informant they selected as “better” (e.g., “she explained it better”, “most of the things she said gave me the right answer”). For children who were presented with the artifacts paradigm, 62.5% of children (*n* = 10) made specific references to the content of the informant’s explanations. Of these 10 children, 8 favoured the functional informant (e.g., “she wasn't describing it, she was saying what it does”, “she told you what you use them for”), and two favoured the surface informant (e.g., “she explained what it looked like and which parts were which”, “she described them, because if you wondered what one of them was, you’d describe them”). In contrast, 25% of children (*n* = 4) made general references to the accuracy or competence of the informant they selected as “better”.

Scoring of children’s responses to the remaining follow-up questions was identical to Study 4. That is, children were given a point for selecting the functional informant in each trial. Separate total scores were created by summing children’s responses, resulting in a total score from 0-3 for each of the knowledge, memory-functional, and memory-surface questions, and a total score from 0-1 for the function vs. appearance question. To allow meaningful comparison with the other totals in this study, totals for the knowledge and the two types of memory questions were linearly transformed (i.e., multiplied by 4/3) such that all total scores now ranged from 0-4. In addition, an overall total memory score was created by summing the memory-functional and memory-surface totals, resulting in a total score from 0-8. These mean scores are presented in Table 9.4.

To examine children’s responses to the remaining follow-up questions, a 2 x 3 mixed ANOVA was conducted, with paradigm (body parts or artifacts) as the between-subjects variable, and follow-up question type (knowledge, memory-functional, memory-surface) as the within-subjects variables. Analyses revealed that there was a significant main effect for follow-up question type, *F*(2,60) = 8.87, *p* < .001, but not for paradigm, *F*(1,30) = 0.57, *p* = .457, and the follow-up question type x paradigm interaction was not significant, *F*(2,60) = 1.02, *p* = .367. To explore how children's responses differed between the follow-up questions, post-hoc *LSD* tests revealed that children performed worse on the knowledge questions than on the memory-functional questions (*p* = .001) and memory-surface questions (*p* = .015). No differences were found between the two types of memory questions (*p* = .116). To further examine children's responses to the follow-up questions as a function of paradigm type, related samples *t*-tests were conducted. Scores for the knowledge and memory questions were compared to a chance expectation of 2, and scores for the memory total were compared to a chance expectation of 4 (see Table 9.4). For the body parts paradigm, children's responses to the knowledge question did not differ significantly from chance, *t*(15) = 1.48, *p* = .159. However, their performance in the memory questions was significantly above chance: memory-functional, *t*(15) = 11.00, *p* = < .001; memory-surface, *t*(15) = 7.89, *p* = < .001; and memory total, *t*(15) = 9.94, *p* = < .001. In other words, children's were able to successfully recall what each informant had said in the body parts paradigm. For the artifacts paradigm, children's responses to all follow-up questions were above chance: knowledge question, *t*(15) = 3.66, *p* = .002; memory-functional, *t*(15) = 16.10, *p* = <.001; memory-surface, *t*(15) = 5.44, *p* = < .001; and memory total, *t*(15) = 9.94, *p* = < .001. To be specific, not only did children in the artifacts paradigm successfully recall what each informant had said, they also systematically credited greater knowledge to the functional informant.

Table 9.4

Mean Performance (and SD) on Follow-up Questions by Paradigm.

Follow-up question	Body parts paradigm	Artifacts paradigm
Knowledge (/4)	2.58 (1.58)	3.17 (1.28)**
Memory-functional (/4)	3.83 (0.67)***	3.83 (0.46)***
Memory-surface (/4)	3.58 (0.80)***	3.58 (1.16)***
Memory total (/8)	7.42 (1.37)***	7.42 (1.37)***

Note. Asterisks denote response patterns that are different from chance.
** *p* < .01, ****p* < .001

Children’s responses to the final function vs. appearance question were also examined. For children presented with the body parts paradigm, all children claimed that a person who knew “what something is for” was smarter than a person who knew “what something looks like”. In addition, for children presented with the artifacts paradigm, all children, except one, selected that a person who knew “what something is for” was smarter than a person who knew “what something looks like”.

Relations Between Responses to Follow-up Questions and Selective Trust

Given that children’s overall performance did not vary significantly between the two paradigms, children’s scores across the paradigms were combined, and bivariate correlations were carried out between children’s performance on the follow-up questions (knowledge, memory-functional, memory-surface, memory total, function vs. appearance) and their responses to ask, endorse, and explicit judgement questions and total trust scores. These correlations are presented in Table 9.5. Consistent with the findings of Study 4, children who preferred the functional informant in the knowledge questions were more likely to favour the functional informant in the endorse questions (r = .352, N = 32, p = .048), explicit judgement questions (r = .742, N = 32, p < .001), and in the total trust scores (r = .645, N = 32, p < .001), but not in the ask questions (r = .161, N = 32, p = .378). In contrast to the findings of Study 4, children’s performance on the memory questions was related to selective trust. Children who were better able to recall which informant provided the functional explanations were more likely to endorse the functional informant (r = .433, N = 32, p = .013) and demonstrate overall trust in that informant (r = .383, N = 32, p = .031). In addition, children with higher memory scores were more likely to endorse the functional informant (r = .400, N = 32, p = .023), and were more likely to have higher overall selective trust scores (r = .429, N = 32, p = .014). These results suggest that children’s trust in the functional informant was related to their construal of that informant as knowledgeable as well as their ability to recall which informant provided a particular type of explanation. It appears that children who more often favoured the functional informant in the selective trust task were more likely to consider her to be knowledgeable and remember what she had said.

Table 9.5

Correlations Between Children's Selective Trust and Follow-up Questions.

	Knowledge questions	Memory-functional	Memory-surface	Total memory	Function vs. appearance
Ask questions	0.161	0.165	0.226	0.233	0.039
Endorse questions	.352*	.433*	0.303	.400*	0.018
Explicit judgements	.742**	0.239	0.276	0.3	0.188
Overall trust	.645**	.383*	.371*	.429*	0.133

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the .01 level (2-tailed).

To further examine the differences between children who favoured the functional informant or the surface informant in the knowledge questions, children were classified into two groups, depending on their knowledge scores: (1) children with higher knowledge (HK) scores of 4 (i.e. 3 out of 3 in terms of raw score on the knowledge questions), and (2) children with lower knowledge (LK) scores below 4. In comparing children's performance to chance, one-sample *t*-tests revealed that, while LK children selected the functional informant at chance levels for all test questions and overall trust scores (all *ps* > .05), HK children were significantly above chance in selecting the functional informant for the explicit judgement questions, $t(16) = 9.60$, $p < .001$, and for the total trust scores, $t(16) = 4.75$, $p < .001$. However, scores for ask questions, $t(16) = 1.57$, $p = .136$, and endorse questions, $t(16) = 1.38$, $p = .188$, were at chance for HK children. Hence, it appears that eight-year-olds who considered the functional informant to be more knowledgeable were more likely to show selective trust in her. However, children who considered the surface informant to be more knowledgeable did not systematically demonstrate selective trust in her.

Relations between Verbal ability and Selective Trust

Bivariate correlations between children's selective trust variables and verbal ability were conducted. There were no indications that children's selective trust was related to verbal ability, but there was one exception. Children who had higher verbal ability were better able to recall the informant who had provided functional explanations ($r = .509$, $N = 32$, $p = .003$).

Discussion

The aim of Study 5A was to investigate whether shortening the functional and surface explanations, and making the difference between explanations more distinctive, would lead children to favour the functional informant. Results showed that, although eight-year-olds in both body parts and artifacts paradigms did not systematically seek and endorse labels for unfamiliar objects from either informant, children who were presented with the artifacts paradigm were more likely to judge that the functional informant as “very good” or “better”. In contrast, children who were presented with the body parts paradigm did not systematically judge the functional informant to be “very good” or “better”. It is surprising that children showed more selectivity when presented with artifacts but not with body parts. However, their general lack of selectivity cannot be attributed to their inability to recall what each informant had said. Children were able to remember which informant had talked about what the objects were “for” or what they “looked like”. Further, consistent with the findings of Study 4, children’s construal of the functional informant as more knowledgeable was associated with greater trust in the functional informant. That is, children who saw the functional informant as a more knowledgeable source of information were also inclined to learn labels for unfamiliar objects from her. On the other hand, children who considered the surface informant to be more knowledgeable did not systematically prefer learning labels for unfamiliar objects from her.

Simplification of the explanations altered children’s justifications in comparison to Study 4, in which only 6.3% of children in the body parts paradigm and 31.3% of children in the artifacts paradigm made specific references to the content of the informants’ explanations. In this study, a larger percentage of children (56.3% in the body parts paradigm and 62.5% in the artifacts paradigm) justified their choices by stating that the informant had specifically talked about the functions or appearance of objects. In the artifacts paradigm, children’s justifications largely favoured the functional informant. In the body parts paradigm, children’s preferences for either informant in their justifications were equally distributed. Nevertheless, even though children were not selective in the body parts paradigm, children recognised how the two informants were distinct.

While children performed similarly in both paradigms, it was perplexing that children more often favoured the functional informant in the explicit judgement and knowledge questions in the artifacts paradigm, but not in the body parts paradigm. One potential explanation for children’s differential performance across the two paradigms could be due to the differences in the type of information the surface informants provided. In the body parts paradigm, the surface informant's descriptions were focused on appearance, but they also referred to specific parts (e.g., eyebrow, toes, fingers). As a result, children may have construed the surface informant's ability to accurately label parts to be indicative of knowledge, even if she had not provided information about how those body parts were used. Therefore, children's lack of differentiation in the body parts paradigm suggests that they construed both informants to be equally competent. On the other hand, in the artifacts paradigm, the claims of the surface informant emphasised appearance, and no labels were given to any parts. This lack of labelling for parts represents a flaw in the design of this study that was inadvertently introduced when we attempted to simplify the explanations, remove references to material and tactile properties, and focus only on observable characteristics. As a result, in the artifacts paradigm, children might have considered the surface informant to be less capable than the functional informant because she had only described the objects in very loose terms.

As discussed in the introduction, the surface explanations presented in Study 4 were modified in this study because it was thought that the over-emphasis on material and tactile properties were leading children to consider the surface informant to be knowledgeable about things which were beyond what could be externally observed. The findings of this study revealed that removing such references to material and tactile properties resulted in children more often dismissing the modified surface explanations in favour of the functional explanations. Hence, children might have construed the surface explanations to be providing superfluous information because the things she said were immediately obvious and could be easily confirmed with their own eyes. As a result, they were less inclined to favour the surface informant. According to this interpretation, children are quite sensitive to the difference between information that they can gather for themselves via inspection and information that calls for specialised knowledge or expertise that cannot be gained via direct inspection. This interpretation implies that if the surface explanations were altered in a subsequent study, either by providing labels for parts in the artifacts paradigm (e.g., sole of the shoe, bristles for the toothbrush), or by removing the labels for the parts in the body parts paradigm (e.g., by saying, for example, that "there is a black dot inside a blue circle and there black lines at the top" for the eye), children would recognise these differences and a reversed pattern would be observed. In other words, in the body parts paradigm, children would prefer the functional informant over the surface informant whereas, in the artifacts paradigm, they would not show preferences for either informant. An important implication of this line of explanation is that children might adopt the same selective strategy when learning about body parts or artifacts. Thus, the current findings raise the interesting possibility that children pick up on subtle differences; that they are sensitive to different types of explanations and, in some instances – notably those explanations that provide information unavailable to direct inspection – they regard some explanations to be superior to others.

Despite children's ability to recall informants' explanations as well as their tendency to favour functional informants in the explicit judgement questions, at least in the artifacts paradigm, children did not show differential preferences in the ask and endorse questions in either paradigm. Consistent with the findings of Study 4, when required to select which informant to seek and endorse labels for unfamiliar body parts/artifacts from, children did not systematically prefer one informant over the other. It was initially expected that the simplification of the explanations would make the difference between the two types of explanation more salient and lead children to prefer learning from the functional informant. However, the results of this study show that simplification of the explanations had little impact on children's selective trust. It is likely that children construed both informants as equally knowledgeable and did not consider one informant to be a superior source for labels of unfamiliar body parts/artifacts because both types of explanations consisted of accurate and relevant information, delivered by informants who appeared genuine.

Even though children were not selective in who they sought labels from, it is not the case that children treated both functional and surface explanations as completely equal in status. The findings showed that, when asked to decide which person would be smarter – a person who knows "what something is for" or a person who knows "what something looks like" – nearly all eight-year-olds chose the option, "what something is for". Therefore, children by the age of eight recognise that knowing the functions of objects is better than simply knowing the appearance of objects, but this distinction does not extend to situations in which they have to decide who to learn labels from.

Study 5B

As found in Study 5A, children showed some signs of differentiation in response to the simplified explanations. Hence, it was possible to examine whether younger children would respond in a similar way. Like eight-year-olds, it was not expected that younger children would show selective trust, but it is plausible that they would still be able to successfully recall what each informant had said and decide that knowledge of functions is better than knowledge of appearance. Hence, five-year-olds were tested in Study 5B. Due to recruitment issues, only the results of the eight-year-olds presented with the body parts paradigm are outlined.

Method – Study 5B

Participants

Participants were 16 five-year-olds (8 girls): *M* = 70.00, *SD* = 3.85, *Range* = 64-76. All children lived in a metropolitan area and spoke fluent English. Most children were Caucasian, although a range of ethnicities was represented. Children were recruited via parental invitation and tested individually in a quiet room in their school. Children participated in one session, lasting approximately 20 minutes, where they were presented with the selective trust paradigm and given verbal ability and ToM assessments.

Materials and Procedure

Materials and procedure were identical to Study 5A. In addition, five-year-olds' ToM was assessed using the same procedure in Study 4.

Results – Study 5B

Results will again be presented in three parts. First, children's selective trust and their responses to the follow-up questions as a function of paradigm are examined. Second, relations between children's responses to the follow-up questions and their selective trust are outlined. Finally, children's performance on the ToM tasks and verbal ability assessments, and its relations to selective trust are presented. The scoring system for children's responses was identical to Study 5A.

Children's Selective Trust

To examine whether there were differences across the question types, a repeated measures ANOVA was conducted with question type as the within-subjects variable. Children's responses did not significantly between the question types, $F(2,30) = 1.64$, $p = .210$. Related samples *t*-tests were then used to determine whether children performed above chance on the questions. Means for the ask, endorse, and explicit judgement questions were compared to a chance expectation of 2, and means for the overall trust scores were compared to a chance expectation of 6 (see Table 9.6). Analyses revealed that children's selective trust did not differ significantly from chance for any of the question types (all *ps* > .05).

Table 9.6

Mean Number (and SD) of Preference for Functional Informant.

Question Type	Body parts paradigm
Ask questions (/4)	1.94 (0.57)
Endorse questions (/4)	1.87 (1.09)
Explicit judgements (/4)	2.42 (1.63)
Overall scores (/12)	6.23 (2.72)

Performance on Follow-up Questions

In relation to children's justifications for selecting a particular informant as "better", 56.3% of children ($n = 9$) made general references to the accuracy or competence of the informant and the remaining children's responses were either "don't know" or uncodable. No child made specific references to the content of the informants' explanations in terms of functional or surface information.

To examine whether there were differences across the follow-up question types, a repeated measures ANOVA was conducted with follow-up question type (knowledge, memory-functional, memory-surface) as the within-subjects variable. Children's responses did not significantly vary across follow-up question types, $F(2,30) = 0.13$, $p = .877$. To assess whether children performed above chance on these follow-up questions, related samples *t*-tests were conducted (see Table 9.7). Means for the knowledge, memory-functional, and memory-surface questions were compared to a chance expectation of 2, and means for the overall memory scores were compared to a chance expectation of 4. It was found that children's scores did not differ significantly from chance for the knowledge, memory-functional, and memory-surface questions (all *ps* > .05). However, children's overall memory-scores (*M* = 4.83, *SD* = 1.45) were significantly above chance, $t(15) = 2.30$, $p = .036$. In other words, five-year-olds showed indications of successfully recalling what informants had said.

In terms of children's responses to the function vs. appearance question, 63% of children ($n = 10$) claimed that a person who knew "what something is for" was smarter than a person who knew "what something looks like". However, a Binomial test revealed that children's responses to this question were at chance ($p = .454$).

Table 9.7

Mean Performance (and SD) on Follow-up Questions.

Follow-up question	Body parts paradigm
Knowledge (/4)	2.33 (1.92)
Memory-functional (/4)	2.58 (1.58)
Memory-surface (/4)	2.25 (1.59)
Memory total (/8)	4.83 (1.45)*

Note. Asterisks denote response patterns that are different from chance.
* $p < .05$

Relations Between Responses to Follow-up Questions and Selective Trust

Bivariate correlations were carried out between children's performance on the follow-up questions (knowledge, memory-functional, memory-surface, memory total, function vs. appearance) and their responses to ask, endorse, and explicit judgement questions and total trust scores. These correlations are presented in Table 9.8. As found in Study 5A, children who preferred the functional informant in the knowledge questions were more likely to favour the functional informant in the endorse questions ($r = .661$, $N = 16$, $p = .005$), explicit judgement questions ($r = .730$, $N = 16$, $p = .001$), and in the total trust scores ($r = .783$, $N = 16$, $p < .001$), but not in the ask questions ($r = .384$, $N = 16$, $p = .142$). Similarly, children who were better able to recall which informant provided the functional explanations were more likely to endorse the functional informant ($r = .512$, $N = 16$, $p = .042$). Surprisingly, children's performance on the memory-surface questions was negatively associated with children's selective trust. Specifically, children who more often favoured the functional informant in the endorse questions ($r = -.647$, $N = 16$, $p = .007$), explicit judgement questions ($r = -.590$, $N = 16$, $p = .016$), and overall trust scores ($r = -.681$, $N = 16$, $p = .004$) were less able to recall which informant provided the surface explanation.

Table 9.8

Correlations Between Children's Selective Trust and Follow-up Questions.

	Knowledge questions	Memory-functional	Memory surface	Total memory	Function vs. appearance
Ask questions	0.384	-0.104	-0.322	-0.467	-0.32
Endorse questions	.661**	.512*	-.647**	-0.155	0.031
Explicit judgements	.730**	0.407	-.590*	-0.207	0.095
Overall trust	.783**	0.427	-.681**	-0.285	0.002

*. Correlation is significant at the 0.05 level (2-tailed).
**. Correlation is significant at the .01 level (2-tailed).

These results indicate that, like eight-year-olds, five-year-olds' endorsements of the functional informant were contingent on their construal of the functional informant as knowledgeable and their ability to remember what type of explanation that informant had provided. The negative association between five-year-olds' performance on the memory-surface questions and their selective trust shows that they were responding to the memory-surface questions by incorrectly stating that the functional informant had also provided surface information.

To further examine the differences between children who favoured the functional informant or the surface informant in the knowledge questions, children were classified into two groups, depending on their knowledge scores: (1) children with higher knowledge (HK) scores of 4 (i.e., 3 out of 3 in terms of raw score on the knowledge questions), and (2) children with lower knowledge (LK) scores below 4. In comparing children's performance to chance, one-sample *t*-tests revealed that LK children selected the functional informant at chance levels for the ask questions, $t(7) = 1.00$, $p = .351$, the explicit judgement questions, $t(7) = 0.78$, $p = .460$, and the overall trust scores, $t(7) = 1.71$, $p = .130$. However, LK children were significantly below chance in selecting the functional informant in the endorse questions, $t(7) = 2.39$, $p = .048$. To be specific, children who more often attributed knowledge to the surface informant were more likely to endorse the labels she provided in the selective trust paradigm. In comparison, HK children were significantly above chance in selecting the functional informant for the explicit judgement questions, $t(7) = 5.29$, $p = .001$, and for the total trust scores, $t(7) = 3.27$, $p = .014$, although they were at chance for the ask questions, $t(7) = 1.00$, $p = .351$, and the endorse questions, $t(7) = 1.53$, $p = .170$. Hence, five-year-olds who considered the functional informant to be more knowledgeable were more likely to show selective trust in her. However, in contrast to eight-year-olds, five-year-olds who considered the surface informant to be more knowledgeable more often endorsed the labels she provided.

Relations between ToM, Verbal Ability and Selective Trust

Five-year-olds scored a mean of 2.81 (*SD* = 1.33) on the first-order ToM reasoning tasks and a mean of 0.63 (*SD* = 0.72) on the second-order ToM reasoning tasks. Bivariate correlations between children's selective trust variables, ToM (first-order, second-order reasoning, and total scores) and verbal ability were carried out. There were no indications that children's selective trust was related to verbal ability or to ToM reasoning (all *ps* > .05). Hence, further analyses were not conducted.

Comparison with Study 5A

To examine age group differences between the five- and eight-year-olds presented with the body parts paradigm, a 3 x 2 mixed ANOVA was conducted with question type (ask, endorse, explicit judgement) as the within-subjects variable and age group as the between-subjects variable. A main effect for question type was found, $F(2,60) = 3.17$, $p = .049$, with post-hoc *LSD* tests revealing that children favoured the functional informant more often in the explicit judgement questions than in the endorse questions ($p = .024$). However, no main effect for age group was found, $F(1,30) = 0.14$, $p = .715$, and no question type x age group interaction was found, $F(2,60) = 0.02$, $p = .983$. To sum, it appears that children's responses in the selective trust paradigm were similar across ages.

A 3 x 2 mixed ANOVA with follow-up question type (knowledge, memory-functional, memory-surface) as the within-subjects variable and age group as the between-subjects variable revealed that there was a significant main effect for age group, $F(1,30) = 15.11$, $p = .001$. However, there was no main effect found for follow-up question type, $F(2,60) = 1.94$, $p = .153$, and the follow-up question type x age group interaction was also not significant, $F(2,60) = 1.23$, $p = .299$. Further exploration of age group differences was conducted using independent samples *t*-tests for each of the follow-up questions. Five- and eight-year-olds' responses to the knowledge questions did not significantly differ from each other, $t(30) = 0.40$, $p = .690$. In contrast, eight-year-olds performed significantly better on the memory-functional questions, $t(30) = 2.92$, $p = .007$, memory-surface questions, $t(30) = 2.99$, $p = .006$, and total memory scores, $t(30) = 5.17$, $p < .001$. In addition, eight-year-olds more often decided that a person who knew "what something is for" was smarter than a person who knew "what something looks like", $t(30) = 3.00$, $p = .005$.

Discussion

Study 5B examined whether five-year-olds could differentiate between informants who provided functional or surface explanations. Results showed that, like eight-year-olds, five-year-olds did not show selective trust when learning labels for unfamiliar body parts. However, while they showed some ability to remember what each informant had said, five-year-olds' recall performance was not as robust as eight-year-olds'. Responses to the other follow-up questions also indicated that five-year-olds did not make specific references to the content of an informant's explanation when justifying why they chose a particular informant to be "better". Further, when asked to decide whether a person who knew "what something is for" was smarter than a person who knew "what something looks like", five-year-olds were not systematic in deciding that a person who knew "what something is for" was smarter. Overall, five-year-olds did not appear to readily evaluate the quality of explanations in terms of whether they consist of functional or surface information. It appears that the ability to consider the adequacy of certain types of explanations does not emerge until later in development and likely coincides with more exposure to formal education.

Consistent with the findings of Studies 4 and 5A, associations were found between children's responses to the endorse, knowledge and memory questions. Specifically, five-year-olds who more often construed the functional informant as knowledgeable were more likely to have endorsed the labels she provided. On the other hand, five-year-olds who construed the surface informant as knowledgeable were more likely to have endorsed the labels she provided. In addition, children's tendency to endorse the labels provided by the functional informant was positively associated with their recall of what the functional informant had said. However, children who preferred the functional informant were poor at remembering which informant had provided surface information and incorrectly stated that the functional informant had also talked about "what things looked like". In other words, five-year-olds tended to over-attribute knowledge to the functional informant they were endorsing, which suggests that they were less sensitive to the differences between the two types of explanations. Therefore, in contrast to the eight-year-olds in Study 5A, the less systematic performance of five-year-olds indicates that they are yet to fully appreciate the differences between the two informants' explanations. Instead, their performance appears to suggest a response bias, in which they continue to positively judge the informant who they had initially endorsed. For instance, children who decided to endorse the surface informant's labels were more likely to judge her favourably in the knowledge questions. In addition, children who decided to endorse the functional informant's labels were more likely to judge her favourably in the knowledge questions, as well as incorrectly recall that she had talked about both “what things are for” and “what things look like”.

A limitation to this study was that, due to issues with recruitment, five-year-olds were not presented with the artifacts paradigm. In a future study, it would be necessary to present five-year-olds with the artifacts paradigm to determine whether they differentiate between the informants. Study 5A revealed that eight-year-olds judged an informant who provided functional explanations to be “better” than an informant who provided surface explanations. It was discussed in Study 5A that eight-year-olds showed differential preferences because they might have considered the explanations offered by the surface informant to be superfluous and not demonstrating extensive knowledge of artifacts in the same way that the surface informant in the body parts paradigm provided accurate labels for parts of body parts. Hence, five-year-olds might also construe the functional informant as being a better source of information when presented with the artifacts paradigm. However, as evidenced by their performance in the follow-up questions in this study, particularly with respect to their justifications and responses to the function vs. appearance question, it is possible that they will not show sensitivity to the differences between the explanations. This remains, of course, an empirical question.

General Discussion

The aims of Studies 5A and 5B were to determine whether five- and eight-year-olds differentiate between informants who provide functional or surface explanations and, as a result, prefer learning new information from the informant who provided functional explanations. The results of these studies essentially replicate the findings of Study 4 in that eight-year-olds did not prefer seeking and endorsing labels for unfamiliar objects from the functional informant, despite their ability to successfully recall the type of explanation each informant had offered. In this study, the shortening and simplification of the explanations substantially improved children’s recall, but had little impact on their selective trust. Such a finding lends support to the proposed explanations in Study 4, where it was suggested that children were not confused by the explanations but, rather, considered both informants to be equally competent. Since both informants provided explanations that were, in and of themselves, accurate, genuine, and relevant to the task of providing information, children likely construed both informants to be trustworthy sources from which to obtain information about labels for unfamiliar objects. The alternative (but not mutually exclusive) explanation presented in Study 4 was that children did not see the functional informant’s knowledge of object function as indicative of her knowledge of labels and, hence, did not distinguish between informants when learning labels for unfamiliar objects.

Two particular findings of this study lend further support to this latter explanation. First, all eight-year-olds (except one), when asked to decide whether a person who knows "what something is for" or knows "what something looks like" is smarter, chose "what something is for". That is to say, despite explicitly stating that knowing how an object works is superior to knowing what an object looks like, eight-year-olds still did not favour the functional informant when asked to seek and endorse labels for unfamiliar objects. Second, children who were presented with the artifacts paradigm systematically preferred the functional informant when asked to judge which informant was "very good" and "better" at talking about the artifacts. However, even though they judged the functional informant in favourable terms, they did not preferentially seek and endorse labels from that informant. As discussed in Study 5A, the surface explanations may have appeared superfluous in that no labels for parts were provided and only references to obvious external characteristics were stated. In spite of the inferiority of the surface explanations, eight-year-olds still did not consider the differential adequacy of the explanations to be a suitable basis to dismiss the labels presented by the surface informant or favour the labels presented by the functional informant.

Children's lack of selective trust in informants when learning labels suggests that the labelling test trials were not sufficient for tapping into children's sensitivity to explanatory depth. For instance, it is possible that we are conflating knowledge of object identity with knowledge of object labels when, in fact, these two aspects are not equivalent. To address this issue, a future study could modify the test trials such that children are asked, "Who would be able to tell you *what this is*?" instead of being asked to decide who to learn the label for the object from. Further, to increase consistency in structure between familiarisation and test trials, the phrasing could be altered such that, when presented with an unfamiliar object (e.g., liver), one informant states, "That's a slod. Your body uses it for making new blood" whereas the other informant states, "That's a linz. There are red lobes and a blue tube at the top", and children are asked which informant they would endorse. The results of this study show that children are able to distinguish between functional and surface explanations. However, further empirical research is required to establish under what contexts children may come to privilege one type of explanation over another.

While the findings do not show strong evidence for children's selective trust in informants who provide functional explanations over informants who provide surface explanations, a developmental change was observed in which eight-year-olds showed better recall and ability to distinguish the informants than five-year-olds. That is, unlike eight-year-olds, five-year-olds had difficulty remembering which informant had provided functional or surface explanations, justified their choice in informants in general terms, and did not systematically select a person who knew “what something is for” as being smarter than a person who knew “what something looks like.” The developmental shift cannot be attributed to maturity per se. As has been consistently found in Studies 3A, 3B and 4, stable or robust relationships were not found between children’s selective trust and their ToM or verbal ability. The lack of evidence for such an association is important as it indicates that children’s preferences for functional explanations are neither due to maturity nor the ability to construe what another person might know or think. In addition, another interesting developmental shift occurred by which five-year-olds, but not eight-year-olds, preferred learning new labels from the informant who provided surface explanations if they construed the surface informant to be knowledgeable. Eight-year-olds, on the other hand, did not prefer learning new labels from the surface informant even when they construed her to be knowledgeable. Such a finding suggests that children's evaluations of the competence of informants who provide surface explanations change between roughly five and eight years of age. Further, it is possible that children’s ability to differentiate between different types of explanations comes about due to exposure to formal education. That is, with more schooling, children are provided with more information about the world that goes beyond the description of external characteristics. Children receive information that involves notions of causality (e.g., underlying processes and mechanisms) and, as a result, might come to learn that certain explanations (i.e., functional) are more informative than others (i.e., surface).

In conclusion, the findings of Studies 5A and 5B showed that presenting children with informants who provided simplified functional or surface explanations did not increase their selective trust in the informant who provided functional explanations. However, as also found in Study 4, children who regarded the functional informant to be more knowledgeable were more likely to endorse the labels she offered. While eight-year-olds’ and, to some extent, five-year-olds, could accurately recall what each informant had said with the introduction of these shortened explanations, they did not systematically seek and endorse labels for unfamiliar objects from either informant. For eight-year-olds, they did not show a preference to learn from the functional informant even if they regarded explanations for how artifacts could be used to be more favourable than superfluous descriptions of observable characteristics of artifacts. Further, eight-year-olds did not prefer learning from the functional informant even though they decided that knowing the functions of objects is better than knowing what objects look like. Overall, the results of this study suggest that children construed both informants to be equally competent and knowledgeable but they did not consider the informants' capacity to provide informative explanations to be indicative of their knowledge of object labels.

In the subsequent chapter, I present a general discussion of the findings and outline their contribution to the selective trust literature. I provide a brief overview of the main findings in light of the aims of this thesis, and I also reflect on the original plans I had for this thesis; specifically, to examine how children simultaneously balance information gleaned from labelling (i.e., accuracy) with other forms of information (e.g., quality of explanation). In addition, the implications and limitations of this thesis are considered, in a global sense, and potential future directions are suggested to address such limitations.

Chapter 10
General Discussion

This thesis sought to extend the research on children's selective trust, which has established that children from about three years of age prefer learning from a previously accurate informant as compared to a previously inaccurate informant. Three major modifications to the typical selective trust paradigm were implemented. First, in going beyond the domain of artifacts, children were presented with familiar and unfamiliar parts of the body to determine whether they also demonstrate selective trust in the biological domain. Because children's understanding of the body burgeons between the ages of four and eight, and much of what they know about the body, especially about internal organs, is learnt through what they hear from others, it was expected that the biological domain would be a fertile one in which to further investigate how children evaluate the trustworthiness of informants. Second, children's trust in informants who provide *new information* was compared to their trust in informants who provide straightforwardly accurate or inaccurate information. It was predicted that informants providing novel labels for familiar body parts (i.e., new information) would appear more credible to children than informants providing inaccurate information about the body. It was also reasoned that informants providing novel information would more closely approximate what children often encounter in the real world. Finally, rather than focusing exclusively on informants who simply provide labels for objects – whether accurate, novel or inaccurate – children's sensitivity to informants' explanations, and notably the *adequacy* of their explanations was examined. Specifically, this thesis considered whether children's precocious capacity to discern accurate from inaccurate labellers extends to other verbal information that can, arguably, distinguish someone who is knowledgeable, and therefore epistemically trustworthy, from someone who is unlikely to be a good source of new information. Thus, in the presence of two informants who both provided accurate and relevant information, the question of interest was whether children would consider an informant who provided explanations for the *functions* of body parts to be more competent and trustworthy than an informant who merely provided descriptions of *obvious characteristics* of body parts. Based on the existing literature, which suggests that children show a preference for causal explanations in particular contexts, it was predicted that children would prefer learning from an informant who provided explanations for the functions of body parts rather than from an informant who provided descriptions of obvious characteristics. However, it should be acknowledged that the extant literature does not present a straightforward basis for such a prediction.

With respect to the first modification to the selective trust paradigm, which was to present children with body parts instead of common artifacts, it is evident that children demonstrate selective trust in the biological domain in the same way that they do in the artifact domain. The preliminary study presented in Chapter 5, in which children were asked about their general knowledge of objects from the human body, indicated that four- and five-year-olds are quite knowledgeable about the body. Specifically, four- and five-year-olds knew more about external body parts (e.g., eye, hand) than internal organs. In addition, some internal organs (e.g., brain, heart) were better known to children than others (e.g., pancreas, liver), which is consistent with everyday experience. Children's understanding of the body also reveals the extent to which they depend on testimony from others to learn about the body, particularly in relation to things that they are unable to witness or personally verify for themselves (Harris, 2007). Despite lacking direct observation of the processes of internal organs, children demonstrated accurate knowledge of some of the processes, and they also provided responses that did not question the existence of those organs. As stated by Harris (2002), children's beliefs in the existence of certain types of entities depend on the type of discourse they have heard. Because children hear other people referring to internal organs and processes in ways that presuppose their existence, it likely follows that children also come to treat them as real entities.

The results presented in Chapter 5 are also in line with independent research which shows that children's understanding of the body rapidly increases from about the age of four (Inagaki & Hatano, 2006; Jaakkola & Slaughter, 2002; Keil, 1992). Further, when asked about what the body parts or organs were "for", children generally responded with core or peripheral functions (e.g., "the brain is for thinking", "the hand is for holding things"). Such findings are consistent with the findings of Kelemen (2003), who showed that children are biased to conceive of objects as being designed to perform specific functions. A few of the four- and five-year-olds also referred to the function of organs as being necessary to sustain life, consistent with the findings of Slaughter and Lyons (2003). For example, children mentioned that the brain or the heart was "to keep you alive". Overall, the findings show that children possess much knowledge about the body from the age of four. These results served as a basis on which to structure the subsequent studies, which implemented variations of the familiar selective trust paradigm.

In relation to the second modification to the selective trust paradigm, which was to investigate children's trust in informants who provide new labels for parts of the body, the results presented in Chapter 6 showed that three-, four-, and five-year-olds differ in the manner by which they construe the informant who provides new labels. Specifically, three-year-olds' trust is consistent with an *inaccuracy* strategy (Corriveau et al., 2009), in which they are untrusting of inaccurate informants when such informants are contrasted with accurate informants. They are receptive to informants who provide new labels just as they are receptive to accurate labellers insofar as neither type of informant is inaccurate. In contrast, four- and five-year-olds begin to privilege accuracy, and they consider the accurate labeller to be more trustworthy than the informant who provides new or inaccurate labels. Finally, five-year-olds, but not four-year-olds, consider the informant who provides new labels to be more trustworthy than the inaccurate labeller. However, five-year-olds remain appropriately cautious; they seek and endorse new information from informants who provide new labels, but they do not judge such informants to be a better source of information than inaccurate labellers. The findings of this study were important because they suggest that children from the age of five treat informants who provide new labels and informants who provide inaccurate labels differently. Further, the informant who provides new labels seems to better reflect situations that children reliably encounter in real life. Given that children's epistemic trust extends to the biological domain using the traditional paradigms, the subsequent studies in this thesis sought to establish the extent to which children's scepticism extends to *explanations* about parts of the human body.

With regards to the third modification to the selective trust paradigm, children were presented with informants who both provided accurate and relevant information, but differed in the *adequacy* of the information they provided. To be specific, children were asked to decide whether an informant who provided explanations for the *functions* of body parts was more trustworthy than an informant who merely provided descriptions of *obvious characteristics* of body parts. The results presented in Chapter 7 showed that, when presented with informants who provided either functional or obvious information for unfamiliar organs, four- to eight-year-olds did not selectively trust one informant over the other. Because children did not know what the organs were, it was proposed that they were attending to both of the informants' explanations, but were unable to reliably distinguish between them. Hence, in Chapter 8, eight-year-olds were presented with informants who provided either functional or obvious information for body parts they were highly familiar with. In addition, to ensure that children's lack of selective trust could not be attributed to difficulties in understanding objects from the biological domain, children were also presented with informants who provided functional or obvious information for common artifacts (e.g., bottle, spoon). Again, eight-year-olds generally did not selectively trust one informant over the other when learning about either unfamiliar organs or unfamiliar artifacts, although they showed some indications of being able to recall what the two informants had said and how the two informants were different. Nevertheless, it was not the case that children were choosing between the informants at random. Instead, children who construed informants who provided functional explanation to be more knowledgeable were more likely to prefer learning from such informants, whereas children who construed informants who provided surface information to be more knowledgeable were unsystematic in their preferences for learning from either informant.

Given that children showed some ability in differentiating between the informants and, in some instances, selectively trusting the functional informant, it was proposed that making the difference between the functional and obvious explanations more distinct would lead children to more likely trust the functional informant. Therefore, in Chapter 9, the functional and obvious explanations were simplified such that they were shorter and sounded more conversational. Further, it was ensured that the surface explanations referred only to external and observable properties, rather than make references to material or tactile properties, an issue that was raised in Chapter 8. As a result of simplifying the information provided by the informants, eight-year-olds showed strong recall of what each informant had said. That is, they reliably remembered who had provided information about what objects “were for” or “looked like”. Further, they even explicitly stated that a person who “knows what something is for” would be smarter than a person who “knows what something looks like”. However, when asked to seek and endorse labels for unfamiliar organs or artifacts, they did not prefer learning from one informant over the other. Interestingly, even though children stated that the informant who provided functional explanations for common artifacts was more competent than the informant who provided obvious descriptions for common artifacts, they still did not prefer learning labels from the functional informant. Five-year-olds were also tested using this procedure, and it was found that, while they showed some ability to remember what each informant had said, they were less systematic in their preferences for the informants than eight-year-olds.

It was also surprising that eight-year-olds judged the functional informant in positive terms when she provided functional explanations for artifacts, but not when she provided functional explanations for body parts. I argued that the reason for domain-specific patterns in children's responding was an unintended result of the simplified explanations. Specifically, since references to material and tactile properties were removed from the obvious descriptions for common artifacts, children perhaps construed the resultant obvious descriptions to be superfluous, providing information that could be easily confirmed with their own eyes. On the other hand, the obvious descriptions for parts of the body, while limited to properties that were externally observable, also happened to refer to *parts* of body parts (e.g., eyebrow, fingers). In fact, the obvious descriptions provided a number of occasions for the surface informant to make accurate statements. For instance, when considering the description of the hand, the surface informant provided labels for parts of the body parts (e.g., "thumb"), correctly counted the number of parts (e.g., "there are four fingers"), and classified the parts in relation to other parts (e.g., "it's part of your arm"). Further, there is a large body of literature on children's formation of categories based on labelling that indicates that children treat objects that receive the same label as possessing common and non-obvious properties (e.g., Gelman, 2009; Jaswal, 2004; Jaswal & Markman, 2007). Hence, children may have found the obvious descriptions for body parts to be acceptable because the surface informant's accurate labelling of parts of the body parts implicitly conveyed information about her knowledge of non-obvious characteristics. As a result, children did not differentiate between the informants who provided functional or surface information for parts of the body because both informants were competent at providing information about the body parts. Under such an interpretation, it appears that children from the age of eight favour informants who provide information for things that are not immediately visible (e.g., functions, labels for parts, relational characteristics) over informants who provide information for properties that are clearly visible.

Despite their ability to differentiate between the informants, however, eight-year-olds did not seek and endorse labels for unfamiliar objects from either informant. In contrast to the findings of other studies (Birch et al., 2008; Koenig & Harris, 2005) which show that children generalise their trust in accurate informants over inaccurate informants to related subject areas (e.g., object labels and functions), children did not consider the adequacy of informants' explanations for objects to be indicative of their knowledge of labels for those objects. As discussed, such findings suggest that the test questions were not adequate for assessing children's sensitivity to differences in the informants' explanatory adequacy. In light of the limitations of the test questions used in these studies, I proposed potential test questions that could be investigated in future studies. For instance, rather than ask children to decide who to seek and endorse labels from, children could be asked who would be able to tell them "what this [object] is". Alternatively, the informants could provide functional or surface information in addition to the novel labels for the unfamiliar objects. Overall, from the current results, it appears that, even though eight-year-olds are explicitly aware that informants who provide information about what objects are "for" are superior to informants who provide information about what objects "look like", they do not readily evaluate informants' explanations against such criteria.

With such findings in mind, I wish to reflect on the original plan I had for this thesis. In the scheme of my overall thesis, I wanted to establish how children simultaneously balance information gleaned from labelling (i.e., accuracy) with other forms of information (e.g., quality of explanation, confidence, etc). A key question of interest was how children construed informants who provided accurate or new labels that were supplemented by either low- or high-quality explanations. In particular, I wanted to examine whether children would be more trusting of informants who provided new labels with high-quality explanations over informants who provided accurate labels with low-quality explanations. At the inception of this work, however, the literature suggested that there was a higher order problem that needed solving first; that is, whether children treat new labels and inaccurate labels differently. Indeed, as shown in Chapter 6, children treat such labels differently at about the age of five. Next, I turned my attention to the issue of how children evaluate informants on the basis of the quality of their explanations. One basis on which explanations may be qualitatively distinct is in whether such explanations refer to the functions of objects or to the appearance of objects. However, based on the results of Chapter 7 to 9, children are surprisingly poor at discerning the merits of these types of explanations.

The findings of this thesis indicate that children trust informants who provide explanations that appear accurate and relevant, and they do not spontaneously evaluate the quality of the information in terms of whether the information is about functional or obvious properties. Against this interpretation, eight-year-olds, when prompted, decided that a person who knows "what something is for" is smarter than a person who knows "what something looks like", whereas five-year-olds did not distinguish between the two options. This developmental shift suggests that children slowly come to realise that they should privilege functional explanations over obvious ones. Hence, in future studies, it will be necessary to further explore how children learn that functional explanations are superior. For example, it is possible that at younger ages, children do not distinguish between such explanations so long as they appear relevant and genuine. This may seem counter-intuitive given findings in the research suggesting that children seek and prefer causal explanations (Bernard et al., 2012;

Chouinard, 2007; Kushnir et al., 2013). Nevertheless, a close reading of the extant literature shows that it is not yet clear if children fully grasp the privileged position of causal explanation (see Chapter 3). Indeed, it seems likely that with increasing exposure to formal education, which heavily emphasises the understanding of causal relations (e.g., functions, how things work, hidden processes, principles), children may come to decide that informants who provide explanations with causal elements are likely to be better sources of information (i.e., functional explanations) than, for instance, informants who merely describe externally visible properties. In line with the arguments put forward by Brewer et al. (1998), the ability of children and adults to evaluate explanations in scientific terms likely comes about only through formal instruction and training.

The notion that children learn to privilege functional explanations via socio-cultural practices (i.e., formal education, books, etc) is also consistent with the findings of Luria (1976), who showed that exposure to formal education facilitated the emergence of particular modes of thought. Indeed, many professions in the Western world require a high level of specialised knowledge that only comes about through education. For instance, doctors have extensive knowledge of the body and its processes in order to successfully treat patients, and information technology specialists require in-depth knowledge of how computers work in order to successfully implement and maintain systems. In contrast, it is plausible that functional explanations are less privileged within certain pursuits or in non-Westernized (or *industrialized*) societies, where other modes of learning remain prominent and perhaps also privileged, such as demonstration. In these latter contexts, knowledge of surface properties may be even more important than knowledge of functional properties. For example, if we consider how our ancestors lived and some people continue to live in small pockets of the world, having extensive knowledge of the appearance of salient plants, places, or predators might be more valuable for survival than, for example, having knowledge of the biological mechanisms by which plants and animals grow.

As was also discussed in Chapter 3, children's question asking appears to be fragile from the age of five, given that they still have a tendency to ask ineffective questions (Mills et al., 2010). Such findings suggest that children are yet to fully understand that certain types of questions elicit certain types of responses. Even though young children do ask many explanation-seeking questions in the form of "why" and "how" interrogatives (Chouinard, 2007), they do not have to understand that they will receive an explanation in return; although they do appear more satisfied when receiving answers with an explanatory form (Frazier et al., 2009). Hence, children may not necessarily have the tools to distinguish between different types of explanations until they are older and have been exposed to formal education, which emphasises cause and function as better explanations. Further evidence in support of this possibility can be gleaned from Kelemen (1999b), who showed that seven- to eight-year-olds favour teleological explanations over more scientifically appropriate physical-reductionistic explanations. It is only from the age of about ten that children begin to prefer the physical-reductionistic explanations, indicating the possible role of classroom instruction in driving this shift. To sum, while further research is necessary, the results of this thesis suggest that it is not until later in development, and with more exposure to formal education, that children recognise the value of explanations that contain functional information.

Overall, the findings of this thesis add to the existing literature in a number of ways. First, it is apparent that children's selective trust is not limited to the domain of artifacts. The domain of biological knowledge proves to be a fruitful one in which to explore how children evaluate the trustworthiness of others. As discussed in earlier chapters, it contains a wealth of information that children are not exposed to until formal education, and the complexity of body parts and organs allows for examining how children consider different types of explanations. Second, the findings of Chapter 6 show that children from the age of five construe informants who provide new information to be distinct from informants who provide inaccurate information. Hence, in the same way that studies have investigated how children evaluate informants who provide information that is neutral (Corriveau et al., 2009; Koenig & Jaswal, 2011), further studies can be conducted to explore how children trust informants who provide new information in different settings. Third, the findings of Chapter 7 to 9 show that children do not differentially prefer learning from informants who provide functional explanations over informants who provide obvious descriptions. It is surprising that despite what appears to be a preference for causal information, as evidenced by their tendency to ask explanation-seeking questions (Chouinard, 2007), children did not readily prefer information that contained causal properties. Nevertheless, there were some indications that children at about the age of eight begin to recognise the value of informants who know about hidden internal processes and functions of objects over informants who only provide information about clearly visible properties of objects.

Overall, the findings of this thesis add to the existing literature by suggesting that children are initially more sensitive to other distinguishing characteristics of informants, such as their accuracy (Koenig & Harris, 2005), attributes (Kinzler, Corriveau, & Harris, 2011; Reyes-Jaquez & Echols, 2013), and manner (Birch et al., 2010; Jaswal & Malone, 2007), than to qualitative aspects of particular types explanations. Further research can be conducted to determine the process by which children realise that functional explanations should be privileged, as well as contexts in which children are more likely to differentiate between functional or obvious explanations. In the next section, limitations to this work and possible future directions are discussed.

Limitations of this Work and Future Directions

The perceived limitations of the experiments presented in this thesis have been addressed in the preceding chapters. In this section, I present some more global points for consideration. While this thesis contributes novel findings to the existing research on children's selective trust, there are a number of limitations to be noted. One global limitation that is apparent across the studies is the small sample size which has led to reduced power in analyses and various marginal or near-significant results. Of course, the clear solution would be to increase the sample size in future studies. Nevertheless, the existing results have highlighted that, in particular contexts, children do show systematic preferences for the functional informant over the surface informant. Hence, additional studies will assist in clarifying such findings.

The studies in this thesis focused on presenting informants who provided information for body parts or internal organs with which children were either highly familiar (i.e., Chapter 6, 8, and 9,) or highly unfamiliar (i.e., Chapter 7). However, this thesis was limited in that it did not examine how children construe informants who provide information for internal organs of which they have partial knowledge (e.g., brain, heart, stomach, and lungs). As discussed in Chapter 1, children are well-balanced in their credulity and scepticism. When children are unsure or have inadequate knowledge, they tend to readily accept other people's testimony (Jaswal, 2010). In contrast, when they receive testimony about things that they are familiar with, they evaluate testimony in light of their existing knowledge (Ma & Ganea, 2010). However, there is little research that examines children's selective trust in informants who provide information about things for which their knowledge is burgeoning or fragile.

As documented in Chapter 5, children's understanding of internal organs and their processes is increasing from the age of four or five, so they would perhaps be receptive to information that is not yet fully consolidated in their knowledge. Further, children rely heavily on testimony to learn about such organs and processes since, in comparison to external body parts (e.g., eye, hand), they have fewer direct opportunities to observe their functions. If, as argued by Keil and Wilson (2000), explanations satisfy some cognitive need, then it may be that when presented with information that addresses gaps in their knowledge, children could be more sensitive to qualitative differences between explanations (e.g., preferring information that refers to non-visible processes over externally observable properties). In a future study, children can be presented with informants who provide functional or surface explanations for partially familiar internal organs (i.e., heart, brain, stomach) to determine whether they are able to detect differences in explanatory depth. By presenting partially familiar organs, it is anticipated that children might construe informants who provide information about non-visible causal processes and functions to be more knowledgeable than informants who simply provide information about clearly visible properties that children can easily determine for themselves. In addition to presenting other objects from the biological domain, the results of the current thesis also suggest that children demonstrate selective trust in domains other than artifacts. Hence, although this thesis focused almost exclusively on the biological domain, future studies can examine children's selective trust in a range of other domains, such as physics or psychology. These domains offer a wealth of new information and different types of explanations which would be fruitful for investigating how children evaluate the trustworthiness of informants based on their provision of novel information or explanations that vary in quality.

As discussed in the earlier part of this chapter, the original aim of this thesis was to consider how children simultaneously evaluate informants' information gleaned from labelling (i.e., accurate or new labels) against explanations that vary in quality (e.g., whether they provided functional or obvious information). The results of this thesis showed that, while children from the age of five treated new labels as distinct from inaccurate labels, there was little evidence that young children reliably distinguished between functional explanations and obvious descriptions. As a result, these two approaches could not be combined as initially intended to determine how children simultaneously weigh accuracy of labelling with quality of explanation. However, children's lack of sensitivity to the difference between functional and obvious explanations does not preclude the possibility of conducting future studies which pair accurate and novel labels with other types of explanations that differ in quality. For example, recent evidence suggests children from about the age of five are able to evaluate the circularity of explanations (Kurkul & Corriveau, 2014; Mercier, Bernard, & Clément, in press), and that children treat circular explanations to be less adequate than non-circular explanations. Hence, a future study could present children with informants who pair accurate or novel labels with either a circular or non-circular explanation to determine whether children are more likely to privilege informants' accuracy, or informants' (non-accuracy-dependent) competence. For instance, it is possible that children might consider an informant who provides new information, accompanied by a more informative non-circular explanation, to be more knowledgeable than an informant who provides accurate information, accompanied by a less informative circular explanation. Of course, this remains an empirical question.

Additional studies can also be undertaken on delineating the specific contexts in which children might demonstrate selective trust in informants who provide functional explanations over informants who provide obvious descriptions given the null findings of Studies 3, 4, and 5. In the present studies, the depth of the informants' explanations and references to obvious or non-obvious features were confounded. To separate out these aspects in a future study, children can be allocated to either an Obvious condition, where both informants provide functional or surface descriptions of obvious and visible parts of body parts, or to a Non-obvious condition, where both informants provide functional or surface descriptions of non-obvious and non-visible parts of body parts. Such a contrast would likely allow for children's sensitivity to explanations to come into sharper focus, and would contribute to the original goal of this thesis in examining how children simultaneously weigh the accuracy of informants' labelling against explanations that vary in quality.

Conclusions

The findings presented in this thesis add to the existing literature by demonstrating that children show selective trust in the biological domain, as well as in contexts which go beyond comparing accurate and inaccurate labellers, whether in the form of novel labels or with different types of explanations. Children are appropriately balanced in their evaluations of informants who provide new information, and they distinguish between informants who provide information that varies in explanatory adequacy. However, in the presence of informants providing functional and surface information (i.e., who both provide accurate and potentially relevant explanations), they do not necessarily consider one informant to be a more knowledgeable source for learning new labels. Such findings pave the way for further research to determine under what circumstances children might prefer informants who provide new information and informants who provide functional or surface information, as well as how children come to decide that certain kinds of explanation should be privileged.

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Appendix A – Ethics Approval

A.1 Ethics Approval

THE UNIVERSITY OF SYDNEY

RESEARCH INTEGRITY
Human Research Ethics Committee
Web: http://sydney.edu.au/ethics/
Email: ro.humanethics@sydney.edu.au

Address for all correspondence:
Level 6, Jane Foss Russell Building - G02
The University of Sydney
NSW 2006 AUSTRALIA

Ref: PB/KW

12/8/2010

Dr Marc de Rosnay
School of Psychology
Brennan MacCallum Building – A18
The University of Sydney
Email: marc.derosnay@sydney.edu.au

Dear De de Rosnay

Thank you for your correspondence dated 28 July 2010 addressing comments made by the Human Research Ethics Committee (HREC). The Executive Committee of the HREC, at its meeting of **10 August 2010**, considered this information and approved the protocol entitled **"Children's sensitivity to speaker accuracy and competence with biological concepts"**.

Details of the approval are as follows:

Protocol No.:	**13020**
Approval Period:	**August 2010 – August 2011**
Authorised Personnel:	**Dr Marc de Rosnay**
	Betty Luu

Documents approved:
Teacher Information Statement (Version 1, 23/6/2010)
Teacher Consent Form (Version 1, 23/6/2010)
Invitation to Director to participate
Invitation to Parent / Guardian to participate
Parent / Guardian Information Statement (Version 1, 23/6/2010)
Parent / Guardian Consent Form (Version 1, 23/6/2010)
Permission form for Director of Centre
Structured Interview

The HREC is a fully constituted Ethics Committee in accordance with the National Statement on Ethical Conduct in Research Involving Humans-March 2007 under Section 5.1.29.

The approval of this project is conditional upon your continuing compliance with the National Statement on Ethical Conduct in Research Involving Humans. N.B. A report on this research must be submitted every 12 months from the date of the approval, or on completion of the project, whichever occurs first. Failure to submit reports will result in the withdrawal of consent for the project to proceed. Your report will be due on **31 August 2011**, please put this in your diary.

Special Condition/s of Approval

1. Please provide written permission from the Directors of the preschools when available prior to commencement of any research.

Deputy Manager Human Ethics
Ms Marietta Coutinho
T: +61 2 8627 8176
E: marietta.coutinho@sydney.edu.au

Human Ethics Secretariat:
Ms Portia Richmond **T:** +61 2 8627 8171 **E:** portia.richmond@sydney.edu.au
Ms Patricia Engelmann **T:** +61 2 8627 8172 **E:** patricia.engelmann@sydney.edu.au
Ms Kala Retnam **T:** +61 2 8627 8173 **E:** kala.retnam@sydney.edu.au

ABN 15 211 513 464
CRICOS 00026A

THE UNIVERSITY OF
SYDNEY

Chief Investigator / Supervisor's responsibilities to ensure that:

1. All serious and unexpected adverse events should be reported to the HREC within 72 hours for clinical trials/interventional research.

2. All unforeseen events that might affect continued ethical conduct of the project should be reported to the HREC as soon as possible.

3. Any changes to the protocol must be approved by the HREC before the research project can proceed.

4. All research participants are to be provided with a Participant Information Statement and Consent Form, unless otherwise agreed by the Committee. The following statement must appear on the bottom of the Participant Information Statement: *Any person with concerns or complaints about the conduct of a research study can contact the Deputy Manager, Research Integrity (Human Ethics), University of Sydney on +61 2 8627 8176 (Telephone); + 61 2 8627 8177 (Facsimile) or ro.humanethics@sydney.edu.au (Email).*

5. Copies of all signed Consent Forms must be retained and made available to the HREC on request.

6. It is your responsibility to provide a copy of this letter to any internal/external granting agencies if requested.

7. The HREC approval is valid for four (4) years from the Approval Period stated in this letter. Investigators are requested to submit a progress report annually.

8. A report and a copy of any published material should be provided at the completion of the Project.

Please do not hesitate to contact Research Integrity (Human Ethics) should you require further information or clarification.

Yours sincerely

Associate Professor Philip Beale
Chair
Human Research Ethics Committee

cc: bluu2618@mail.usyd.edu.au

Appendix B – Parent Information Package

B.2 Parent Invitation Letter

THE UNIVERSITY OF SYDNEY

School of Psychology
Faculty of Science

ABN 15 211 513 464

Marc de Rosnay *DPhil*
Senior Lecturer

Room BM344
Brennan MacCallum Building A18
The University of Sydney
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Telephone: +61 2 9351 4528
Facsimile: +61 2 9036 5223
Email: marc.derosnay@sydney.edu.au
Web: sydney.edu.au/science/psychology

11th October, 2012

RE: Invitation to participate in a study conducted at schools by The University of Sydney

Dear Parent/Guardian,

We would like to invite your child to participate in our study, *Children's sensitivity to speaker accuracy and competence with biological concepts*, which is being conducted by PhD candidate, Ms Betty Luu, under the supervision of myself, Dr Marc de Rosnay, of the School of Psychology at the University of Sydney.

The study will be conducted at your child's school and your child will watch some short video clips of people talking about various body parts and organs (such as the eyes, hands and heart), which will take 10-15 minutes to complete. After watching the clips, your child will make decisions about which person they would trust to give them reliable information about the body.

We would like to emphasise that your child will only see stylised 'cartoon-like' coloured pictures of organs and body parts. NO graphical photographs or depictions of actual body parts and organs will be shown.

Your child's teacher will have access to your child at all times. Participation in this study is entirely voluntary and you are under no obligation to consent. If you do consent, you can choose to withdraw your child from the study at any time. Please find enclosed a Parent/Guardian Information Sheet and a Consent Form which outline the details of this study.

If you are interested in volunteering for our study, please complete the enclosed Consent Form and return it to your School Principal. If you would like further information, please feel free to contact Ms Betty Luu on (02) 9351 3321 or bluu2618@uni.sydney.edu.au. You are also welcome to contact Dr Marc de Rosnay on (02) 9351 4528 or marc.derosnay@sydney.edu.au.

Yours sincerely,

Marc de Rosnay

B.2 Parent Information Statement

THE UNIVERSITY OF SYDNEY

School of Psychology
Faculty of Science

ABN 15 211 513 464

Marc de Rosnay *DPhil*
Senior Lecturer

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Web: sydney.edu.au/science/psychology

Children's Sensitivity to Speaker Accuracy and Competence with Biological Concepts

PARENTAL (OR CAREGIVER) INFORMATION STATEMENT

(1) What is the study about?

You are invited to permit your child to participate in a study of how five- and six-year-olds monitor the quality of information provided by other people. The implications of this study are wide-reaching and will add to research examining how children come to rely on other people (informants) to provide them with reliable biological information about the human body.

Your child was selected as a possible participant in this study because he/she is of the target age and your school has kindly agreed to support this research.

(2) Who is carrying out the study?

The study is being conducted by current PhD candidate, Ms Betty Luu and will form the basis for the degree of Doctor of Philosophy undertaken at The University of Sydney under the supervision of Dr Marc de Rosnay, an Australian Postdoctoral Fellow and Lecturer in the School of Psychology.

(3) What does the study involve?

This study will be conducted at your child's school and your child will watch a series of short video clips with a researcher (Ms Betty Luu). The clips feature two informants who describe various cartoon-like pictures of external body parts (e.g., hands, eyes), either in a *knowledgeable competent* manner or in a *hesitant incompetent* manner. Your child will participate by choosing which of the two informants to ask for help when learning new labels for internal body parts (e.g., thymus, larynx).

Please note that all the body parts and organs your child will see are 'cartoon-like' stylised pictures. NO graphical depictions or photographs of actual body parts and organs will be shown. Your child's teacher will have access to your child at all times during the study.

(4) How much time will the study take?

The study will take about 10-15 minutes. This time commitment has been reviewed and approved by the Principal.

(5) Can I withdraw from the study?

Being in this study is completely voluntary. You are not under any obligation to consent your child. Your child will only take part in the study with your consent.

Your decision whether or not to permit your child to participate will not prejudice you or your child's future relations with The University of Sydney. If you decide to permit your child to participate, you are free to withdraw your consent and to discontinue your child's participation at any time without affecting your relationship with the University of Sydney.

Further, because of your child's age, the researcher and/or your child's teacher will terminate any aspect of the study if they have any concern about your child's welfare, although this is not at all expected to occur.

(6) Will anyone else know the results?

All aspects of the study, including results, will be strictly confidential and only the researchers will have access to information on participants. A report of the study may be submitted for publication or presented at national and international conferences related to this area of research, but individual participants or schools will not be identifiable in such a report(s). In any publication, information will be presented in such a way that you or your child will not be able to be identified. All original materials will be destroyed within 7 years of the completion of this study.

(7) Will the study benefit me or my child?

We do not anticipate that there will be any adverse consequences for your child by taking part in our study. However, we cannot and do not guarantee or promise that your child will receive any benefits from the study.

If we have any indication that your child is unhappy or dislikes the procedures, which we do not expect, the study will be terminated. We will always speak with your child's teacher in the unlikely event that this occurs.

(8) Can I tell other people about the study?

You are more than welcome to tell other people about the study as it will not affect the outcomes of the research.

(9) What if I require further information?

When you have read this information, Ms Betty Luu is available to discuss it with you further and answer any questions you may have. If you would like to know more at any stage, please feel free to contact her on (02) 9351 3321 or bluu2618@uni.sydney.edu.au. You are also welcome to contact Dr. Marc de Rosnay on (02) 9351 4528 or marc.derosnay@sydney.edu.au.

(10) What if I have a complaint or concerns?

Any person with concerns or complaints about the conduct of a research study can contact The Manager, Human Ethics Administration, University of Sydney on +61 2 8627 8176 (Telephone); +61 2 8627 8177 (Facsimile) or ro.humanethics@sydney.edu.au (Email).

This information sheet is for you to keep

B.3 Parent Consent Form

THE UNIVERSITY OF SYDNEY

School of Psychology
Faculty of Science

ABN 15 211 513 464

Marc de Rosnay *DPhil*
Senior Lecturer

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Email: marc.derosnay@sydney.edu.au
Web: sydney.edu.au/science/psychology

PARENTAL (OR CAREGIVER) CONSENT FORM

I, ... [PRINT NAME], agree to permit

.............……... [PRINT CHILD'S NAME], who is aged, ...

years and .... months, to participate in the research project –

TITLE: CHILDREN'S SENSITIVITY TO SPEAKER ACCURACY AND COMPETENCE WITH BIOLOGICAL CONCEPTS

In giving my consent I acknowledge that:

1. The procedures required for the project and the time involved for my child's participation in the project have been explained to me, and any questions I have about the project have been answered to my satisfaction.

2. I have read the Information Statement and have been given the opportunity to discuss the information and my child's involvement in the project with the researcher/s.

3. I understand that being in this study is completely voluntary – I am not under any obligation to consent to my child's participation.

4. I understand that my child's involvement is strictly confidential. I understand that research data gathered from the results of the study may be published however no information about my child nor I will be used in any way that is identifiable.

5. I understand that I can withdraw my child from the study at any time without prejudice to my or my child's relationship with the researcher/s or the University of Sydney. If I do not wish for my child to continue, any information provided by my child will not be included in the study.

6. I understand that if I have any questions relating to my child's participation in this research I may contact the researcher/s who will be happy to answer them.

7. I consent to: –

(i) Receiving Feedback YES ☐ NO ☐

If you answered YES to the "Receiving Feedback Question (iii)", please provide your details i.e. mailing address, email address.

<u>Feedback Option</u>

Address: ____

____

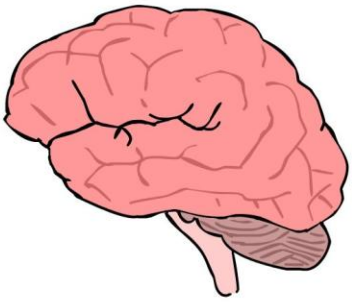
Email: ____

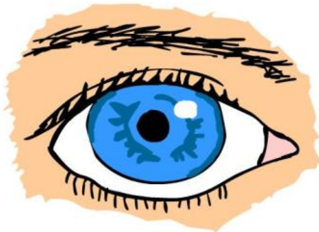
....
Signature of Parent/Guardian

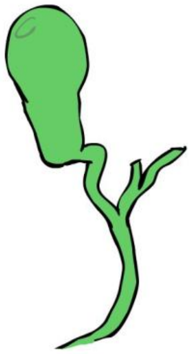
....
Please PRINT name

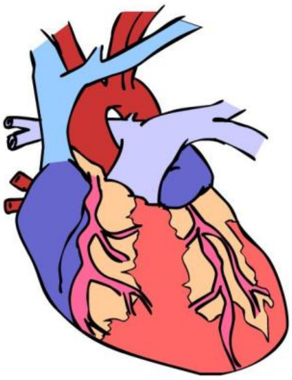
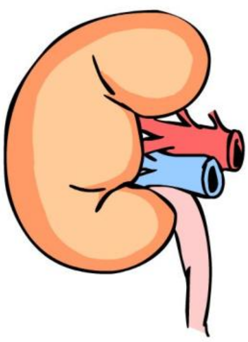
....
Date

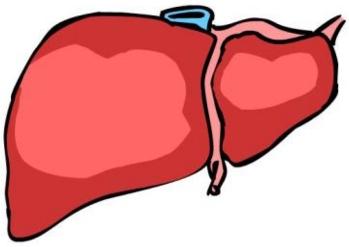
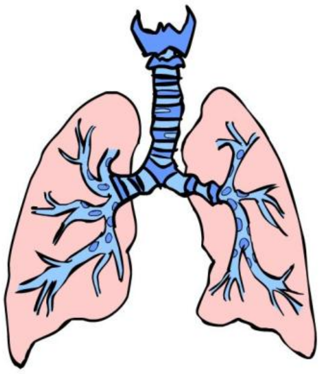
Appendix C - Overview of Body Parts and Organs



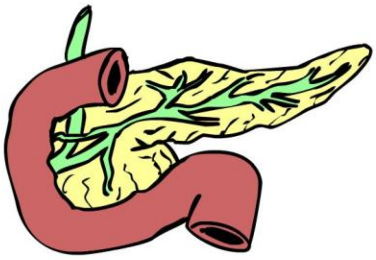


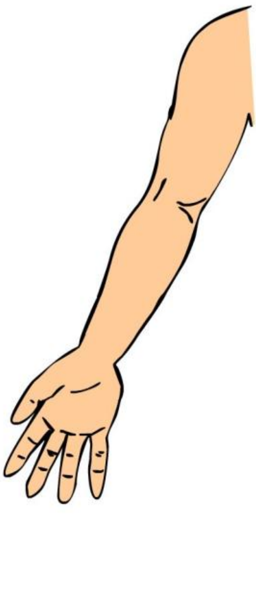
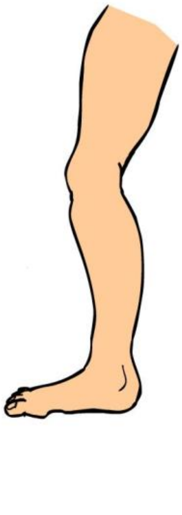






Appendix D – Children's Responses to What Body Parts/Organs are "For" in Study 1

Four- and five-year-olds' explanations of each body part/organ

Body Part/Organ	Four-year-olds	Five-year-olds
Arm	S1001: "..."| S1002: "move your fingers"| S1003: "does nothing"| S1004: "helps you wave and make music"| S1005: "grab stuff / for your muscles"| S1008: "bending / on your hand, you can pick up something, like boxes"| S1009: "stretching"| S1010: "waving"| S1013: "bending, swimming, reaching"| S1015: "..."| S1016: "help for moving, holding"| S1017: "stretching"| S1019: "for walking and punching, kicking"| S1022: "there's bones inside it, stretch it, move your bones / the bones inside have blood on it and stick to bones"	S1006: "waving"| S1007: "holding / and this bit is for doing this (bends elbow); and to look at your elbow; fingers"| S1011: "so you can move your arm / use your fingers for picking stuff up and eating, use hands for holding knives and spoons for different foods"| S1012: "put them up, down, swing them around, clap when spinning around / sometimes arms can move, stretch, like exercise"| S1014: "helps you run really fast in a running race, helps you move food to your mouth / tattoos"| S1018: "hold hands"| S1020: "(crosses over arms) for holding / I have a stamp"| S1021: "you can move it"| S1023: "holding fork; arms hold your hands up; food for touching your hands / put nail polish on fingers"| S1024: "for moving"| S1025: "cutting your hair"| S1026: "play, leave it"| S1027: "brushing, colouring|"
Ear	S1001: "..."| S1002: "hear something"| S1003: "for listening"| S1004: "helps you hear"| S1005: "hearing"| S1008: "listening / things go in your ear and put your finger to let it out, there is a big and a little one [points to holes]"| S1009: "so you can hear, tell someone and hear what they are saying"| S1010: "listening"| S1013: "for listening"| S1015: "..."| S1016: "helps you hear"| S1017: "listening"| S1019: "for wiggling / (blocks ears) sounds like the ocean"| S1022: "listening, hearing"|	S1006: "hearing"| S1007: "helps you hear / inside the holes are two straws and that's where what you hear goes inside"| S1011: "listen to it with your ear, hear inside your ear to hear everything / when it's loud, you can hear all the things"| S1012: "hearing / some people can't hear"| S1014: "helps you hear"| S1018: "hearing"| S1020: "put the medicine and your mouth"| S1021: "listening"| S1023: "you hear with your ears; listen"| S1024: "for hearing"| S1025: "to hear"| S1026: "hearing people talk"| S1027: "hearing, earrings"|

Body Part/Organ	Four-year-olds	Five-year-olds
Eye	S1001: “Close one eye; and another is open; blink; closing your eyes to sleep / eyebrows”| S1002: “moving your eye / two”| S1003: “look and blink”| S1004: “blinking / that's the colour of the eye”| S1005: “looking”| S1008: “looking / watching out where you step, looking out for bad people”| S1009: “seeing, see where you're going”| S1010: “blinking”| S1013: “for looking / not blue like mine”| S1015: “for looking”| S1016: “helps to see”| S1017: “look / eyelashes on it”| S1019: “blinking faster”| S1022: “it sees in the dark when you eat carrots; look in the eye, it looks green, brown, blue, black / eyelashes”|	S1006: “blinking, looking / close like this, sleeping”| S1007: “sleeping / close your eyes and opening; circle bits are round, there is blood inside your eyes, people have different colours”| S1011: “looking at stuff, you can look at the eye and own eye in the mirror”| S1012: “seeing, you can move your eye, can move left to right / some people can't see very well so they need glasses”| S1014: “helps you see. I think it helps you know where you're going / helps you go everywhere”| S1018: “looking, seeing”| S1020: “to blink your eye and (pulls skin under eyes downwards)”| S1021: “looking”| S1023: “you see with your eyes, look for stuff / have a big and a little ball in eye; different colours; have eyelashes”| S1024: “helps you see”| S1025: “see, you can’t see if you’re blind”| S1026: “looking at the sky, looking at trees”| S1027: “looking, seeing”|
Foot	S1001: “Wiggle your toes / Nail polish”| S1002: “walk, move your toes”| S1003: “kick, walk, run, jump, star jumping”| S1004: “helps you walk and sit down”| S1005: “for walk / shoes”| S1008: “stepping and have to look out in the jungle for snakes / football and roads”| S1009: “walking, putting socks on, running, exercising”| S1010: “running, walking / wiggle your toes”| S1013: “walking, crawling”| S1015: “using”| S1016: “walking, moving”| S1017: “twitching your toes”| S1019: “running, sitting down, walking, backflips, jumping, meatball”| S1022: “helps you walk, when you flip over you need to push it along / there's little bits inside the foot, blood inside the nails”|	S1006: “walking”| S1007: “that's a bit of your bone sticking up; walking / the skin is not that colour inside, in case you fall over and break your skin”| S1011: “walking / put nail polish on”| S1012: “kicking, spinning around on a bike”| S1014: “it helps you move your toes and it helps you walk. I think it helps you run, skip, hop”| S1018: “to walk”| S1020: “ / nail polish”| S1021: “you can walk with them”| S1023: “have toes and feet are very smelly, put nail polish on, walking”| S1024: “walking”| S1025: “sit, keep germs away”| S1026: “wearing things, putting nail polish on”| S1027: “walking”|

Body Part/Organ	Four-year-olds	Five-year-olds
Hand	S1001: “Shake your hands off in the sink when you wash your hand / [Does an emu action], twinkle twinkle little star”| S1002: “move your hand”| S1003: “they just move”| S1004: “wave, opening and shutting”| S1005: “touching”| S1008: “pick up things, tickle, building blocks / it can move”| S1009: “to pick up, pick some toys up, to pack away your room”| S1010: “clap, eat”| S1013: “can bend it, gets sandy, holding, making noise louder”| S1015: “for holding stuff”| S1016: “helps you move”| S1017: “reaching, holding hands”| S1019: “grabbing things, doing backflips, exercises”| S1022: “little parts inside it, if there are holes in the side of your finger, bones might come out; pick things up”|	S1006: “clapping, pick up things, flicking, waving / I have tattoos on my hand”| S1007: “for thinking (points at head)”| S1011: “eating stuff, holding forks, hold spoons to eat different stuff”| S1012: “doing stars, jump jump star”| S1014: “helps you eat, when you don't have a hand you can't do anything, and it will be sore and it will bleed”| S1018: “waving, saying goodbye”| S1020: “eating stuff, holding forks, hold spoons to eat different stuff / (counts number of fingers) "five"”| S1021: “touching and grabbing”| S1023: “have little bumps on your hand and you plant with your hands, hold little seeds; hold many things with your hands”| S1024: “picking things up, for eating”| S1025: “touching”| S1026: “holding things”| S1027: “touching”|
Leg	S1001: “Walk, kicking, clap feet, starfish with arms and legs at the beach, jump / knee”| S1002: “helps you walk, sit down / knee”| S1003: “kick, run, star jump”| S1004: “makes you run”| S1005: “walking”| S1008: “stepping, watch for where you're stepping, bending / knee”| S1009: “walking, put some shoes on”| S1010: “jumping”| S1013: “use it to walk, run, tiptoe”| S1015: “walking”| S1016: “helps you to walk, moving”| S1017: “they are very straight, walking, standing up”| S1019: “walking / feet”| S1022: “makes your foot walk”|	S1006: “walking”| S1007: “walking, hopping”| S1011: “walking”| S1012: “sitting down, dancing, ballet / put shoes on and (points to her hellokitty plush) she has a heart on her foot”| S1014: “helps you run, walk, skip & hop; helps you move your knee, foot, toes”| S1018: “you walk with it”| S1020: “walk, jump, crawl, in the jumping castle, park / foot”| S1021: “you can bend it”| S1023: “is very long, knees are very strong and never break; but if you cut it, it will break; holding your foot”| S1024: “walk with it, put shoes on your leg, bend”| S1025: “walk, run, swim”| S1026: “walking, running”| S1027: “walking”|
Mouth	S1001: “...”| S1002: “...”| S1003: “eat, kiss, and move and make people talk”| S1004: “make music”| S1005: “talking”| S1008: “saying, stick on / putting stuff on and putting it on tongue”| S1009: “licking, eating”| S1010: “moving, talking”| S1013: “talking, counting, breathing, spitting out”| S1015: “...”| S1016: “helps you talk”| S1017: “kissing, smiling”| S1019: “ / lipstick”| S1022: “eats food, tastes food and it licks food, lick icecream”|	S1006: “licking, kissing, chewing / they are beautiful, my teeth wobbled and it fell out”| S1007: “lick, and go down the hole and goes to your tongue, and makes your tongue”| S1011: “your lips help you eat / for lipstick”| S1012: “talking, there is teeth inside, sucking their thumb / hello kitty's lip is behind her fur”| S1014: “cooking, putting your food in / i think it helps you speak”| S1018: “kissing”| S1020: “for putting lipstick”| S1021: “you can put lipstick on there, you can lick them”| S1023: “talking / can have lipstick sometimes”| S1024: “for talking”| S1025: “to talk, be fresh”| S1026: “eating lollies”| S1027: “moving your lips”|

Body Part/Organ	Four-year-olds	Five-year-olds
Nose	S1001: “wiggle your nose, wiggle your body at the same time”| S1002: “breathe”| S1003: “sniffs”| S1004: “smells”| S1005: “smelling”| S1008: “sniffing”| S1009: “smelling, smelling what your mum cook today”| S1010: “smelling / i got a blocked nose”| S1013: “sniffing”| S1015: ““| S1016: “helps you smell”| S1017: “sniffing”| S1019: “blowing air out”| S1022: “it smells stuff”|	S1006: “smelling”| S1007: “smelling / there is a hole in your nose”| S1011: “sniffing, smell / when i go to bed and mum & dad cook dinner, i can smell it and hear lots of noise”| S1012: “smelling / wobble it around like this”| S1014: “it helps you smell, breathe”| S1018: “sniffing”| S1020: “you bump your nose at the car and it hurts”| S1021: “you can breathe with it, you can wiggle it”| S1023: “smells lots of things with your nose, you blow your nose like what I just did”| S1024: “smelling”| S1025: “smelling”| S1026: “smelling things”| S1027: “smelling”|
Teeth	S1001: “Chew; eating; brush your teeth / Crunch”| S1002: “chew on meat, chicken, beef, rice, beans, bite on bone”| S1003: “eat, chomp chomp chomp”| S1004: “helps you chew food and make music and helps you eat good”| S1005: “for crunch, eat, hungry / it fell out and wobbly”| S1008: “snapping and licking, tasting / dinosaurs have teeth”| S1009: “biting, eating”| S1010: “eating / licking”| S1013: “breaking up food”| S1015: “eating”| S1016: “talking, brushing your teeth”| S1017: “mouth is for eating / they fall out”| S1019: “biting”| S1022: “chew food up, it yells, talks, screams really loud”|	S1006: “chewing, talking / I lost my tooth because I was getting older”| S1007: “eating, breaking up the food / the red bits near the teeth are things the little kids think are blood, called nodules; help keep your teeth in; the middle red bit [points to tonsil] in the middle is where your food goes in and where you swallow your food”| S1011: “for eating, helps you grow big teeth”| S1012: “eating, swallowing”| S1014: “helps you bite, swallow”| S1018: “eating”| S1020: “brush your teeth, and make your teeth sore / i lost one teeth”| S1021: “you can chew with them”| S1023: “grow lots of times; when one comes out and your teeth grows (talks about tooth fairy); eating”| S1024: “for chewing, washing”| S1025: “make it shiny, for talking”| S1026: “falls down, eating, wiggles”| S1027: “eating, drinking”|
Brain	S1001: “have an eyebrow wiggle / through your body”| S1002: “vomit”| S1003: “move around”| S1004: “...”| S1005: “...”| S1008: “like an ‘o’”| S1009: “to keep alive”| S1010: “...”| S1013: “talking, remembering, thinking”| S1015: “...”| S1016: “for thinking and for dreaming”| S1017: “being quiet / very squishy, soft”| S1019: “for the head and you wobble it and it shakes”| S1022: “thinking, there's a little black thing (forehead) and it clicks to your brain”|	S1006: “...”| S1007: “thinking / you have holes and they are different colours; the blue is full of stuff that makes you think”| S1011: “blood goes through your brain “| S1012: “makes you hear with your ear / you can do this (covers ears) if it's too loud, cover with your hands”| S1014: “keeps you alive, helping your blood / helps you have dreams”| S1018: “...”| S1020: “ / head, body, eyes”| S1021: “you think with it “| S1023: “you think with lots of stuff in your brain, this is called a brain “| S1024: “looking, concentrating “| S1025: “makes you smart, for reading”| S1026: “...”| S1027: “to think”|

Body Part/Organ	Four-year-olds	Five-year-olds
Gall Bladder	S1001: "..."| S1002: "..."| S1003: "..."| S1004: "..."| S1005: "..."| S1008: "..."| S1009: "..."| S1010: "..."| S1013: "..."| S1015: "..."| S1016: "..."| S1017: "..."| S1019: "for water"| S1022: "pumps up all the blood; it goes in your tummy and the blood gets on it"|	S1006: "..."| S1007: "..."| S1011: "..."| S1012: "..."| S1014: "..."| S1018: "..."| S1020: "makes your body feel well"| S1021: "..."| S1023: "..."| S1024: "..."| S1025: "swallowing"| S1026: "..."| S1027: "..."|
Heart	S1001: "..."| S1002: "..."| S1003: "..."| S1004: "keeps birds warm"| S1005: "..."| S1008: "..."| S1009: "pumping the blood to keep you alive"| S1010: "beat"| S1013: "..."| S1015: "..."| S1016: "helps you do this; pump"| S1017: "..."| S1019: "the bones, it beats"| S1022: "it beats and makes noise"|	S1006: "it beats / I can't feel my heart, I think I'm dead"| S1007: "helps you pump the blood / these bits are the pumping bits"| S1011: "helps you move"| S1012: "pumps blood around your body"| S1014: "putting your body good"| S1018: "..."| S1020: "checks your body"| S1021: "..."| S1023: "for breathing and talking; if your heart stops, you'll die"| S1024: "..."| S1025": "to stay, to walk"| S1026: "..."| S1027: "breathing"|
Kidney	S1001: "cook"| S1002: "..."| S1003: "..."| S1004: "..."| S1005: "..."| S1008: "..."| S1009: "..."| S1010: "..."| S1013: "..."| S1015: "..."| S1016: "for doing wees"| S1017: "..."| S1019: "jump around"| S1022: "it makes poo come out / there's blue and red bones together and a little pink line"|	S1006: "..."| S1007: "..."| S1011: "..."| S1012: "..."| S1014: "..."| S1018: "..."| S1020: " / it's a circle, two circles"| S1021: "..."| S1023: "kidney stones hurt a lot and you have to go to hospital; my mum had them and she vomited and it was painful and she had to call my dad"| S1024: "helps you hear"| S1025: "it can come out"| S1026: "..."| S1027: "..."|
Larynx	S1001: "Curl your hair, ears / Ankles with your bone"| S1002: "Move your body"| S1003: "..."| S1004: "..."| S1005: "..."| S1008: "..."| S1009: "..."| S1010: "..."| S1013: "..."| S1015: "..."| S1016: "talk, move"| S1017: "..."| S1019: "can see some white bones, putting your belly back"| S1022: "there's a little food and the food goes down and it softens food, it opens and closes / there's yellow bones and sometimes food gets stuck on it"|	S1006: "..."| S1007: "..."| S1011: "..."| S1012: "..."| S1014: "..."| S1018: "..."| S1020: "..."| S1021: "..."| S1023: "..."| S1024: "put food in it"| S1025: "body inside"| S1026: "..."| S1027: "..."
Liver	S1001: "..."| S1002: "lick"| S1003: "..."| S1004: "..."| S1005: "..."| S1008: "..."| S1009: "..."| S1010: "..."| S1013: "..."| S1015: "..."| S1016: "..."| S1017: "..."| S1019: "to swallow food"| S1022: "its got blood on it and sometimes gets food on the blood / blood goes in the blue thing"|	S1006: "..."| S1007: "pumping"| S1011: "..."| S1012: "..."| S1014: "helps you walk, it moves your feet"| S1018: "..."| S1020: "..."| S1021: "..."| S1023: "..."| S1024: "..."| S1025: "stay with you all day"| S1026: "..."| S1027: "..."|

Body Part/Organ	Four-year-olds	Five-year-olds
Lungs	S1001: “Scratch your ears / Like a butterfly”| S1002: “...”| S1003: “...”| S1004: “helps you breathe”| S1005: “...”| S1008: “breathing”| S1009: “...”| S1010: “eating”| S1013: “breathing”| S1015: “...”| S1016: “breathing”| S1017: “...”| S1019: “...”| S1022: “...”|	S1006: “breathe”| S1007: “pumping / feel my bones here”| S1011: “...”| S1012: “...”| S1014: “helps you go one way to your poo and the good part where you keep your food”| S1018: “...”| S1020: “...”| S1021: “...”| S1023: “breathing section, for breathing, neck holds lungs together; when you breathe, they come in and come out”| S1024: “...”| S1025: “stay for a long day”| S1026: “hearing”| S1027: “...”|
Pancreas	S1001: “ / Music comes out of holes and you put whistle through it”| S1002: “move”| S1003: “...”| S1004: “makes you talk”| S1005: “...”| S1008: “...”| S1009: “...”| S1010: “...”| S1013: “...”| S1015: “...”| S1016: “...”| S1017: “...”| S1019: “crack your bones”| S1022: “food goes down in it / there's bones in it, there's yellow stuff in it, it crushes up all the food inside”|	S1006: “...”| S1007: “[points to tube] that's where your poo comes out; food goes in and poo goes out”| S1011: “...”| S1012: “...”| S1014: “...”| S1018: “...”| S1020: “...”| S1021: “...”| S1023: “...”| S1024: “...”| S1025: “for your hair, vomit comes down”| S1026: “...”| S1027: “...”|
Stomach	S1001: “wiggle your hair”| S1002: “blow”| S1003: “nothing”| S1004: “makes music, helps”| S1005: “to eat, use mouth to eat”| S1008: “air out of your mouth”| S1009: “...”| S1010: “breathe”| S1013: “...”| S1015: “for eating”| S1016: “...”| S1017: “to breathe”| S1019: “breathing air out of your mouth”| S1022: “...”|	S1006: “eating”| S1007: “breathing”| S1011: “when you eat, it goes down there (points)”| S1012: “...”| S1014: “putting your food in, keeping your sugar up”| S1018: “...”| S1020: “...”| S1021: “...”| S1023: “sometimes you call it tummy, your tummy rumbles and nothing else”| S1024: “...”| S1025: “helps you walk”| S1026: “eating”| S1027: “...”|

Note. S represents individual participants’ responses.
‘ / ’ denotes a prompt by the experimenter, “Can you tell Johnny/Jenny anything else about X?”
“...” denotes a “don’t know” response by children.
[ ] denotes any gestural actions performed by children.

Appendix E – Theory of Mind (ToM) tasks

E.1 Script

Subject: **Date:**

Location:

☐ **FALSE BELIEF: Unexpected Contents**

Picture ONE

Here is a box of Pringles [pointing]**.** ***What do you think is inside the box?***

Response: ____________________________________

Let's have a look inside the box?
[children are invited to lift the flap with the Pringles to reveal crayons].

Can you tell me what is really inside the box?

Response: ____________________________________

That's right! There are crayons inside the box.
Now, put the lid back on so the box is closed.

Here's Lily [lift flap]***. Lily has never seen inside this box of Pringles before.***

[Target question]

What does Lily think is inside the box?

Response: ____________________________________

(if the child does not answer spontaneously open the last flap and ask: [pointing]

Does she think there are <u>Pringles</u> or crayons?) (Circle child's response)

[Reality question]

Okay, what's really inside the box?

Response: ________________________________

(if the child does not answer spontaneously then ask [pointing]:

Are there Pringles or <u>crayons</u>?) (Circle child's response)

☐ **FALSE BELIEF: Unexpected Transfer**

[pointing on the FIRST sheet]
This is Luke. Luke has a ball and a pink box.

[show the child the SECOND sheet]
Luke puts his ball into the pink box to keep it safe
and then he goes to play.

[show the child the THIRD sheet]
While Luke is outside playing, Sean decides to surprise him.
Sean takes the ball out of the pink box and puts it inside the blue box.
Then he goes outside to play.

[show the child the FOURTH sheet, pointing Luke but NOT the boxes]
Luke comes back because he wants to play with his ball.

[Target question: false belief base action]

Where will Luke look for his ball?

Response: ________________________________

(if the child does not answer spontaneously then ask [pointing]:
inside the <u>pink</u> box or inside the blue box? (circle child's response)

[Target question]

Okay, where does Luke think his ball is before looking for it?

Response: ___________________

(if the child does not answer spontaneously then ask [pointing]:

In the <u>pink</u> box or in the blue box?) (circle child's response)

[Reality question]

Okay, where is the ball really?

Response: ________________________________

(if the child does not answer spontaneously then ask [pointing]:

In the pink box or in the <u>blue</u> box?) (circle child's response)

☐ **Second order false belief – task 1**

Picture 1: Tomorrow is Joe's birthday and his mum is surprising him with a bike. She's hidden the bike in the garage. Joe says "mum, I really hope you get me a bike for my birthday!'. Because Joe's mum wants to surprise him she says "sorry Joe, I got you a toy instead'.

Control 1/ToM$_1$ Question 1: What does Joe think he's getting for his birthday?

Control Question 2: What is he really getting?

Must pass both of these questions to continue

Picture 2: Later Joe goes to the garage to look for a ball to play with. In the garage Joe sees a brand new bike with ribbons wrapped around it. Joe's mum doesn't see him go into the garage and find the bike.

In the evening, Joe's dad asks his mum 'does Joe know what you really got him for his birthday?'

2nd Order Ignorance Question 3: What does Joe's mum say?

Justification Question 4: Why does she say that?

Then Joe's dad says 'What does Joe think you got him for his birthday?'

2nd Order False-Belief Question 5: What does mum say?

Justification Question 6: Why does she say that?

Reality Control Question 7: What does Joe really know he is getting for his birthday?

Memory Control Question 8: What did Joe's mum pretend he was getting first of all?

☐ **Second order false belief – task 2**

Picture 1: Dad has given Mary and Simon some chocolate to share, “Go and put it in the fridge now,” says Dad, “you can have some after dinner”.

Picture 2: They put the chocolate in the fridge and then go out to play.

Picture 3: A little later, Simon comes in for a drink. He goes to the fridge and he sees the chocolate. He wants to keep the chocolate all for himself, so he takes it out of the fridge and puts it in his bag.

Control/ToM$_1$ Question 1: Where does Mary think the chocolate is?

Control Question 2: Where has Simon really put the chocolate?

Must pass both of these questions to continue

Picture 4: Oh look! Mary is playing by the window; she can see everything that Simon is doing! She sees him put the chocolate in his bag! Simon is so busy hiding the chocolate that he doesn’t see Mary watching him!

After dinner Dad says they can have some of the chocolate. So, Simon and Mary run into the kitchen.

ToM$_2$Test Question 3: Where does Simon think Mary will look for the chocolate?

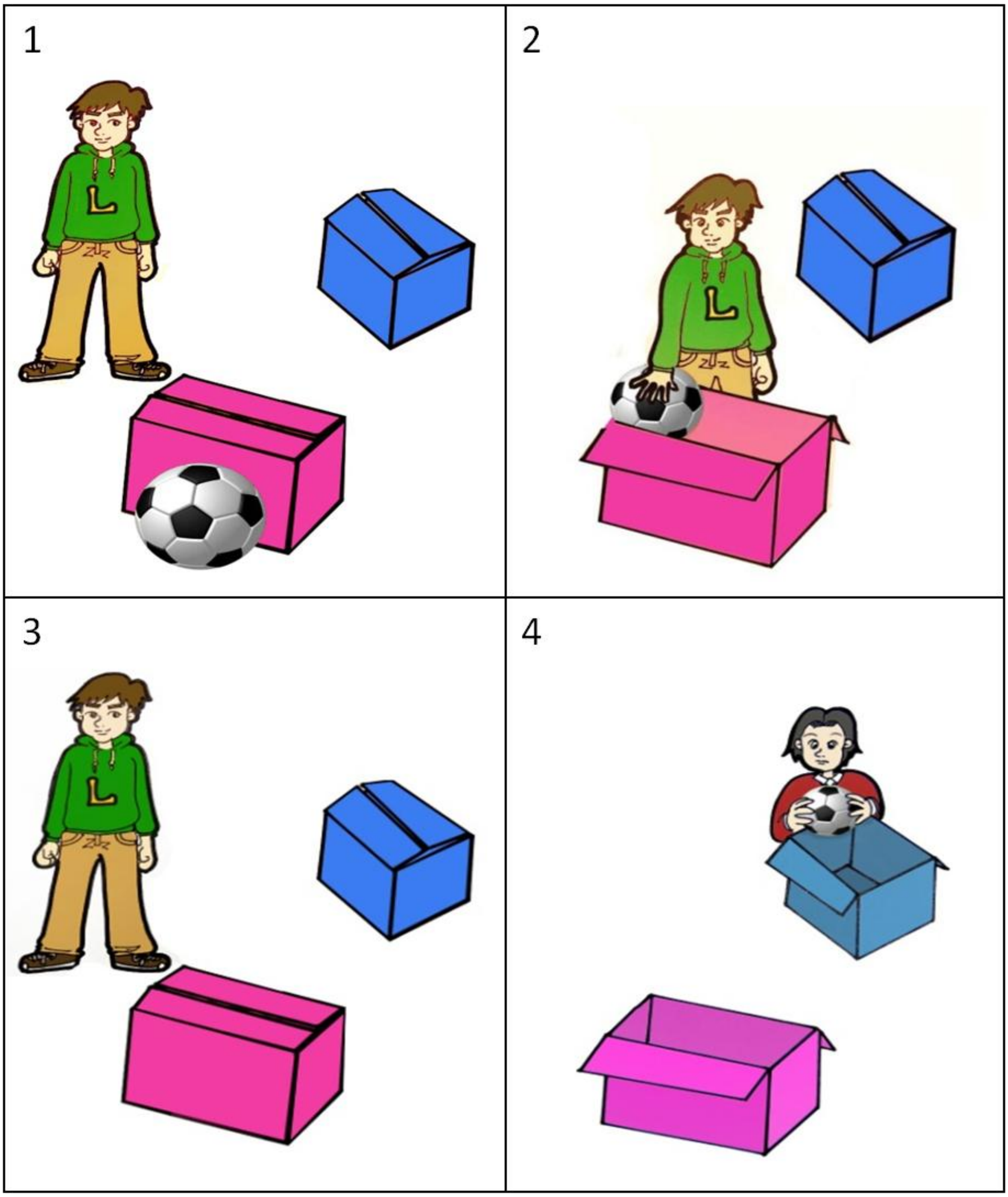
Justification Question 4: Why does Simon think that?

Reality Control Question 5: Where is the chocolate really?

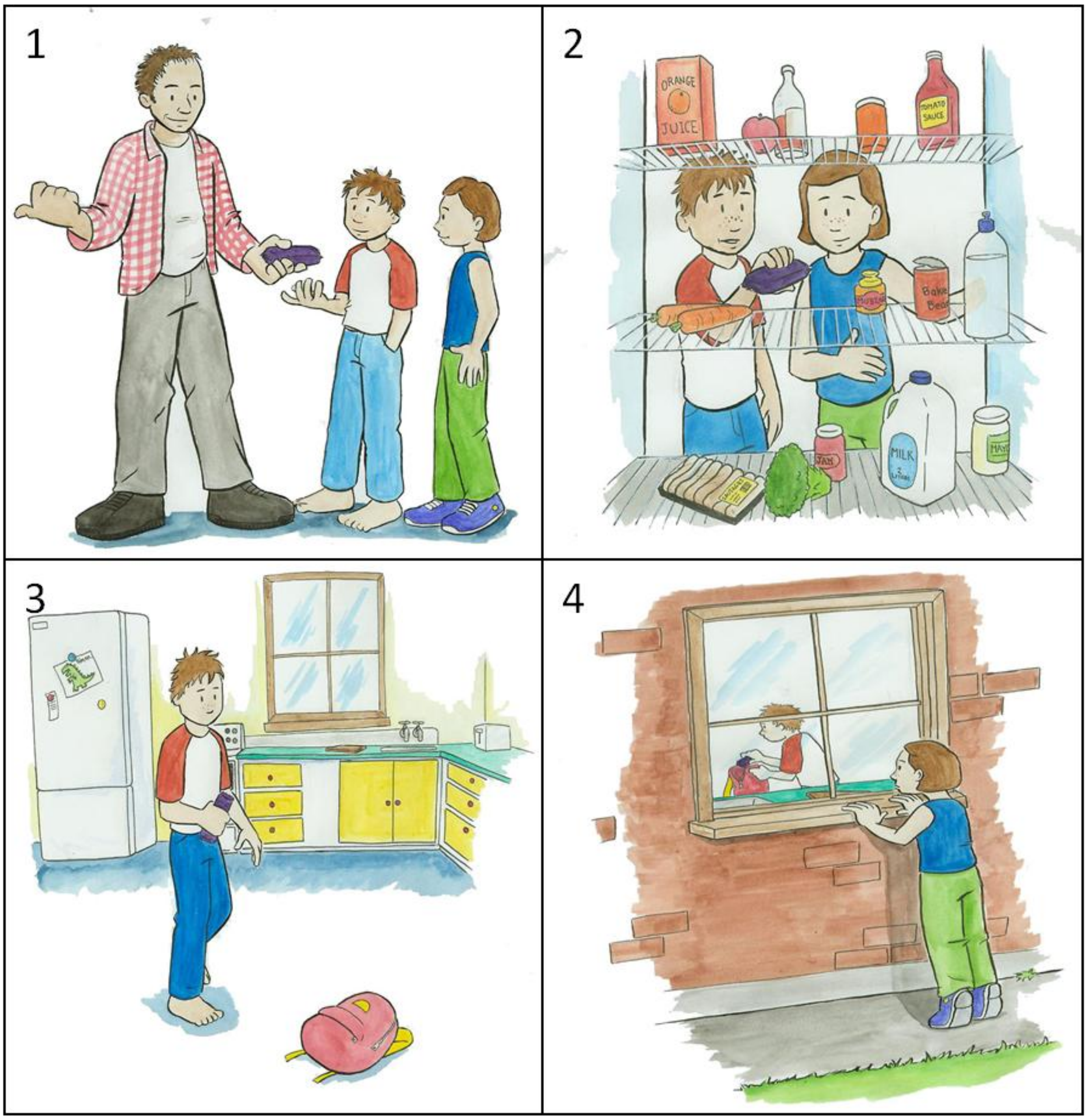
Memory Control Question 6: Where was the chocolate first of all?

E.2 Pictures for False Belief: Unexpected Contents

E.3 Pictures for False Belief: Unexpected Transfer



E.4 Pictures for Second order false belief – Task 1



E.5 Pictures for Second order false belief – Task 2