Children's biological causal models of disability

David Menendez

University of California-Santa Cruz

&

Susan A. Gelman

University of Michigan

Acknowledgements

This research was supported by NSF Grant #2055164 to Gelman. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Highlights

- Children might hold biological models of disability
- The essentialist model treats disabilities as inborn and immutable
- The infectious disease model treats disabilities as contagious, and not normal
- The bodily damage model treats disability as stable but not inheritable
- Future work should examine the cultural messages that support or counter each model

Abstract

The term “disability” encompasses many conditions (including a range of learning, intellectual, physical, sensory and socioemotional disorders) that can be caused by a variety of genetic, environmental, and unknown factors. We examine how children reason about the biological nature of disabilities, specifically the extent to which they use 'essentialist', 'infectious disease', or 'bodily damage' causal models. These models provide competing predictions regarding the biological nature of disability. The essentialist model views disabilities as caused by an internal essence, akin to genes, and entails thinking of disabilities as stable, immutable, and inheritable. The infectious disease model views disabilities as communicable, abnormal, and needing intervention. The bodily damage model views disabilities as resulting from injuries or toxins, which maybe stable but are not inheritable or transmissible. We review what is known about children's acquisition of these models, and discuss how disentangling these biological models is a fruitful avenue for future research.

Keywords (6 max): Disability; Essentialism; Illness; Intuitive theories; Biological reasoning; Explanatory co-existence

Children’s biological causal models of disability

The term “disability” encompasses a broad and diverse range of conditions (including a range of learning, intellectual, physical, sensory, and socioemotional disorders) that may be caused by a variety of genetic, environmental, and unknown factors (depending on the condition). A given disability may reflect the interacting influence of multiple factors (e.g., many psychological disorders have both genetic and environmental causes), and the very same disability could result from any one of a range of different causes (e.g., hearing loss due to genetic difference, viral disease, medication that damages cochlear hair cells, or injury to the ears). It is also the case that the etiology may be either incompletely understood (e.g., Autism Spectrum Disorder) or completely unknown (e.g., the cause of an individual's learning disability). Altogether, then, disabilities are heterogeneous in multiple dimensions, and thus provide a contrast to much prior research about children's causal understanding, which has argued that children use a set of domain-specific causal principles when reasoning about the world (such as naive biology, naive physics, naive psychology, or naive sociology; Shutts & Kalish, 2021; Spelke & Kinzler, 2007; Wellman & Gelman, 1998). Despite this heterogeneity, children might still develop specific intuitions about disabilities that gloss over variation and allow them to make inferences about the causes, malleability, transmissibility, and inductive potential of disabilities.

Given the complex landscape sketched out above, an important question is how children understand the causes of disabilities, including whether children are sensitive to variability in the causes of disability, and how sensitivity to this variation develops. These questions are important to investigate for at least three reasons. First, as with any causal theory, children's intuitive theories about disability have implications for their predictions and explanations. For example, children’s understanding of what causes a disability can inform their judgments of whether they think of disabilities as chronic or transient (Lewis, 1993). Second, given the wide range of potential causes for any disability, children's causal understandings may reveal misconceptions and mismatches (e.g., attributing a biological cause to a psychological condition, or vice versa). And third, certain causal models of disability may have harmful social and interpersonal consequences. For example, if one believes that a disability is genetically rooted, this could relate to the erroneous assumption that treatment would be ineffective and therefore a waste of time. Or, if one's causal theory is that a disorder is contagious, this could relate to stigma and avoidance of contact with the disabled individual. Or, if one's causal theory is that a disorder is due to external factors damaging the interior and/or exterior of the body, this could relate to the erroneous assumption that changing a person’s environment will change their disability. Mapping out children's causal understandings is thus the first step in correcting their misconceptions and ideally addressing or even preventing potential downstream negative consequences.

In this paper, we examine children’s reasoning about disability from a theory-theory perspective (Carey, 1985; Gelman & Wellman, 1991; Gopnik & Wellman, 2012; Wellman & Gelman, 1992). We start with the assumption that children’s knowledge includes theory-like representations that, like scientific theories, are inferentially rich and allow children to reason about unobservable entities in multiple ways (Gelman & Wellman, 1991): to make predictions, provide explanations, and generalize broadly to novel instances (Hatano & Inagaki, 1994). A ‘theory theory’ approach typically assumes that children’s initial theories cover the domains of physics, biology, psychology, and sociology, depending on their content (Shutts & Kalish, 2021; Wellman & Gelman, 1992). Although there are other theoretical accounts for children's conceptual representations (diSessa, 1988; Sloutsky, 2010), theory-like representations are generally supported in multiple areas of conceptual development (Baillargeon, 1994; Gopnik & Wellman, 1992; Hatano & Inagaki, 1994), and provide a starting point for exploring children's conceptualization of disabilities.

For the present review, our focus is on children's biological models of disability. Although there are other models of disability such as social or moral models (for reviews see Goering, 2015; Retief & Letšosa, 2018), we focus on biological models, as biology is an area where children have sophisticated knowledge from an early age (Hatano & Inagaki, 1994; Labotka & Gelman, 2023; Menendez et al., 2020), and because biological functions are implicated in many disabilities. Additionally, biological models of disability are used into adulthood (Angermeyer et al., 2011; Kvaale et al., 2013), and they might be related to stigma (Haslam, 2011; Kvaale et al., 2013).

Three biological models

Building on the literature regarding children's intuitive theories, we propose that a fruitful yet largely unexplored set of questions revolves around how children reason about the biological nature of disabilities. We consider these questions by focusing on three different biological models: an essentialist model, an infectious disease model, and a bodily damage model (for a review of additional models of disability, see Retief & Letšosa, 2018). Briefly, an essentialist model assumes that a disability is caused by an internal, inherent quality (Berent & Platt, 2021a; Smith & Williams, 2004; Williams, 2012; Williams & Smith, 2006). Such a framework entails thinking of a disability as stable, immutable, and inheritable. In contrast, an infectious disease model views a disability as transmitted from one person to another, unhealthy, and in need of intervention (Dyson, 2005). This model is also biologically based, but not essentialized; in contrast, disability is viewed as akin to transmissible illnesses like the flu. A bodily damage model views a disability as involving temporary or permanent harm due to injuries (such as a car accident) or environmental factors (such as air pollution, lead exposure, or excessive noise) and thus a departure from typical bodily functions (Maas et al., 1978; Sigelman & Begley, 1987). This model places greater emphasis on factors external to the person, but it is still biological in that the disability disrupts the body's biological system(s). It should be noted that the accuracy of these models depends not only on the disability, but also on the myriad of structural and societal factors surrounding how the disability is perceived, leading to variations in which aspects of human functioning are even considered disabilities.

Prior research outside of disability has shown that biological models emerge early in development (Gelman, 2003; Labotka & Gelman, 2023; LoBue et al., 2023), undergo important changes with age (Kalish, 1996; Labotka & Gelman, 2023; Rhodes & Mandalaywala, 2017), and are sensitive to cultural input (Anggoro & Jee, 2021; Hernandez et al., 2020; Waxman et al., 2007). To our knowledge, however, these models have largely been considered separately from one another, and as applying to different phenomena. For example, essentialist models have largely been examined with regard to the physical and behavioral features of animal kinds (e.g., lions, dogs) and social kinds (e.g., gender, race), infectious disease models have largely been examined with regard to diseases (e.g., colds, flu, COVID, AIDS, cancer), and bodily damage models with regards to death or disability. Yet we propose that all three models share a commonality in their focus on biological causes and all may be employed to understand and reason about disability.

When considered individually, it is important to unpack these three models, as each can lead to misunderstandings, and each can contribute to prejudice, bias, and stigma regarding disability. Furthermore, in addition to the importance of each model individually, when considered together, these three models provide competing predictions and explanations about the biological nature of disability. The three models differ in what they posit about a disability's source, changeability, inductive potential, transmissibility, and relation to non-disabled individuals (see Table 1). The various factors will be discussed in more detail in the sections focused on each model.

Table 1. Comparison of three biological models of disability.

	Essentialism	Infectious disease	Bodily damage
Prototype	genetic disorder	communicable disease	injuries
Ontology	non-obvious basis; appearances may be deceiving	symptoms reflect ill health	symptoms reflect externally-caused damage to the body
Source of disability	inherent, inborn	transmitted by others	injuries or exposure to toxins
Where disability resides	in the disabled individual	in the disabled individual	in the disabled individual or individual/environment interaction
Changeability	immutable	treatable by doctors	potentially malleable if there are changes in the environment and/or bodily functioning
Inductive potential	highly informative; predicts other features	specific to the disorder	localized to the damaged body part(s)
Transmissibility	from parent to child (prior to birth)	to anyone via proximity and direct contact	not transmissible
Relation to non-disabled	discretely different kind	not "normal"	unlucky or unfortunate

Relation to non-biological causal models	under-appreciation for non-biological factors	under-appreciation for non-biological factors	focus on external environmental factors

The rest of this paper is organized into five sections, as follows. In the first, second, and third sections, we focus on how essentialism, infectious disease, and bodily damage, respectively, provide causal frameworks for reasoning about disability. For each, we discuss the relevant causal model, review the evidence in the literature for how the model is applied to children's reasoning about disability, spell out the potential consequences, and identify gaps in the literature. In the fourth section, we directly consider the question of if and how children reconcile these competing models, how they may compete or co-exist in children's reasoning, and what are the contexts or framing that may highlight one or the other model. Then, in the final section, we turn to additional questions and future directions for the study of children's understanding of disability that follow from the framework we have provided. We will also briefly consider how these biological models relate to other, non-biological models of disability.

Essentialist models of disability

Psychological essentialism is an intuitive belief that for certain categories, members are alike on a 'deep' level, and possess an internal, inherent, underlying quality or substance that causes members of that category to be alike (Gelman, 2003). Gelman and Roberts (2017, p. 7902) characterize essentialism as follows:

> an intuitive belief that categories of the natural world share not just observable features, but also a deeper, nonobvious reality: they "carve up nature at its joints" … Thus, tigers share more than a certain size, gait, striped fur, and ferocity, but also internal parts, temperament, instincts, as well as an innate, unchanging tiger "essence."

This causal 'essence' is assumed to give an item its identity -- the tiger essence is what makes something a tiger, and causes it to have stripes, for example.

For kinds of animals or people, this internal essence can be conceptualized as genes (Cheung et al., 2014; Dar-Nimrod & Heine, 2011), blood (McIntosh, 2009), or internal parts (Waxman et al., 2007), or may be an unspecified placeholder -- something internal and inherent that gives an individual its identity but that is as-yet-unknown (Gelman, 2004; Medin & Ortony, 1989). Because essentialism in children is often a placeholder concept, it is revealed not by asking what constitutes the essence of a category (e.g., young children cannot say what the essence of a tiger is, and they know little about genes; Smith & Williams, 2007; Solomon & Johnson, 2000). Rather, it is determined by assessing a host of other characteristics, including a belief that features are innate and immutable, that the category supports a wealth of novel inferences (also known as inductive potential), and that there are sharp boundaries between different kinds of entities. When these characteristics are measured, children have been shown to have essentialist beliefs about a range of natural kinds (animals, plants, natural substances) and social kinds (e.g., gender) by 4 or 5 years of age (Diesendruck, 2001; Gelman, 2003; Rhodes & Mandalaywala, 2017; Taylor et al., 2009).

Evidence for disability essentialism

With this in mind, essentialist perspectives on disability could include any or all of the following beliefs: that a disability is present at birth (*innateness*), that it cannot be changed (*immutability*), that it is passed down from parent to child but not via close contact (*inheritance*), that people with the same disability will share a host of other similarities as well (*inductive potential*), that a disability may be 'hidden' and invisible to others (*non-obvious basis*), that those with a disability are fundamentally different from those without a disability (*discreteness*), and that a disability is found in the brain, blood, DNA, chromosomes, or other internal bodily part (*biological basis*).

A tendency toward essentialist assumptions has been noted in research in Disabilities Studies (Goethals et al., 2015; Lesnik-Oberstein, 2015) and examined in psychological research with adults. For example, in a study assessing adults' essentialist beliefs about 40 different social categories, Haslam et al. (2000) found that the two disabilities that were included (blind, paraplegic) were relatively highly essentialized compared to other social categories. Similarly, Gelman, Heyman, and Legare (2007) assessed adults' essentialist beliefs regarding 12 social attributes, and found that the one disability that was included (schizophrenia) received overall the highest essentialist ratings (e.g., found in the brain, inborn, immutable, unaffected by the environment). Haslam and Ernst (2002) also found that learning one essentialist attribute for a mental disorder (e.g., that it was biologically based) led to essentialist inferences about other attributes as well (e.g., that it was immutable, inductively potent, or sharply bounded). Additionally, Peters, Menendez, and Rosengren (2020) found that describing a mental illness in essentialist terms led people to think that biological treatments, such as medications, would be more effective.

The evidence with children is less systematic, but suggestive that children hold essentialist views of at least some disabilities. When presented with different possible causes for a disability, 5- to 6-year-old children endorsed that the disability was inherited or present at birth for a wide array of conditions, including physical disabilities, blindness, and learning disabilities (Smith & Williams, 2004, 2005). By the age of 7, children judged several disabilities to be stable over time (from childhood to adulthood) and outside of a person’s intentional control (i.e., not something they could change if they wanted to; Smith & Williams, 2005). Children's judgments of the inheritance of disabilities have been shown to be very similar to their judgments of the inheritance of genetically determined features such as hair color (Williams, 2012; Williams & Smith, 2006). Furthermore, children of all ages also tended to treat disabilities as having inductive potential, by generalizing limitations from one disability to others (e.g., judging that blindness would be associated with cognitive limitations; Smith & Williams, 2001).

Gaps in the developmental literature

Although prior research provides important evidence, there are gaps in the developmental literature. We briefly discuss three of them here.

First, we are unaware of research that systematically examines the full range of components of disability essentialism in young children, to examine their developmental trajectory and relatedness to one another. As noted above, these components include innateness, immutability, inheritance, inductive potential, non-obvious basis, discreteness, and biological basis -- but the research has focused almost exclusively on innateness, inheritance, and immutability. As we discuss next, different components may have distinct implications for beliefs and attitudes, and thus are important to disentangle.

Second, we know little about how essentialist beliefs about disability are linked to other beliefs and attitudes. Some essentialist beliefs are theorized to lead to erroneous beliefs, bias, and stigma, whereas others may even increase insights, understanding, and empathy. Part of this puzzle might be related to people's attributions (Weiner et al., 1988). If a disability is seen as controllable and internal to the person (e.g., Haslam & Kvaale, 2015), then it might relate to more negative emotions such as blaming the disabled person for their own condition. At the same time, stable and uncontrollable disabilities might evoke pity (Weiner et al., 1988). Essentializing a disability might reduce the attribution of blame, but also an underappreciation for external factors that cause or relate to the disability, and in the extreme case the fatalistic assumption that a disability cannot be improved. Mapping out these implications for children is important as it might eventually lead to effecting real-world positive changes in lay perceptions of disability.

Essentialist beliefs in adults have been shown to have a number of negative consequences. For example, inborn disabilities are stigmatized more than acquired disabilities (Bogart et al., 2019). Belief in inductive potential can lead to people drawing a host of inferences about a person based on their identity as a disabled person. For example, Goethals et al. (2015, p. 75) reported that, "People with disabilities are frequently assumed to share the same views, experiences, and priorities, regardless of gender, age, cultural background, sexual orientation, socio-economic status, religion, and other categories of difference." Belief in discreteness may relate to treating a person with disabilities as "categorically distinct from the norm" (Hinshaw & Stier, 2008, p. 370), and as fundamentally different from non-disabled individuals (Haslam & Ernst, 2002). Treating a social group as different from one's own can relate to lowered empathy (e.g., Cikara et al., 2011). Treating a disability as having a genetic or biological basis can lead to inappropriately downplaying non-biological factors (Dar-Nimrod & Heine, 2011; Hinshaw & Stier, 2008). For example, when reasoning about mental disorders, clinicians viewed biological bases as inversely related to environmental and psychological bases (although logically this is not entailed), and viewed medication and psychotherapy as differentially effective depending on their cause (Ahn et al., 2009). Attributing mental disorders to genetic and neurobiological factors is also associated with less empathy (Angermeyer et al., 2011; Lebowitz & Ahn, 2014), higher perceptions of danger and desire for distance (Kvaale et al., 2013), and more stigma (Haslam, 2011). Finally, with any of these factors, errors may result from the misapplication of a biological model to a disorder to which it does not apply. This is especially relevant to young children, who sometimes struggle to differentiate different disabilities in terms of their causes and consequences, such as physical versus cognitive limitations (Smith & Williams, 2001, 2005). Finally, in an essentialist model, disabilities might become "master statuses" (i.e., the disability becomes the most salient identity of the person with a disability, in other people's minds), and thus might overshadow other identities that they share with non-disabled people (Goffman, 2009).

Essentialist beliefs may also have some positive consequences (Peretz-Lange, 2021), although these are less evident than the negative consequences spelled out above. For example, attributing disabilities to genetic and neurobiological factors is associated with less blame, as the disability is thought to be outside of the person's control (Bogart et al., 2019; Kvaale et al., 2013; Weiner et al., 1988). Likewise, viewing certain disabilities as having a non-obvious basis could increase understanding and lower blame, by undermining causal accounts that attribute symptoms to moral limitations (such as laziness or weakness of will, in the case of ADHD or depression).

A third gap in the literature is that we know little about which disorders are most likely to be essentialized by children. Prior research with adults has shown that people are more likely to essentialize categories that are viewed as rooted in the body, a belief known as embodiment (Berent & Platt, 2021a, 2021b). For example, adults are more likely to essentialize psychiatric disorders when they were linked to the body (e.g., assessed via a brain scan rather than a behavioral test; Berent & Platt, 2021a). Likewise, children might more readily use an essentialist model for conditions that are more clearly linked to the body, such as blindness or hearing loss, than for conditions that might be seen as less embodied, such as learning disabilities. Given that innateness is one component of essentialism, children might also be more likely to hold an essentialist model for disabilities that are present at birth than ones that emerge later in life. Prior work on essentialism has also shown that the more people essentialize a condition, the more effective they believe that interventions that affect the body will be (Peters et al., 2020). Therefore, children who hold an essentialist model might think that medical interventions that change the body (i.e., surgery or medications) would be more beneficial for people with disabilities than therapy, or changes to the environment.

Infectious disease models of disability

An infectious disease model of disabilities could include any or all of the following beliefs: that a disability is a departure from 'normal' human behavior or functioning (and thus stigmatized; Burris, 2002; Joachim & Acorn, 2000; Mehta & Farina, 1997), that it is problematic, that it requires (medical) intervention, and that it resides in the individual (Retief & Letšosa, 2018). It may also include the belief that a disability is communicable via contact with others. As sketched out in Table 1, this model differs from an essentialist model along multiple dimensions[1], including the source of the disability, beliefs in change, transmissibility, and how those are disabled are viewed relative to those who are not disabled. For example, by contrast, although an essentialist framework may also treat a disability as “not normal,” doing so is not inherent to the concept of essentialism, as a person can be essentialist about identities without

---

[1] Commonalities between essentialist and infectious disease models have been previously discussed in the literature (Gelman & Hirschfeld, 1999; Springer & Ruckel, 1992). Specifically, contagion and essence transmission are similar in that both assume that there are tiny or invisible entities inside of each person that are difficult to remove, that have large consequences, and that can be transferred from one person to another. In this respect, the cognitive foundations that underlie people's thinking about the two processes are hypothesized to be similar, At the same time, these two kinds of processes differ in several key ways. Most notably, the nature of the tiny or invisible entities are quite different (e.g., germs vs. genes), the consequences are different (see Table 1), and the mode of transfer is quite distinct (e.g., via sneezing on someone nearby vs. passing down to one's offspring via inheritance). These models might be supported by similar cognitive foundations, but because of their differences, we treat them as two distinct types of causal models that may nonetheless co-exist in the minds of children and adults.

pathologizing them (e.g., transgender; Deafness; neurodiversity are all identities that can be essentialized without being pathologized). However, there are also a few respects in which the two models overlap: Both posit that disability resides in the individual, and both place an emphasis on biological factors and treatments to the neglect of non-biological factors and treatments.

Evidence for viewing disability as an infectious disease

Prior research suggests several key respects in which disabilities may be construed with an infectious disease model. First, a rich literature on medical models of disability have characterized beliefs and practices consistent with the notion that disabilities are problematic, medicalized, and not normal (Marks, 1997). Second, individuals with disabilities often report being treated as if their conditions were contagious, even if this is not explicitly endorsed as true (Heumann, 2020; Nario-Redmond et al., 2019). Third, chronic illnesses and lingering consequences of infectious diseases are often considered to constitute a type of disability (Goering, 2015), thus linking disability and illness directly.

As with essentialism, children understand infectious disease at an early age. By the age of 5, children are fairly knowledgeable about infectious disease (Au & Romo, 1996; Kalish, 1996; Labotka & Gelman, 2023; Raman & Gelman, 2005; Siegal & Petersen, 1999). For example, they understand that illness can be spread via contact, that it has negative consequences, and that medicine can be curative (DeJesus et al., 2021; Kalish, 1996; Lockhart & Keil, 2018).

There are also several reasons to believe that children may at times have an infectious disease model of disability. Work with 5-year-old children shows that about 20% reported that disabilities are contagious (Dyson, 2005). When presented with different explanations for disabilities, 5- to 6-year-old children endorsed "germ" explanations (e.g., endorsing that disabilities are caused by bugs; Smith & Williams, 2004). There is also evidence that children at times overgeneralize a contagion model of illness to chronic and non-contagious illness (e.g., Bares & Gelman, 2008).

Gaps in the developmental literature

The gaps in the developmental literature regarding infectious disease models of disability are parallel to those regarding essentialist models of disability, discussed above.

First, we are unaware of research that systematically examines the full range of components of infectious disease models in young children, over development. Little is known regarding the scope of disabilities that children believe to be the domain of the medical community, or the extent to which the range of human variation is translated into a binary contrast between 'normal' and 'disabled'. The developmental trajectory of these beliefs is also largely unexplored. For example, although explicit endorsement of contagion as a cause of disability decreases with age (Smith & Williams, 2004), many adults tend to avoid making physical contact or being in proximity with people with disabilities, particularly when they have an excuse to avoid them (LoBue et al., 2022; Snyder et al., 2003; Thompson, 1982). People with disabilities often interpret these avoidances as reflecting a belief that disabilities are contagious (Heumann, 2020; Nario-Redmond et al., 2019), although it remains an open empirical question as to how often people actually have such concerns. It is unknown whether children may likewise implicitly interpret disabilities within a contagion model. Relatedly, we are unaware of research examining if children view different components of the infectious disease model as related to one another, and if so, how. For example, if children believe that a disability is treatable by doctors (as they might, for example, if their ADHD is treated by medication), do they also assume that this disability is not 'normal'?

Second, little is known about the implications of infectious disease models of disability for children's beliefs, behaviors, and attitudes. We speculate that there may be a range of negative consequences of viewing disabilities as pathological and in need of intervention (Bogart & Dunn, 2019; Olkin & Pledger, 2003). For example, the association of disability with infectious disease may relate to social avoidance and stigma (Oaten et al., 2011). As another example, positing that a disability is not 'normal' may be closely linked to viewing it as pathological, "bad", or a problem to be solved, and thus stigmatizing individuals with the disability (Retief & Letšosa, 2018).

Viewing difference as requiring 'fixing' by doctors or the medical community can relate to unnecessary or even harmful interventions, such as performing "corrective" surgery on intersex children (Feder, 2014), or treating atypical stature (either 'too tall' or 'too short') in healthy children as requiring medication or even surgery (Cohen & Cosgrove, 2009). This approach might be exacerbated by attributing the disability to something internal to the person. It is unknown whether children share this expectation that differences from the norm should be 'fixed' by doctors. For adults, a further consequence of reliance on an infectious disease model is that it locates disability in the individual, and thus may lead to downplaying the relevance of social context (Marks, 1997), and underappreciating psychological and structural factors. Children may be especially susceptible to this bias, as they appear to have difficulty understanding that psychological factors can play a role in physical illness (e.g., Notaro et al., 2001).

Third, although children may apply these models more broadly than adults, past research has not examined which disorders are most likely to be construed as infectious diseases by children. For example, although contagious illness can sometimes lead to disabilities, as in the case of polio or HIV, children seem at times to extend assumptions of contagion to conditions that adults would view as clearly non-contagious, such as leg injuries (LoBue et al., 2022). Further work is needed to examine this issue beyond contagion beliefs.

Another avenue for future research is investigating what leads some children to abandon an infectious disease model, as this might inform both theory (regarding conceptual change) and practice (e.g., the design of effective educational materials). Instruction about contagious illness could either challenge or reinforce the infectious disease model of disability. It is possible that children come to understand that disabilities are not contagious by learning more about germs and viruses. However, prior work in cognitive development and science education has shown that science instruction can sometimes reinforce (rather than challenge) intuitive models (Donovan, 2017; Legare et al., 2013).

Bodily damage models

The third model we discuss is a bodily damage model, where disability is seen as the result of damage to the body by external forces. These external forces may include injuries, accidents (such as falls or car crashes), exposure to toxins such as air pollution or lead, or other dangerous encounters. The damage caused by these external forces could be temporary, meaning that once the environment is changed or the person changes environments the disability changes or disappears. However, these external forces could also cause persistent or even immutable damage, as in the case of repeated exposure to loud noises causing permanent hearing loss. In contrast to the essentialist and infectious disease models, the bodily damage model attributes disabilities to external factors, outside of the person's control. Additionally, it views disability as potentially malleable.

Evidence for disability as damage to the body

In contrast to the other two models, which are rarely explicitly mentioned by children, accidents and bodily harm are common responses to the causes of disability (Diamond, 1993; Maas et al., 1978; Sigelman & Begley, 1987; Smith & Williams, 2005). This model might be supported by the fact that many physical disabilities are visible and salient due to equipment used by disabled people, such as walkers or hearing aids. This is evident in how preschool children often appeal to the fact that someone is using this type of equipment as a way they know they have a disability (Diamond & Hestenes, 1996). Relatedly, children may treat physical disabilities as localized to motor skills, but not affecting other areas such as cognitive or social skills (Diamond & Hestenes, 1996).

Children's understanding that accidents and injuries can lead to bodily damage can also be seen in domains outside of disability. For example, accidents that cause great damage to the body are common responses for what causes someone to die (Carey, 1985; Gutiérrez et al., 2020; Panagiotaki et al., 2018). This understanding of the effects of external forces might be supported by children's own experiences with injuries leading to temporary damages (Bijur et al., 1986; O'Neal & Plumert, 2014), and by conversation with caregivers about the consequences of environmental hazards or risky behaviors (O'Neal et al., 2016; O'Neal & Plumert, 2014, 2019). Additionally, children understand that toxins and poisons can damage the body (Kalish, 1999), although they have trouble distinguishing dangerous versus safe household products (Schwebel et al., 2015).

Although injuries are a typical explanation children provide to explain bodily damage, with age children place greater emphasis on external causes for behaviors (Maas et al., 1978), especially for behavioral problems (Sigelman & Begley, 1987). Furthermore, older children are also more likely with age to recognize the importance of the environment, and to recognize that changes to the environment might lead to changes in a disabled person’s behavior or condition (Maas et al., 1978). As such, the environmental focus of bodily harm models might encourage viewing disabilities as malleable.

Gaps in the developmental literature

There are several gaps on the literature on bodily harm models. First, although there is work on how children think that accidents can negatively affect the body, there is less work on how other sorts of environmental factors can cause damage. This literature is scant even for adults. Although it is reasonable to assume that adults know that exposure to certain substances, such as pollution, lead, or carcinogens, can have negative effects on their health, we do not know of any work that has systematically examined adults’ or children’s models on this topic. There is also little research examining whether thinking that a disability is the result of damage to the body could lead children to draw incorrect conclusions regarding the scope of the disability. On the one hand, children may incorrectly assume that a localized disability is more general, also known as "disability spread" (.g., treating someone in a wheelchair as if they are cognitively impaired; Houser, 1997; Liesener & Mills, 1999; Robey et al., 2006). On the other hand, and in the opposite direction, children may incorrectly assume that a general disability is localized. For example, children sometimes infer that a person is in a wheelchair because they were in an accident (Sigelman & Begley, 1987; Smith & Williams, 2001), and thus might assume that the person is only different in the motor domain. However, conditions like cerebral palsy can lead to cognitive impairments in addition to motor problems. This can also be the case with many toxins and environmental pollutant which can cause damage to bodily systems and also lead to cognitive, behavioral and social problems (Lanphear, 2015).

Second, bodily damage models can also have consequences for stigma. These models might relate to attributions of disabilities as external and uncontrollable (Weiner et al., 1988). Although this could reduce prejudice, it might also relate to feelings of pity (Weiner et al., 1988). Even seemingly sympathetic reactions to disability can reflect an underlying strain of viewing disability as "less than", as when those with disabilities are viewed as objects of pity, or are treated with anger if a disabled individual turns down offers of help -- responses known as "benevolent ableism" (Nario-Redmond et al., 2019). Additionally, a bodily damage model could also attribute the disability to internal controllable causes, where the disability is the result of damage to the body caused by the individual’s action(s) (e.g., the belief that a person got into a car accident because of their own reckless driving). We know of no work that has examined when children might start to think of injuries or accidents as the personal responsibility of the injured person, or what factors might guide children to this attribution. In these cases, the internal controllable attribution might not lead to pity, but rather anger or blame. We stress that alternative models are available, in which a disability is viewed instead as a difference that possesses its own positive values and strengths (e.g., idiosyncratic ways autistic individuals express social interest; Jaswal & Akhtar, 2019; the shared cultural community of Deafness; Jones, 2002; also called affimation models; Swain & French, 2000).

Third, although children often mention bodily harm as the cause for physical disabilities (Smith & Williams, 2005), more work is needed to study when and how children come to grasp the breadth of environmental causes, including pervasive and invisible sources of harm, such as lead exposure, polluted air, and other environmental toxins. Such causes may be relatively more difficult for children, as they do not involve a discrete event with immediate causal impacts. Moreover, not all environmental causes of disability are alike. For example, atypical or disordered behavior may result from social causes, including peers or parents (Maas et al., 1978). Although prior research highlights that children can grasp the importance of external causes, more work is needed to examine how they think of environmental effects on the body. It is also critical to examine the development of these ideas through childhood and into adulthood.

Reconciling the models: replacement vs. co-existence

Given the evidence for essentialist, infectious disease, and bodily damage models in reasoning about disability, an important question is whether and how these models relate to one another in children's reasoning. Many classic models of children's theories propose that earlier, developmentally prior models are replaced with more sophisticated models, in a process of conceptual change (Carey, 1985; Chi, 2008). For example, children at first seem to have an undifferentiated model of heat and temperature that undergoes radical restructuring over development, analogous to theory change in science (Carey, 1985). Likewise, it could be that younger children at first understand disability with a bodily damage model and over time replace it with an essentialist or infectious disease model -- or vice versa -- due to increasing knowledge and cognitive sophistication. However, the difficulty with a developmental replacement model in the case of disability is that there is evidence for all models throughout development, in both young children and adults, as revealed in the sections above.

We therefore believe that a reasonable starting assumption is that the three models co-exist throughout development. In other words, rather than an early model being outgrown and replaced, all three models appear to play a role in children's reasoning. But how do they do so, and how do they 'divide the spoils' in terms of when one or the other model is employed? We first consider three distinct ways that these models may co-exist, drawing on work on children’s explanatory co-existence (Legare et al., 2012; Shtulman & Harrington, 2016). Then, we turn to the question of the contexts or framing that might encourage one or the other of these models, including familial, cultural, linguistic, and interview settings.

What is the nature of co-existence?

Explanatory co-existence has been demonstrated in several important domains of thought. For example, children maintain both natural and supernatural frameworks to explain the origin of species, illness, and death (Legare et al., 2012). For adults, intuitive theories co-exist with scientific theories across a wide range of topics, ranging from astronomy to evolution to physiology and thermodynamics (Shtulman & Harrington, 2016; for other demonstrations of explanatory co-existence, see Gutiérrez et al., 2020; Kelemen et al., 2013; Labotka & Gelman, 2023; Legare & Gelman, 2008; Menendez et al., 2020; Rosengren & Gutiérrez, 2011; Shtulman, 2023; Shtulman & Calabi, 2013).

Work on explanatory co-existence suggests three possible ways that different causal models might co-exist in the minds of children. The first way is target-dependent thinking, where children choose between models depending on the target or context. This might be seen as children showing an essentialist model for certain disabilities, potentially those they know appear early in life, a bodily damage model for physical disabilities resulting from accidents, and an infectious disease model for disabilities resulting from disease. Additionally, children might decide between different models depending on the context, such that they might use one model if talking to a doctor, but a different one if talking to a family member. The second way is synthetic thinking, where children might mention several models without integrating them. A hypothetical example might be seen in a child believing that a person was disabled due to a car accident, but also believing that their disability would be passed along to their children, and that some features of their disability might be transmissible through close contact. The third way is integrative thinking, and it is arguably the rarest. Here, a child would combine several models into a single cohesive explanation. For adults, an example from illness understanding would be that a supernatural explanation provides a distal cause whereas a natural biological explanation provides a proximal cause (e.g., a person got AIDS because witchcraft put them in contact with someone who is HIV-positive; Legare & Gelman, 2008). We have not encountered reports of explanations of this sort in the domain of disability, but such explanations could appeal to the idea that certain people are genetically more susceptible to develop a disability (distal cause) after suffering from a serious disease (proximal cause). Although prior work has asked children about the causes of disabilities (Diamond, 1993; Lewis, 1993; Smith & Williams, 2004, 2005), the data have not been reported in a way that allows us to distinguish whether children are using more than one biological model and if so, when do they use them. This remains an important direction for future research.

What might encourage the use of different causal models?

If, as we propose, all three models are evident in children's reasoning about disability, an important future direction is when and why people use different causal models. For example, several studies show that children tend to be optimistic about a variety of outcomes (Lockhart et al., 2002, 2013), which might push them to choose models of disability that see conditions as malleable. On the other hand, children have also been shown to readily endorse essentialist accounts (Gelman, 2003; Rhodes & Moty, 2020), which might push them to choose models of disability that see conditions as immutable.

Additionally, future work might try to determine the contexts or framing that might encourage -- or counteract -- these models. The literature cited above regarding co-existence models of death provide some initial clues. For example, children are more likely to appeal to medical models of death when in a medical context (e.g., hearing a story where a character talks with a doctor) as opposed to a religious context (Harris, 2011; Harris & Giménez, 2005). Likewise, children are less likely to use a biological model when thinking about death in the context of a particular cultural ritual, such as *día de los muertos* (Gutiérrez et al., 2020; Menendez et al., 2020). Therefore, children might similarly use the context of where they are being asked about a disability to guide which model to use.

Another potentially important factor is that of language. There is extensive discussion in the literature regarding how subtle cues in language may convey important implicit messages about social categories, even to young children (Chestnut et al., 2021; Gelman & Roberts, 2017). Of particular interest in the context of disability is whether labels may increase stigma and encourage an essentialist perspective. For example, diagnostic labels have been associated with negative evaluations and essentialism (Franz et al., 2023; Gibbs et al., 2020). Moreover, the form of a diagnostic label may also have an effect. For example, labels (“a depressive”) may evoke more essentialism or stigma than descriptive or possessive phrases "a person with depression" (Cuttler & Ryckman, 2019; Gelman & Heyman, 1999; Reynaert & Gelman, 2007; but see Granata & Lane, 2023; Mallinson et al., 2022). It is also possible that referring to a disability as a disease (e.g., "mental illness") may encourage an illness or medical model. Additionally, generic statements (e.g., those about a category as a whole, such as "Zarpies love to eat flowers") have been shown to increase essentialist beliefs about the category they refer to, as compared to specific statements (e.g., "This Zarpie loves to eat flowers"; Benitez et al., 2022; Cimpian & Markman, 2011; Gelman et al., 2010; Rhodes et al., 2012; but see Vasilyeva & Lombrozo, 2020, for evidence that generics can also support structural reasoning). Thus, providing generic language about disabilities (e.g., generic claims about disability groups) may likewise encourage essentialist views of that disability. These are questions that remain for the future.

Some additional future directions

We have proposed that an informative approach to understanding disability is to consider the causal theories that children use. In this section, we first discuss some avenues for future work on children's biological reasoning about disability. Second, we propose some potential socio-cultural mechanisms for how children might learn these theories. Finally, we acknowledge that children's biological models of disability can only be fully understood within the context of other models that were outside the scope of the present paper, including non-biological models that take into account structural forces.

Biological reasoning about disability

For each of the models we proposed, we identified potential fruitful avenues for future research, but there are also some directions that span across the three models. One of these directions is whether the theories we have proposed (e.g., essentialism, contagious disease) may be too broad, and would benefit from a more in-depth analysis. More specifically, a dimensional approach might provide additional insights. A dimensional approach would examine which dimensions of disabilities (potentially similar to rows in Table 1) children endorse, without assuming that these dimensions cohere. A dimensional approach has been tested for children's essentialist beliefs, and has found that children younger than 9 show little cohesion among the different dimensions of essentialism, but older children and adults show more cohesion (Gelman et al., 2007; Rhodes & Mandalaywala, 2017). We do not know of any work that has examined cohesion among children's reasoning about disability.

Another possible future direction is to examine the directionality of the relation between children’s models of disability and their attitudes. It is possible that, as we suggest in prior sections, these causal models lead to different attitudes toward people with disabilities. However, the inverse relation is also possible, where negative attitudes make it more likely for people to adopt a particular model (Haidt, 2001). A third possibility is that more complex relations between children’s reasoning and attitudes unfold over development. Future longitudinal work examining the development of children’s models of disability and attitudes toward people with disabilities, would help elucidate the nature of this relation.

Finally, a potential future direction is to examine how people think internal and external factors may combine. Although there has been work on how children and adults consider different causes for human characteristics (Jayaratne et al., 2009; Meyer et al., 2020), most prior work has considered only one causal factor at a time. Even when limiting to biological causal factors, gene-environment interactions can influence a variety of human characteristics, yet little work has examined how people think about these interactions. Moreover, university students have a limited understanding of how internal and external factors may jointly cause a trait, even when they understand that these interactions are possible (Haskel-Ittah et al., 2020). To our knowledge, this question has not yet received systematic study with children nor in the context of disabilities.

Children's lived experiences

In recent years, the study of children's naive theories has demonstrated that children's causal theories are not monolithic, but rather are embedded within children's lived experiences and their cultural contexts (e.g., Menendez et al., 2020; Rogoff et al., 2018). Here we briefly note some ways in which these factors could enrich our understanding of how children reason about biological models of disability.

As the field of child development places more emphasis on children’s lived experiences (Rogoff et al., 2018), a pressing question is how children with disabilities think about their own and other disabilities (Emery et al., 2022). Other sources of individual variability on children’s beliefs about disability could be contact or interactions with people with disabilities (Friedman & Owen, 2017). Studies of how contact with individuals with disability shapes children’s beliefs have shown either no effects (Huckstadt & Shutts, 2014), or that more interactions with people with disabilities are associated with more positive attitudes (Favazza & Odom, 1997). Future work should examine how children’s own experience with a disability, or interactions with friends, peers, or family members with disabilities, influence their conceptual understandings of disability. However, doing this work will necessitate engagement with the disability community and collaboration with Disability Studies scholars and researchers with disabilities, in order to avoid repeating many instances of ableism in psychology's history (Emery et al., 2022). This will require psychology as a field to place greater value on community work and to improve the view of self-relevant research by acknowledging the strengths of researchers’ own lived experiences (Devendorf et al., 2023; Victor et al., 2022).

Cultural messages

Prior work outside the topic of disability has found that children's understanding of essentialism, infectious disease, and bodily damage are highly sensitive to cultural input. For example, caregivers transmit both theory-relevant messages to children in ordinary conversations (essentialism: Gelman et al., 2004; Rhodes et al., 2012; infectious disease: Hernandez et al., 2020; bodily harm: O’Neal et al., 2016; O’Neal & Plumert, 2014). Yet relatively little is known about the nature of cultural input to children about disability. We believe this is an important goal for future research. Note that we are not suggesting that children passively take in whatever they told. Rather, reflecting a 'theory theory' approach to development (e.g., Wellman & Gelman, 1998), we presume that children must have an interpretive framework for sorting through and assimilating the information they receive.

Currently, little is known about how caregivers talk with their children about disability, and if they do, what messages or information these conversations typically transmit. Future work could survey caregivers about the presence and frequency of these conversations, and analyze naturalistic child-caregiver conversations about disability to examine the messages that are conveyed. Additionally, researchers could probe conversations about different disabilities, and examine how they relate to children's differentiated models (Jipson & Callanan, 2003). Children might also learn about disabilities by observing how other people (such as caregivers, siblings, and peers) interact with people with disabilities. Infants and young children have been shown to make social inferences based on how their caregivers interact with other people (Thomas et al., 2022). Therefore, observing interactions with people with disabilities might implicitly teach children how to interact with people with disabilities. However, this needs to be empirically tested.

Another potential socialization venue for children might be children’s media, such as books, movies, and videos. Prior work has shown that children’s television shows and movies rarely have characters with disabilities (Bond, 2013; Holcomb & Latham-Mintus, 2022; Matthew & Clow, 2007). A few studies have examined how portrayals of disability influence children’s attitudes toward people with disabilities. These studies generally show that positive portrayals of disabilities are related to positive attitudes after children watch them (Diamond & Kensinger, 2002; Favazza et al., 2000). Future work should probe in more depth how portrayals of disability in children's media might influence children's biological models of disability. Furthermore, future work should examine how children's media might serve as a socialization venue by sparking child-caregiver conversations about disability.

Formal schooling might play a significant role in the development of children's models about disability for three reasons. First, formal schooling is a setting where children who do not have lived or familial experiences with disability interact with children with disabilities (Huckstadt & Shutts, 2014). As discussed previously, these interactions could potentially influence children's models of disability (Favazza & Odom, 1997; Huckstadt & Shutts, 2014). Second, children learn biological information in school. Given that all the models we discussed here are biological in nature, biology instruction could reinforce or challenge these models. Prior work has suggested that traditional biology curricula in the United States reinforce essentialist beliefs (Donovan, 2017), but that changes to genetics curricula can challenge these beliefs (Donovan et al., 2021). Thus, future work should examine how exposure to formal biology instruction might influence children's models of disability. Although infectious disease (and illness more broadly) is not part of the science curriculum in the United States (NGSS Lead States, 2013), teachers often discuss this issue with their students, conveying important scientific information in the process (Ünlütabak et al., 2022). An open question is whether such instruction would reinforce or challenge infectious disease models of disability. Finally, teachers could be important socializations agents for children's models of disability. Teachers report talking about disability with their students, particularly in the context of students' learning or when sparked by the curricula or conversations with the students about biology or health (Hansen et al., 2023).

More work is needed to understand the nature of these conversations and how they might shape children’s beliefs.

By examining the nature of the cultural messages that children receive as well as how they make use of it, such work would have implications not only for children's causal reasoning about disability, but also for effective public health messaging, and informing parents and teachers (who may also fall prey to some of the misconceptions seen in children).

Beyond biology

In this paper we have focused on biological models of disability, but we would be remiss not to mention that understanding disabilities goes beyond understanding the biological foundations into understanding the structural factors that marginalize individuals with disabilities. Indeed, a key question within the biological models is whether biological models suppress attention to larger forces beyond the individual. As such, we encourage future work to examine how children think about the structural facets of disability, given that children are capable of thinking structurally about social categories from a young age (Peretz-Lange et al., 2021; Rizzo & Killen, 2020; Vasilyeva et al., 2018; Vasilyeva & Lombrozo, 2020). We are unaware of work that has examined children’s structural reasoning in the domain of disability or how this reasoning might intersect with their biological causal models.

Conclusion

From an early age, children hold three biological causal models of disabilities: an essentialist causal model, an infectious disease causal model, and a bodily damage causal model. These models are supported by children’s early understandings of psychological essentialism, contagious illness, and injuries--all causal frameworks that have been observed in other domains. These models are early emerging, are related to stigma, and might relate to an underappreciation of the influence of non-biological factors (with the possible exception of the bodily damage model). Critically, these models provide competing predictions for how children will think about the source and ontology of a disability, as well as its malleability, informativeness, and transmissibility. Further, we argue that children likely hold all three models simultaneously, and might use contextual cues to decide when to use each. Understanding how children think about the biological basis of disabilities, and how they acquire these beliefs are central questions for the future, as their answers can advance our understanding of children's conceptual development, and can inform public messaging to children and caregivers.

References

Ahn, W., Proctor, C. C., & Flanagan, E. H. (2009). Mental health clinicians' beliefs about the biological, psychological, and environmental bases of mental disorders. *Cognitive Science*, *33*(2), 147–182. https://doi.org/10.1111/j.1551-6709.2009.01008.x

Angermeyer, M. C., Holzinger, A., Carta, M. G., & Schomerus, G. (2011). Biogenetic explanations and public acceptance of mental illness: Systematic review of population studies. *British Journal of Psychiatry*, *199*(5), 367–372. https://doi.org/10.1192/bjp.bp.110.085563

Anggoro, F. K., & Jee, B. D. (2021). The substance of cold: Indonesians' use of cold weather theory to explain everyday illnesses. *Frontiers in Psychology*, *12*, 734044. https://doi.org/10.3389/fpsyg.2021.734044

Au, T. K., & Romo, L. F. (1996). Building a coherent conception of HIV transmission. In D. L. Medin (Ed.), *Psychology of learning and motivation: Advances in research and theory* (Vol. 35, pp. 193–241). Academic Press. https://doi.org/10.1016/S0079-7421(08)60576-9

Baillargeon, R. (1994). How do infants learn about the physical world? *Current Directions in Psychological Science*, *3*(5), 133–140. https://doi.org/10.1111/1467-8721.ep10770614

Bares, C. B., & Gelman, S. A. (2008). Knowledge of illness during childhood: Making distinctions between cancer and colds. *International Journal of Behavioral Development*, *32*(5), 443–450. https://doi.org/10.1177/0165025408093663

Benitez, J., Leshin, R. A., & Rhodes, M. (2022). The influence of linguistic form and causal explanations on the development of social essentialism. *Cognition*, *229*, 105246. https://doi.org/10.1016/j.cognition.2022.105246

Berent, I., & Platt, M. (2021a). Essentialist biases toward psychiatric disorders: Brain disorders are presumed innate. *Cognitive Science*, *45*(4), e12970. https://doi.org/10.1111/cogs.12970

Berent, I., & Platt, M. (2021b). Public misconceptions about dyslexia: The role of intuitive psychology. *PLOS ONE*, *16*(12), e0259019. https://doi.org/10.1371/journal.pone.0259019

Bijur, P. E., Stewart-Brown, S., & Butler, N. (1986). Child behavior and accidental injury in 11,966 preschool children. *American Journal of Diseases of Children*, *140*(5), 487–492. https://doi.org/10.1001/archpedi.1986.02140190097036

Bogart, K. R., & Dunn, D. S. (2019). Ableism special issue introduction. *Journal of Social Issues*, *75*(3), 650–664. https://doi.org/10.1111/josi.12354

Bogart, K. R., Rosa, N. M., & Slepian, M. L. (2019). Born that way or became that way: Stigma toward congenital versus acquired disability. *Group Processes & Intergroup Relations*, *22*(4), 594–612. https://doi.org/10.1177/1368430218757897

Bond, B. J. (2013). Physical disability on children's television programming: A content analysis. *Early Education & Development*, *24*(3), 408–418. https://doi.org/10.1080/10409289.2012.670871

Burris, S. (2002). Disease Stigma in U.S. Public Health Law. *The Journal of Law, Medicine & Ethics*, *30*(2), 179–190. https://doi.org/10.1111/j.1748-720X.2002.tb00385.x

Carey, S. (1985). *Conceptual change in childhood*. MIT Press.

Chestnut, E. K., Zhang, M. Y., & Markman, E. M. (2021). "Just as good": Learning gender stereotypes from attempts to counteract them. *Developmental Psychology*, *57*(1), 114–125. https://doi.org/10.1037/dev0001143

Cheung, B. Y., Dar-Nimrod, I., & Gonsalkorale, K. (2014). Am I my genes? Perceived genetic etiology, intrapersonal processes, and health. *Social and Personality Psychology Compass*, *8*(11), 626–637. https://doi.org/10.1111/spc3.12138

Chi, M. T. H. (2008). Three types of conceptual change: Belief revision, mental model transformation, and categorical shift. In S. Vosniadou (Ed.), *Handbook of research on conceptual change* (pp. 61–82). Erlbaum.

Cikara, M., Bruneau, E. G., & Saxe, R. R. (2011). Us and them: Intergroup failures of empathy. *Current Directions in Psychological Science*, *20*(3), 149–153. https://doi.org/10.1177/0963721411408713

Cimpian, A., & Markman, E. M. (2011). The generic/nongeneric distinction influences how children interpret new information about social others. *Child Development*, *82*(2), 471–492. https://doi.org/10.1111/j.1467-8624.2010.01525.x

Cohen, S., & Cosgrove, C. (2009). *Normal at Any Cost: Tall Girls, Short Boys, and the Medical Industry's Quest to Manipulate Height*. Penguin.

Cuttler, C., & Ryckman, M. (2019). Don't call me delusional: Stigmatizing effects of noun labels on people with mental disorders. *Stigma and Health*, *4*(2), 118–125. https://doi.org/10.1037/sah0000132

Dar-Nimrod, I., & Heine, S. J. (2011). Some thoughts on essence placeholders, interactionism, and heritability: Reply to Haslam (2011) and Turkheimer (2011). *Psychological Bulletin*, *137*(5), 829–833. https://doi.org/10.1037/a0024678

DeJesus, J. M., Venkatesh, S., & Kinzler, K. D. (2021). Young children's ability to make predictions about novel illnesses. *Child Development*, *92*(5), e817–e831. https://doi.org/10.1111/cdev.13655

Devendorf, A. R., Victor, S. E., Rottenberg, J., Miller, R., Lewis, S. P., Muehlenkamp, J. J., & Stage, D. L. (2023). Stigmatizing our own: Self-relevant research (me-search) is common but frowned upon in clinical psychological science. *Clinical Psychological Science*, 21677026221141655. https://doi.org/10.1177/21677026221141655

Diamond, K. E. (1993). Preschool children's concepts of disability in their peers. *Early Education and Development*, *4*(2), 123–129. https://doi.org/10.1207/s15566935eed0402_4

Diamond, K. E., & Hestenes, L. L. (1996). Preschool children's conceptions of disabilities: The salience of disability in children's ideas about others. *Topics in Early Childhood Special Education*, *16*(4), 458–475. https://doi.org/10.1177/027112149601600406

Diamond, K. E., & Kensinger, K. R. (2002). Vignettes from Sesame Street: Preschooler's ideas about children with down syndrome and physical disability. *Early Education & Development*, *13*(4), 409–422. https://doi.org/10.1207/s15566935eed1304_5

Diesendruck, G. (2001). Essentialism in Brazilian children's extensions of animal names. *Developmental Psychology*, *37*(1), 49–60. https://doi.org/10.I037//0012-I649.37.1.49

diSessa, A. A. (1988). Knowledge in pieces. In G. Forman & P. Pufall (Eds.), *Constructivism in the Computer Age* (pp. 49–70). Lawrence Erlbaum.

Donovan, B. M. (2017). Learned inequality: Racial labels in the biology curriculum can affect the development of racial prejudice. *Journal of Research in Science Teaching*, *54*(3), 379–411. https://doi.org/10.1002/tea.21370

Donovan, B. M., Weindling, M., Salazar, B., Duncan, A., Stuhlsatz, M., & Keck, P. (2021). Genomics literacy matters: Supporting the development of genomics literacy through genetics education could reduce the prevalence of genetic essentialism. *Journal of Research in Science Teaching*, *58*(4), 520–550. https://doi.org/10.1002/tea.21670

Dyson, L. L. (2005). Kindergarten children's understanding of and attitudes toward people with disabilities. *Topics in Early Childhood Special Education*, *25*(2), 95–105. https://doi.org/10.1177/02711214050250020601

Emery, A., Louick, R. A., & Sabrowsky, J. (2022). Moving beyond the ableist roots of educational psychology: Audit of the field and a path forward. *Educational Psychology Review*, *34*(3), 1517–1540. https://doi.org/10.1007/s10648-022-09673-6

Favazza, P. C., La Roe, J., Phillipsen, L., & Kumar, P. (2000). Representing young children with disabilities in classroom environments. *Young Exceptional Children*, *3*(3), 2–8. https://doi.org/10.1177/109625060000300301

Favazza, P. C., & Odom, S. L. (1997). Promoting positive attitudes of kindergarten-age children toward people with disabilities. *Exceptional Children*, *63*(3), 405–418. https://doi.org/10.1177/001440299706300308

Feder, E. K. (2014). *Making Sense of Intersex: Changing Ethical Perspectives in Biomedicine*. Indiana University Press.

Franz, D. J., Richter, T., Lenhard, W., Marx, P., Stein, R., & Ratz, C. (2023). The influence of diagnostic labels on the evaluation of students: A multilevel meta-analysis. *Educational Psychology Review*, *35*(1), 17. https://doi.org/10.1007/s10648-023-09716-6

Friedman, C., & Owen, A. L. (2017). Defining disability: Understandings of and attitudes towards ableism and disability. *Disability Studies Quarterly*, *37*(1), Article 1. https://doi.org/10.18061/dsq.v37i1.5061

Gelman, S. A. (2003). *The essential child: Origins of essentialism in everyday thought*. Oxford University Press.

Gelman, S. A. (2004). Psychological essentialism in children. *Trends in Cognitive Sciences*, *8*(9), 404–409. https://doi.org/10.1016/j.tics.2004.07.001

Gelman, S. A., & Heyman, G. D. (1999). Carrot-eaters and creature-believers: The effects of lexicalization on children's inferences about social categories. *Psychological Science*, *10*(6), 489–493. https://doi.org/10.1111/1467-9280.00194

Gelman, S. A., Heyman, G. D., & Legare, C. H. (2007). Developmental changes in the coherence of essentialist beliefs about psychological characteristics. *Child Development*, *78*(3), 757–774. https://doi.org/10.1111/j.1467-8624.2007.01031.x

Gelman, S. A., & Hirschfeld, L. A. (1999). How biological is essentialism? In D. L. Medin & S. Atran (Eds.), *Folkbiology* (pp. 403–446). The MIT Press.

Gelman, S. A., & Roberts, S. O. (2017). How language shapes the cultural inheritance of categories. *Proceedings of the National Academy of Sciences*, *114*(30), 7900–7907. https://doi.org/10.1073/pnas.1621073114

Gelman, S. A., Taylor, M. G., Nguyen, S. P., Leaper, C., & Bigler, R. S. (2004). Mother-child conversations about gender: Understanding the acquisition of essentialist beliefs. *Monographs of the Society for Research in Child Development*, *69*(1), i–142.

Gelman, S. A., Ware, E. A., & Kleinberg, F. (2010). Effects of generic language on category content and structure. *Cognitive Psychology*, *61*(3), 273–301. https://doi.org/10.1016/j.cogpsych.2010.06.001

Gelman, S. A., & Wellman, H. M. (1991). Insides and essences: Early understanding of the non-obvious. *Cognition*, *38*, 213–244.

Gibbs, S., Beckmann, J. F., Elliott, J., Metsäpelto, R.-L., Vehkakoski, T., & Aro, M. (2020). What's in a name: The effect of category labels on teachers' beliefs. *European Journal of Special Needs Education*, *35*(1), 115–127. https://doi.org/10.1080/08856257.2019.1652441

Goering, S. (2015). Rethinking disability: The social model of disability and chronic disease. *Current Reviews in Musculoskeletal Medicine*, *8*(2), 134–138. https://doi.org/10.1007/s12178-015-9273-z

Goethals, T., Schauwer, E. D., & Hove, G. V. (2015). Weaving intersectionality into disability studies research: Inclusion, reflexivity and anti-essentialism. *DiGeSt. Journal of Diversity and Gender Studies*, *2*(1–2), 75–94. https://doi.org/10.11116/jdivegendstud.2.1-2.0075

Goffman, E. (2009). *Stigma: Notes on the Management of Spoiled Identity*. Simon and Schuster.

Gopnik, A., & Wellman, H. M. (1992). Why the child's theory of mind really is a theory. *Mind & Language*, *7*(1–2), 145–171. https://doi.org/10.1111/j.1468-0017.1992.tb00202.x

Gopnik, A., & Wellman, H. M. (2012). Reconstructing constructivism: Causal models, Bayesian learning mechanisms, and the theory theory. *Psychological Bulletin*, *138*(6), 1085–1108. https://doi.org/10.1037/a0028044

Granata, N., & Lane, J. D. (2023). Investigating the efficacy of prescribed labeling practices: Conceptualizing persons with disabilities. *Group Processes & Intergroup Relations*, 13684302231157990. https://doi.org/10.1177/13684302231157990

Gutiérrez, I. T., Menendez, D., Jiang, M. J., Hernandez, I. G., Miller, P., & Rosengren, K. S. (2020). Embracing death: Mexican parent and child perspectives on death. *Child Development*, *91*(2). https://doi.org/10.1111/cdev.13263

Haidt, J. (2001). The emotional dog and its rational tail: A social intuitionist approach to moral judgment. *Psychological Review*, *108*(4), 814–834. https://doi.org/10.1037/0033-295X.108.4.814

Hansen, N., Kan, I. P., Bialka, C. S., & Lundell, A. (2023). Are teachers talking about disability?: An investigation of factors associated with discussion in pk-12 classrooms. *International Journal of Disability, Development and Education*, 1–17. https://doi.org/10.1080/1034912X.2023.2211017

Harris, P. L. (2011). Conflicting thoughts about death. *Human Development*, *54*(3), 160–168. https://doi.org/10.1159/000329133

Harris, P. L., & Giménez, M. (2005). Children's acceptance of conflicting testimony: The case of death. *Journal of Cognition and Culture*, *5*(1), 143–164. https://doi.org/10.1163/1568537054068606

Haskel-Ittah, M., Duncan, R. G., & Yarden, A. (2020). Students' understanding of the dynamic nature of genetics: Characterizing undergraduates' explanations for interaction between genetics and environment. *CBE—Life Sciences Education*, *19*(3), ar37. https://doi.org/10.1187/cbe.19-11-0221

Haslam, N. (2011). Genetic essentialism, neuroessentialism, and stigma: Commentary on Dar-Nimrod and Heine (2011). *Psychological Bulletin*, *137*(5), 819–824. https://doi.org/10.1037/a0022386

Haslam, N., & Ernst, D. (2002). Essentialist beliefs about mental disorders. *Journal of Social and Clinical Psychology*, *21*(6), 628–644. https://doi.org/10.1521/jscp.21.6.628.22793

Haslam, N., & Kvaale, E. P. (2015). Biogenetic explanations of mental disorder: The mixed-blessings model. *Current Directions in Psychological Science*, *24*(5), 399–404. https://doi.org/10.1177/0963721415588082

Haslam, N., Rothschild, L., & Ernst, D. (2000). Essentialist beliefs about social categories. *British Journal of Social Psychology*, *39*(1), 113–127. https://doi.org/10.1348/014466600164363

Hatano, G., & Inagaki, K. (1994). Young children's naive theory of biology. *Cognition*, *50*(1), 171–188. https://doi.org/10.1016/0010-0277(94)90027-2

Hernandez, I. G., Menendez, D., Seitz, V., Pinto-Pro, I., Zeitler, M. H., & Rosengren, K. S. (2020). Parent-child conversations of germ and cold weather theories of the common cold in two cultures. *PsyArXiv*. https://doi.org/10.31234/osf.io/7j8pb

Heumann, J. (2020). *Being Heumann: An unrepentant memoir of a disability rights activist*. Beacon Press.

Hinshaw, S. P., & Stier, A. (2008). Stigma as related to mental disorders. *Annual Review of Clinical Psychology*, *4*(1), 367–393. https://doi.org/10.1146/annurev.clinpsy.4.022007.141245

Holcomb, J., & Latham-Mintus, K. (2022). Disney and disability: Media representations of disability in disney and pixar animated films. *Disability Studies Quarterly*, *42*(1), Article 1. https://doi.org/10.18061/dsq.v42i1.7054

Houser, J. A. (1997). Stigma, spread and status: The impact of physical disability on social interaction [Ph.D., The University of Iowa]. In *ProQuest Dissertations and Theses*. https://www.proquest.com/docview/304344028/abstract/68DCEA87CCEA4EC3PQ/1

Huckstadt, L. K., & Shutts, K. (2014). How young children evaluate people with and without disabilities. *Journal of Social Issues*, *70*(1), 99–114. https://doi.org/10.1111/josi.12049

Jaswal, V. K., & Akhtar, N. (2019). Being versus appearing socially uninterested: Challenging assumptions about social motivation in autism. *Behavioral and Brain Sciences*, *42*, e82. https://doi.org/10.1017/S0140525X18001826

Jayaratne, T. E., Gelman, S. A., Feldbaum, M., Sheldon, J. P., Petty, E. M., & Kardia, S. L. R. (2009). The perennial debate: Nature, nurture, or choice? Black and white Americans' explanations for individual differences. *Review of General Psychology*, *13*(1), 24–33. https://doi.org/10.1037/a0014227

Jipson, J. L., & Callanan, M. A. (2003). Mother–child conversation and children's understanding of biological and nonbiological changes in size. *Child Development*, *74*(2), 629–644. https://doi.org/10.1111/1467-8624.7402020

Joachim, G. L., & Acorn, S. (2000). Living with Chronic Illness: The Interface of Stigma and Normalization. *Canadian Journal of Nursing Research Archive*. https://cjnr.archive.mcgill.ca/article/view/1589

Jones, M. (2002). Deafness as culture: A psychosocial perspective. *Disability Studies Quarterly*, *22*(2), Article 2. https://doi.org/10.18061/dsq.v22i2.344

Kalish, C. W. (1996). Causes and symptoms in preschoolers' conceptions of illness. *Child Development*, *67*, 1647–1670.

Kalish, C. W. (1999). What young children's understanding of contamination and contagion tells us about their concepts of illness. In C. C. Peterson & M. Siegal (Eds.), *Children's Understanding of Biology and Health* (pp. 99–130). Cambridge University Press. https://doi.org/10.1017/CBO9780511659881.006

Kelemen, D., Rottman, J., & Seston, R. (2013). Professional physical scientists display tenacious teleological tendencies: Purpose-based reasoning as a cognitive default. *Journal of Experimental Psychology: General*, *142*(4), 1074–1083. https://doi.org/10.1037/a0030399

Kvaale, E. P., Gottdiener, W. H., & Haslam, N. (2013). Biogenetic explanations and stigma: A meta-analytic review of associations among laypeople. *Social Science & Medicine*, *96*, 95–103. https://doi.org/10.1016/j.socscimed.2013.07.017

Labotka, D., & Gelman, S. A. (2023). "It kinda has like a mind": Children's and parents' beliefs concerning viral disease transmission for COVID-19 and the common cold. *Cognition*, *235*, 105413. https://doi.org/10.1016/j.cognition.2023.105413

Lanphear, B. P. (2015). The impact of toxins on the developing brain. *Annual Review of Public Health*, *36*(1), 211–230. https://doi.org/10.1146/annurev-publhealth-031912-114413

Lebowitz, M. S., & Ahn, W. (2014). Effects of biological explanations for mental disorders on clinicians' empathy. *Proceedings of the National Academy of Sciences*, *111*(50), 17786–17790. https://doi.org/10.1073/pnas.1414058111

Legare, C. H., Evans, E. M., Rosengren, K. S., & Harris, P. L. (2012). The coexistence of natural and supernatural explanations across cultures and development. *Child Development*, *83*(3), 779–793. https://doi.org/10.1111/j.1467-8624.2012.01743.x

Legare, C. H., & Gelman, S. A. (2008). Bewitchment, biology, or both: The co-existence of natural and supernatural explanatory frameworks across development. *Cognitive Science*, *32*(4), 607–642. https://doi.org/10.1080/03640210802066766

Legare, C. H., Lane, J. D., & Evans, E. M. (2013). Anthropomorphizing science: How does it affect the development of evolutionary concepts? *Merrill-Palmer Quarterly*, *59*(1), 168–197.

Lesnik-Oberstein, K. (2015). *Rethinking Disability Theory and Practice: Challenging Essentialism*. Springer.

Lewis, A. (1993). Primary school children's understanding of severe learning difficulties. *Educational Psychology*, *13*(2), 133–145. https://doi.org/10.1080/0144341930130204

Liesener, J. J., & Mills, J. (1999). An Experimental Study of Disability Spread: Talking to an Adult in a Wheelchair Like a Child1. *Journal of Applied Social Psychology*, *29*(10), 2083–2092. https://doi.org/10.1111/j.1559-1816.1999.tb02296.x

LoBue, V., Bonawitz, E., Leotti, L., & Fefferman, N. (2023). How children develop healthy behavioral choices to promote illness prevention. *Current Directions in Psychological Science*, 09637214221141847. https://doi.org/10.1177/09637214221141847

LoBue, V., Kim, E., Marrone, L., Blacker, K.-A., & Walle, G. V. de. (2022). Behavioral avoidance of contagious and non-contagious adults. *PLOS ONE*, *17*(8), e0272726. https://doi.org/10.1371/journal.pone.0272726

Lockhart, K. L., Chang, B., & Story, T. (2002). Young children's beliefs about the stability of traits: Protective optimism? *Child Development*, *73*(5), 1408–1430. https://doi.org/10.1111/1467-8624.00480

Lockhart, K. L., & Keil, F. C. (2018). What heals and why? Children's understanding of medical treatments. *Monographs of the Society for Research in Child Development*, *83*(2), 1–174. https://doi.org/10.1111/mono.12345

Lockhart, K. L., Keil, F. C., & Aw, J. (2013). A bias for the natural? Children's beliefs about traits acquired through effort, bribes, or medicine. *Developmental Psychology*, *49*(9), 1669–1682. https://doi.org/10.1037/a0030769

Maas, E., Marecek, J., & Travers, J. R. (1978). Children's conceptions of disordered behavior. *Child Development*, *49*(1), 146–154. https://doi.org/10.2307/1128603

Mallinson, M. G., Giannakopoulou, A., & Clements, A. J. (2022). The impact of linguistic form of labels on desire for social distance in mental health. *International Journal of Mental Health and Addiction*. https://doi.org/10.1007/s11469-022-00967-y

Marks, D. (1997). Models of disability. *Disability and Rehabilitation*, *19*(3), 85–91. https://doi.org/10.3109/09638289709166831

Matthew, N., & Clow, S. (2007). Putting disabled children in the picture: Promoting inclusive children's books and media. *International Journal of Early Childhood*, *39*(2), 65. https://doi.org/10.1007/BF03178225

McIntosh, J. (2009). *The Edge of Islam: Power, Personhood, and Ethnoreligious Boundaries on the Kenya Coast*. Duke University Press.

Medin, D., & Ortony, A. (1989). Psychological essentialism. In S. Vosniadou & A. Ortony (Eds.), *Similarity and analogical reasoning*. Cambridge University Press.

Mehta, S., & Farina, A. (1997). Is Being "Sick" Really Better? Effect of the Disease View of Mental Disorder on Stigma. *Journal of Social and Clinical Psychology*, *16*(4), 405–419.

Menendez, D., Hernandez, I. G., & Rosengren, K. S. (2020). Children's emerging understanding of death. *Child Development Perspectives*, *14*(1), 55–60. https://doi.org/10.1111/cdep.12357

Meyer, M., Roberts, S. O., Jayaratne, T. E., & Gelman, S. A. (2020). Children's beliefs about causes of human characteristics: Genes, environment, or choice? *Journal of Experimental Psychology: General*. https://doi.org/10.1037/xge0000751

Nario-Redmond, M. R., Kemerling, A. A., & Silverman, A. (2019). Hostile, benevolent, and ambivalent ableism: Contemporary manifestations. *Journal of Social Issues*, *75*(3), 726–756. https://doi.org/10.1111/josi.12337

NGSS Lead States. (2013). *Next Generation Science Standards: For States, By States*. https://doi.org/10.17226/18290

Notaro, P. C., Gelman, S. A., & Zimmerman, M. A. (2001). Children's understanding of psychogenic bodily reactions. *Child Development*, *72*(2), 444–459. https://doi.org/10.1111/1467-8624.00289

Oaten, M., Stevenson, R. J., & Case, T. I. (2011). Disease avoidance as a functional basis for stigmatization. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *366*(1583), 3433–3452. https://doi.org/10.1098/rstb.2011.0095

Olkin, R., & Pledger, C. (2003). Can disability studies and psychology join hands? *American Psychologist*, *58*(4), 296–304. https://doi.org/10.1037/0003-066X.58.4.296

O'Neal, E. E., & Plumert, J. M. (2014). Mother–child conversations about safety: Implications for socializing safety values in children. *Journal of Pediatric Psychology*, *39*(4), 481–491. https://doi.org/10.1093/jpepsy/jsu005

O'Neal, E. E., & Plumert, J. M. (2019). Do mother-child conversations about safety differ in middle- and low-income families? *Journal of Injury and Violence Research*, *11*(2), 171–178. https://doi.org/10.5249/jivr.v11i2.1093

O’Neal, E. E., Plumert, J. M., & Peterson, C. (2016). Parent–child injury prevention conversations following a trip to the emergency department. *Journal of Pediatric Psychology*, *41*(2), 256–264. https://doi.org/10.1093/jpepsy/jsv070

Panagiotaki, G., Hopkins, M., Nobes, G., Ward, E., & Griffiths, D. (2018). Children’s and adults’ understanding of death: Cognitive, parental, and experiential influences. *Journal of Experimental Child Psychology*, *166*, 96–115. https://doi.org/10.1016/j.jecp.2017.07.014

Peretz-Lange, R. (2021). Why does social essentialism sometimes promote, and other times mitigate, prejudice development? A causal discounting perspective. *Cognitive Development*, *59*, 101085. https://doi.org/10.1016/j.cogdev.2021.101085

Peretz-Lange, R., Perry, J., & Muentener, P. (2021). Developmental shifts toward structural explanations and interventions for social status disparities. *Cognitive Development*, *58*, 101042. https://doi.org/10.1016/j.cogdev.2021.101042

Peters, D., Menendez, D., & Rosengren, K. (2020). Reframing mental illness: The role of essentialism on perceived treatment efficacy and stigmatization. *Memory & Cognition*. https://doi.org/10.3758/s13421-020-01061-1

Raman, L., & Gelman, S. A. (2005). Children’s understanding of the transmission of genetic disorders and contagious illnesses. *Developmental Psychology*, *41*(1), 171–182. https://doi.org/10.1037/0012-1649.41.1.171

Retief, M., & Letšosa, R. (2018). Models of disability: A brief overview. *HTS Teologiese Studies / Theological Studies*, *74*(1), Article 1. https://www.ajol.info/index.php/hts/article/view/177914

Reynaert, C. C., & Gelman, S. A. (2007). The influence of language form and conventional wording on judgments of illness. *Journal of Psycholinguistic Research*, *36*(4), 273–295. https://doi.org/10.1007/s10936-006-9045-4

Rhodes, M., Leslie, S. J., & Tworek, C. M. (2012). Cultural transmission of social essentialism. *Proceedings of the National Academy of Sciences*, *109*(34), 13526–13531. https://doi.org/10.1073/pnas.1208951109

Rhodes, M., & Mandalaywala, T. M. (2017). The development and developmental consequences of social essentialism. *WIREs Cognitive Science*, *8*(4), e1437. https://doi.org/10.1002/wcs.1437

Rhodes, M., & Moty, K. (2020). Chapter One—What is social essentialism and how does it develop? In M. Rhodes (Ed.), *Advances in Child Development and Behavior* (Vol. 59, pp. 1–30). JAI. https://doi.org/10.1016/bs.acdb.2020.05.001

Rizzo, M. T., & Killen, M. (2020). Children's evaluations of individually- and structurally-based inequalities: The role of status. *Developmental Psychology*, *56*(12), 2223–2235. https://doi.org/10.1037/dev0001118

Robey, K. L., Beckley, L., & Kirschner, M. (2006). Implicit Infantilizing Attitudes About Disability. *Journal of Developmental and Physical Disabilities*, *18*(4), 441–453. https://doi.org/10.1007/s10882-006-9027-3

Rogoff, B., Dahl, A., & Callanan, M. (2018). The importance of understanding children's lived experience. *Developmental Review*, *50*, 5–15. https://doi.org/10.1016/j.dr.2018.05.006

Rosengren, K. S., & Gutiérrez, I. T. (2011). Searching for coherence in a complex world: Introduction to the special issue on explanatory coexistence. *Human Development*, *54*(3), 123–125.

Schwebel, D. C., Wells, H., & Johnston, A. (2015). Children's recognition of dangerous household products: Child development and poisoning risk. *Journal of Pediatric Psychology*, *40*(2), 238–250. https://doi.org/10.1093/jpepsy/jsu088

Shtulman, A. (2023). When competing explanations converge: Coronavirus as a case study for why scientific explanations coexist with folk explanations. In J. N. Schupbach & D. H. Glass (Eds.), *Conjunctive explanations: New essays on the nature, epistemology, and psychology of explanatory multiplicity*. Routledge.

Shtulman, A., & Calabi, P. (2013). Tuition vs. Intuition: Effects of instruction on naïve theories of evolution. *Merrill-Palmer Quarterly*, *59*(2), 141–167.

Shtulman, A., & Harrington, K. (2016). Tensions between science and intuition across the lifespan. *Topics in Cognitive Science*, *8*(1), 118–137. https://doi.org/10.1111/tops.12174

Shutts, K., & Kalish, C. W. (2021). Intuitive sociology. *Advances in Child Development and Behavior*, *61*, 335–374. https://doi.org/10.1016/bs.acdb.2021.05.004

Siegal, M., & Petersen, C. C. (Eds.). (1999). *Children's understanding of biology and health* (pp. xiii, 291). Cambridge University Press. https://doi.org/10.1017/CBO9780511659881

Sigelman, C. K., & Begley, N. L. (1987). The early development of reactions to peers with controllable and uncontrollable problems. *Journal of Pediatric Psychology*, *12*(1), 99–115. https://doi.org/10.1093/jpepsy/12.1.99

Sloutsky, V. M. (2010). From perceptual categories to concepts: What develops? *Cognitive Science*, *34*(7), 1244–1286. https://doi.org/10.1111/j.1551-6709.2010.01129.x

Smith, L. A., & Williams, J. M. (2001). Children's understanding of the physical, cognitive and social consequences of impairments. *Child: Care, Health and Development*, *27*(6), 603–617. https://doi.org/10.1046/j.1365-2214.2001.00236.x

Smith, L. A., & Williams, J. M. (2004). Children's understanding of the causal origins of disability. *Journal of Cognition and Development*, *5*(3), 383–397. https://doi.org/10.1207/s15327647jcd0503_5

Smith, L. A., & Williams, J. M. (2005). Developmental differences in understanding the causes, controllability and chronicity of disabilities. *Child: Care, Health and Development*, *31*(4), 479–488. https://doi.org/10.1111/j.1365-2214.2005.00532.x

Smith, L. A., & Williams, J. M. (2007). "It's the X and Y thing": Cross-sectional and longitudinal changes in children's understanding of genes. *Research in Science Education*, *37*(4), 407–422. https://doi.org/10.1007/s11165-006-9033-6

Snyder, M. L., Kleck, R. E., Strenta, A., & Mentzer, S. J. (2003). Avoidance of the handicapped: An attributional ambiguity analysis. In *Understanding prejudice and discrimination* (pp. 84–91). McGraw-Hill.

Solomon, G. E. A., & Johnson, S. C. (2000). Conceptual change in the classroom: Teaching young children to understand biological inheritance. *British Journal of Developmental Psychology*, *18*(1), 81–96. https://doi.org/10.1348/026151000165580

Spelke, E. S., & Kinzler, K. D. (2007). Core knowledge. *Developmental Science*, *10*(1), 89–96. https://doi.org/10.1111/j.1467-7687.2007.00569.x

Springer, K., & Ruckel, J. (1992). Early beliefs about the cause of illness: Evidence against immanent justice. *Cognitive Development*, *7*(4), 429–443. https://doi.org/10.1016/0885-2014(92)80002-W

Swain, J., & French, S. (2000). Towards an affirmation model of disability. *Disability & Society*, *15*(4), 569–582. https://doi.org/10.1080/09687590050058189

Taylor, M. G., Rhodes, M., & Gelman, S. A. (2009). Boys will be boys; cows will be cows: Children's essentialist reasoning about gender categories and animal species. *Child Development*, *80*(2), 461–481. https://doi.org/10.1111/j.1467-8624.2009.01272.x

Thomas, A. J., Saxe, R., & Spelke, E. S. (2022). Infants infer potential social partners by observing the interactions of their parent with unknown others. *Proceedings of the National Academy of Sciences*, *119*(32), e2121390119. https://doi.org/10.1073/pnas.2121390119

Thompson, T. L. (1982). Gaze toward and avoidance of the handicapped: A field experiment. *Journal of Nonverbal Behavior*, *6*(3), 188–196. https://doi.org/10.1007/BF00987067

Ünlütabak, B., Hernandez, G. T., Velioglu, I., Menendez, D., & Rosengren, K. S. (2022). Children's questions and teachers' responses about the COVID-19 pandemic in Turkey and the United States. *PsyArXiv*. https://doi.org/10.31234/osf.io/nrk5d

Vasilyeva, N., Gopnik, A., & Lombrozo, T. (2018). The development of structural thinking about social categories. *Developmental Psychology*, *54*(9), 1735–1744. https://doi.org/10.1037/dev0000555

Vasilyeva, N., & Lombrozo, T. (2020). Structural thinking about social categories: Evidence from formal explanations, generics, and generalization. *Cognition*, *204*, 104383. https://doi.org/10.1016/j.cognition.2020.104383

Victor, S. E., Schleider, J. L., Ammerman, B. A., Bradford, D. E., Devendorf, A. R., Gruber, J., Gunaydin, L. A., Hallion, L. S., Kaufman, E. A., Lewis, S. P., & Stage, D. L. (2022). Leveraging the strengths of psychologists with lived experience of psychopathology. *Perspectives on Psychological Science*, *17*(6), 1624–1632. https://doi.org/10.1177/17456916211072826

Waxman, S., Medin, D., & Ross, N. (2007). Folkbiological reasoning from a cross-cultural developmental perspective: Early essentialist notions are shaped by cultural beliefs. *Developmental Psychology*, *43*(2), 294–308. https://doi.org/10.1037/0012-1649.43.2.294

Weiner, B., Perry, R. P., & Magnusson, J. (1988). An attributional analysis of reactions to stigmas. *Journal of Personality and Social Psychology*, *55*(5), 738–748. https://doi.org/10.1037/0022-3514.55.5.738

Wellman, H. M., & Gelman, S. A. (1992). Cognitive development: Foundational theories of core domains. *Annual Review of Psychology*, *43*(1), 337–375. https://doi.org/10.1146/annurev.ps.43.020192.002005

Wellman, H. M., & Gelman, S. A. (1998). Knowledge acquisition in foundational domains. In *Handbook of child psychology: Volume 2: Cognition, perception, and language* (pp. 523–573). John Wiley & Sons, Inc.

Williams, J. M. (2012). Children and adolescents' understandings of family resemblance: A study of naïve inheritance concepts: Phenotypic similarity and difference. *British Journal of Developmental Psychology*, *30*(2), 225–252. https://doi.org/10.1111/j.2044-835X.2011.02031.x

Williams, J. M., & Smith, L. A. (2006). Social and experiential influences on the development of inheritance concepts. *International Journal of Behavioral Development*, *30*(2), 148–157. https://doi.org/10.1177/0165025406063630