

Folk Teleology and Split Entity Identity

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Abstract

Reasoning about the identity of objects is challenging, because objects can experience alterations that change its properties. Researchers have proposed that causal explanations are important in making identity judgments, and one important causal factor is objects' teleology (purpose or function). This study focuses on how teleological information affects identity judgments of entities that split into two descendants. In Experiment 1, we provide evidence that two types of teleological information – function type (structure-dependent or not) and function preservation influence the likelihood that a descendant is judged as the original entity. In Experiment 2, we show that object/substance construal is a mediator of function type in the identity task, suggesting that some of the teleological effects can be explained via construing the entity as object/substance. Together, these two experiments highlight the importance of teleological information in identity judgments.

Keywords: folk teleology; object persistence; object identity

Introduction

Individual objects are omnipresent in physical environments around us. In the short term, we can use pre-conceptual mechanisms to keep track of objects (Meyerhoff et al., 2017; Pylyshyn, 2009). However, the problem of object identity is more complicated when we consider objects that can undergo alterations over longer periods of time (Scholl, 2007). For example, a lit candle becomes shorter over time and eventually transforms into a bent candle stub. Simply comparing the shared properties of objects before and after the alteration may yield few similarities. Yet people are good at making inferences about how objects persist over time.

One way to explain this phenomenon is to suppose that people try to trace the causal history of objects. Several metaphysics theories have emphasized the role of causal explanation. Haslanger (1989) suggests that natural explanations about changes and the idea that the past constrains the present are important for reasoning about object persistence. It has also been proposed that the causal theory of object persistence may reconcile endurantist (objects are wholly present at different times) and perdurantist (objects have distinct temporal parts) views (Wasserman, 2016). This is because the causal theory posits that the object at the present time depends on what the object was in the past, tied together by plausible causal explanations. Similarly, Ingthorsson (2022) provides a unified account of object constitution and persistence based on causal

explanations. In an object's causal history, substances (e.g., wood) are transformed into the object (e.g., a table), which persists over some time, and eventually goes out of existence. Alterations that occur over this history can be explained by (physical) laws of causation.

More recently, there have been attempts to formalize causal explanations based on internal or external forces via a "shaping" process (Rips & Hespos, 2015). The main causal forces include sustaining forces, emergent forces, and teleological forces. Sustaining forces bind components (e.g., particles) together and maintain them. Emergent forces are causal forces that depend on the organization of an object's components (i.e., are not reducible to those of its components). Teleological forces are forces that involve the purpose, goal, or function of objects.

Several studies have illustrated the role of teleological information on object persistence judgments. Dink and Rips (2014) asked people to judge whether a computer still existed after it was disassembled. They found that when the owner intended to reassemble the parts in the future, participants were more likely to answer that the computer existed. In another study (Rose, 2015), a variant of the Ship of Theseus problem (Hobbes, 1655; for a more recent experimental variation, see Hall, 1998) was used, in which the original object's parts were gradually replaced, until the object was entirely constituted of new parts; the old parts were also assembled in the same way to form another object. In three conditions, the object constituted of original parts preserved function, the object constituted of new parts preserved function, or no function was preserved. Rose found that participants were more likely to judge the object that preserved the function to be the original object. Similarly, when teleological and normative information were manipulated, teleological considerations but not normative considerations, were able to explain object persistence judgments (Rose et al., 2020). Furthermore, teleological effects were also observed in object categorization and mereology judgments (Rose & Nichols, 2019; Rose & Schaffer, 2017).

Though accumulating evidence suggests teleological information affects identity judgments, little is known about why this occurs. We are interested in examining whether the interplay between form and matter (e.g., Koslicki, 2008) in an object's causal history can explain teleological effects. Properties related to matter (e.g., wood) are present before an object (e.g., a wooden table) comes into existence and after

the object goes out of existence. In contrast, properties related to form are only meaningful during object persistence. These two types of properties align with two distinct psychological perspectives in thinking about identity: object construal and substance construal (Prasada et al., 2002). Object (or form) construal refers to the notion that the structure of the entity is nonarbitrary. Substance construal, on the other hand, considers structure irrelevant. For example, a wooden table is at the same time a chunk of wood. When we think of the orientation of this entity, we consider the entity an object of the category “table.” Yet when we consider whether it is flammable, we think of the entity as substance. The differences between form and matter are reflected in linguistic devices to talk about them. For instance, objects are often described by count nouns, and substances by mass nouns (see Rips & Hespos, 2019, for a review). One of the factors that increases the likelihood of object construal is structure-dependent functions (Prasada et al., 2002). Structure-dependent functions provide a causal explanation of why the structure of the entity is what it is. For example, knives are sharp because we use them to cut other things, and water bottles have sealed lids to avoid spilling liquids. The availability of causal explanations for structure may affect identity judgments, though this possibility has not been addressed in previous studies.

The current study focuses on the effect of teleological information on identity judgments when the entity splits into two descendants. The split alteration poses special challenges for identity judgments, because both descendants stem from the common causal history of the original entity (Rips, 2011). In Experiment 1, the design included the following factors: (a) we assigned two types of function (structure-dependent or structure-independent) to the entities; and (b) we manipulated whether the descendants preserved these functions. We hypothesized that preserving function (especially structure-independent function) would make participants more likely to judge the descendant as the original. In Experiment 2, we used the participants’ subjective judgment of function type as a predictor for identity judgment. We further examined whether the object/substance construal could help explain the teleological effects found in Experiment 1.

Experiment 1

In Experiment 1, we used a within-participants design and manipulated orthogonally two independent variables: function type (structure-dependent or structure-independent of the original object) and function preservation. We hypothesized that descendants preserving functions will be more likely to be judged as the original (Rose et al., 2020). We also hypothesized that descendants that inherit structure-dependent functions will be more likely to be the original. This prediction comes from the observation that the causal explanations of structure-dependent functions tend to be more concrete, and participants may be more confident when making judgments based on such explanations. We show examples of causal explanations for some structure-dependent and structure-independent functions in Table 1.

From the table, we can see that the causal explanations of structure-dependent functions often draw inferences from tangible properties (e.g., length), whereas the structure-independent functions usually require more knowledge about intangible properties.

Table 1: Causal explanations for functions.

Object	Function	Function Type	Causal explanation
Pole	Pole jumping	Structure-dependent	Poles are <i>long</i> enough to support a person jumping through the air.
Hat	Covers the head	Structure-dependent	The bottom of the hat has the same <i>perimeter</i> as one’s head.
Soap	Cleans stains	Structure-independent	Soap molecules have <i>polar</i> and <i>nonpolar</i> parts, which allow it to attract both water and oil.
Fridge Magnet	Fasten message to the fridge	Structure-independent	Particles of the magnet are organized in a special way that creates a <i>magnetic field</i> .

Method

Materials Participants were presented with an original entity that has a function. This entity splits into two parts: descendant A and descendant B. A figure was provided to illustrate the shape of the original entity and that of the two descendants. Participants rated how likely each descendant, A and B, was to be the original entity on a scale of 1-5 (1=Very unlikely, 5=Very likely). Across the trials, function type and function preservation were varied independently. Half of the original entities had a structure-dependent function (e.g., pillars can support the roof), and half had a structure-independent function (e.g., candles are inflammable). These functions were either preserved or lost in descendants A and B. The shape of the descendants was counterbalanced, so that on half the trials A and B had equal size. In total, there were 48 original entities and 96 descendants. An example stimulus is shown below:

Sam has a tube called Gollywag. He uses Gollywag for pole jumping. One day he leaves Gollywag in the yard. The next morning, he finds two smaller tubes (tube A and tube B) in the vicinity of Gollywag. Tube A and tube B are shown in Figure 1. Sam finds that only tube A can be used for pole jumping. How likely is A the original (Gollywag)? How likely is B the original?

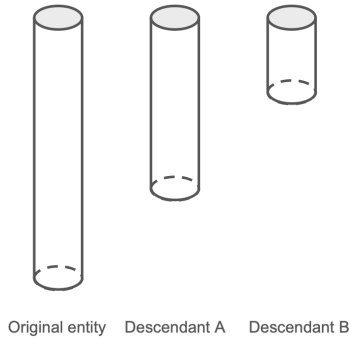


Figure 1: Example of identity judgment task.

To control for physical similarity between shapes, participants were also asked to rate the shape of the original entity and descendant on a scale of 1-5 (1=Very dissimilar, 5=Very similar). For example, the shape of the original entity and descendant A in Figure 1 would be shown together without other background information. In total, there were 20 pairs of similarity judgments, corresponding to the total number of ways that an original entity could split into two parts.

Procedure In the instructions, participants were told that they would make judgments about how likely the descendant is the original entity. It was emphasized that “likely to be the original” should be understood as identity (different from the relation between twins, and not merely a matter of similarity between the objects’ properties) (see Rips, 2011). First, participants made similarity judgments for pairs of shapes, which were shown in random order. Then, they read excerpts about original entities that split into two descendants, as in the earlier example. For each descendant, they rated how likely it was the original entity. These questions were shown in randomized blocks of trials, with each block containing original entities of the same shape. Data were collected on Qualtrics, and participants were given up to 60 minutes to complete the questionnaire.

Participants For this study, we recruited 58 college students, who received course credit for participating. Participants’ age ranged from 18-22 ($M=18.7$, $SD=0.9$).

Results

We hypothesized that descendants that preserved the function of the original object would be more likely to be judged identical to be the original than descendants that lost that function. Likewise, functions that were structure-dependent would lead to higher likelihood that a descendant was identical to the original than functions that were structure-independent. To test these hypotheses, we used a linear mixed effect model to assess the effect of function type and preservation on identity judgment of each descendant. Geometric shape of original entity, physical similarity between original entity and descendant, and whether descendants had equal size were entered as control variables. We started with the maximal model, and simplified until model convergence: we entered random intercepts for each participant and random slopes for similarity judgments. The

effect of function preservation was significant, with the descendant that preserves function rated as more likely to be the original ($b=0.97$, $t(5426)=25.63$, $p<0.001$). The effect of function type was also significant: descendants with a structure-dependent function were rated as more likely to be the original ($b=0.38$, $t(5432)=10.01$, $p<0.001$). Interaction between function preservation and function type was significant: function preservation had a larger influence on descendants with structure-independent functions ($b=-0.56$, $t(5376)=-10.41$, $p<0.001$). The results are summarized in Figure 2.

As expected, we found that function preservation and function type had an effect of identity judgments. Descendants that preserved functions were judged as more likely to be the original, consistent with prior work. Descendants that had structure-dependent functions were more likely to be judged as the original, perhaps due to the concreteness of causal explanations (see examples in Table 1). We did not expect to find interaction between function preservation and function type. Descendants with structure-independent functions are judged less likely to be the original when the function is lost, compared to descendants with structure-dependent functions. We suspected that this is linked to object/substance construal, which we test in Experiment 2.

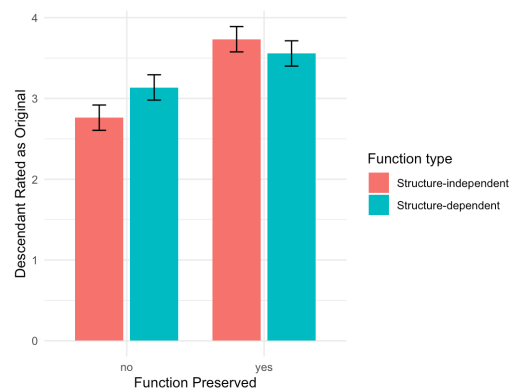


Figure 2: Effects of function type and function preservation on identity judgment.

Experiment 2

The interaction we observed in Experiment 1 was unexpected. We hypothesize that this interaction could be explained by the object/substance construal of entities: Loss of a structure-independent function (e.g., failure of a part of a candle to burn) may imply a radical change in the underlying nature of the descendant. Specifically, loss of structure-independent functions may prompt participants to consider the possibility that the substance of the entity has changed (Prasada, 2004; Prasada et al., 2002). To test this hypothesis, we used a within-participants design and again manipulated orthogonally two independent variables: function type (structure-dependent or structure-independent function) and function preservation. In addition, for each set of original

entity and two descendants, we measured participants' conception of function type and object/ substance construal of the original entity. We predicted that the effects of function preservation and function type would replicate Experiment 1. In addition, we predicted that object/substance construal of entities would mediate the effect of function type.

Method

Materials Participants were given an original entity X with a function. They were asked to describe X using either a mass noun or a count noun based on a nonsense category. They were also asked to judge function type. As in Experiment 1, entity X splits into two descendants, and participants were asked to rate how likely each descendant is to be the original entity on a scale of 1-5. In total, there were 48 original entities and 96 descendants. An example stimulus is shown below (the accompanying figures are the same as in Experiment 1; see Figure 1):

X is shaped as a cylinder and it can be used for pole jumping. One day, X was placed in the garden.

[object/substance construal question:]

X belongs to a category called gollywag. Which of the following sentences best describes X?

- A. *There was a gollywag in the garden. [object]*
- B. *There was gollywag in the garden. [substance]*

[function type question:]

Which of the following statements is true?

- A. *X can be used for pole jumping primarily because of what it's made of.*
- B. *X can be used for pole jumping primarily because of its shape / structure.*

[identity judgment:]

The next morning, we find A and B in the vicinity of where X had been (see figure). We also find that only A can be used for pole jumping. How likely is A the original (X)? How likely is B the original?

To control for physical similarity between shapes, participants were asked to rate each pair of original entity and descendant on a scale of 1-5.

Procedure Participants first judged the similarity between shapes. Then, for each problem set (containing one original entity and two descendants), they judged function type, how object-like the original entity was, and whether each of the two descendants was likely to be the original one. Data was collected on Qualtrics, and participants were given up to 60 minutes to complete the questionnaire.

Participants 32 college students were recruited for the study, and they received course credit for participating. Participants' age ranged from 18-22 ($M=19.1$, $SD=1.2$). Two participants were excluded due to failing the comprehension check (i.e., did not understand "which is the original" should be judged as identity) or performing at chance level on the function type questions.

Results

Descriptive statistics 64% of the original entities were judged as objects, with the remaining 36% of entities judged

as substance. The gap between objects and substance responses may be due to the use of geometric shapes in the diagrams (see Figure 1), because regularity of structure increases the likelihood of entities being conceived as objects. Overall, participants' judgments of function type aligned with the experimenter's judgment (in Experiment 1) on 81% of the items. In subsequent analysis, we used participants' responses for the function type questions in the model.

Effect of function type and function preservation We hypothesized that descendants that preserved function would be more likely to be judged as the original than those that lost function. Similarly, original objects with a structure-dependent function would be more likely to have a descendant judged as identical than originals with a structure-independent function. To test these hypotheses, we used a linear mixed effect model to assess the effect of function type (per participants' judgment) and preservation of function for each descendant. Geometric shape of original entity, physical similarity between original entity and descendant, and whether descendants had equal size were entered as control variables. We started with the maximal model and simplified random effects until model convergence. We included random intercepts for each participant, and random slopes for function type judgments and similarity judgments. We found that the main effect of function type was significant ($b=0.65$, $t(46.7)=7.9$, $p<0.001$). Structure-dependent functions produced higher ratings that the descendant was the original than structure-independent functions. The main effect of function preservation was also significant ($b=1.65$, $t(2782)=29.9$, $p<0.001$). Descendants that preserved the function of the original entity were rated as more likely to be the original. Finally, the interaction between function type and function preservation was significant ($b=-0.91$, $t(2788)=12.0$, $p<0.001$). Function preservation had a larger influence if the original object had a structure-independent function. Overall, the findings are consistent with those of Experiment 1 (see Figure 3).

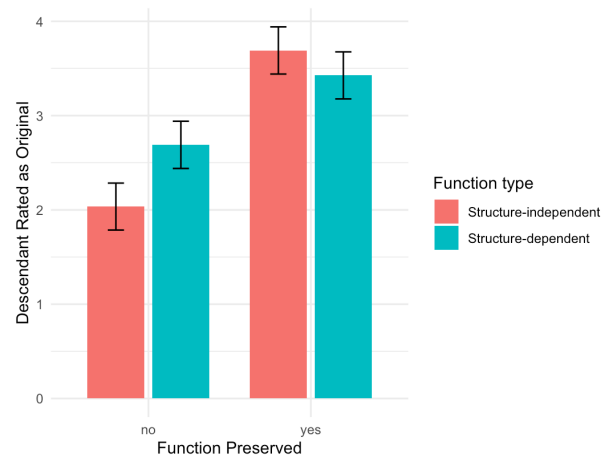


Figure 3: Effects of function type and function preservation on identity judgment.

Mediation analysis We tested whether object/substance construal mediated the effect of function type on identity judgments (using the mediation package in R). Object/substance construal was fitted by a logistic regression model with function type as predictor and controlling for other variables. We found that the average causal mediation effect (ACME) was 0.056 (95% CI = [0.033, 0.080]), thus the object/substance construal was a significant mediator. This mediator explained 28% of the variance in identity judgment when varying function type. The results are summarized in Table 2.

Table 2: Summary of mediation analysis.

	Estimate	CI
ACME	0.056 ***	[0.033, 0.080]
ADE	0.140 **	[0.053, 0.220]
Total Effect	0.195 ***	[0.112, 0.280]
Proportion Mediated	0.285 ***	[0.149, 0.530]

Discussion

In this study, we report participants' intuitions about identity when an entity splits into two parts. The split alteration is arguably difficult to understand because it violates cohesion (objects maintain a cohesive boundary over time), which is regarded as one of the principles underlying the core knowledge system for objects (Spelke, 2022). There have been studies showing that violation of cohesion disrupts object persistence in infants and increases visual processing load for adults (Scholl, 2007). Nonetheless, people have intuitions that objects can sometimes persist when they split into two parts (instead of believing that the objects simply go out of existence). In previous work, a non-negligible portion of participants consider both descendants as the original when presented with objects that split into two descendants (Rips, 2011). A similar trend appeared in the current study, with few participants responding that a descendant was very unlikely to be the original, even when the function was not preserved.

Across two experiments, we found that function preservation affected identity judgments when the original entity splits into two descendants. This replicates findings of previous studies where function preservation influenced object persistence judgments when the object undergoes gradual physical alteration or abstract alterations (Rose, 2015; Rose et al., 2020). The results imply that people generally expect teleological properties to remain unchanged if the entity persists over alterations.

We also investigated the effect of function type (structure-dependent functions or structure-independent functions) on identity judgment. Structure-dependent functions provide a causal explanation of why the structure of the entity is the way it is. While structure-independent functions could also lay the ground for causal explanations, such explanations are typically more abstract and not reflected in the entity's structure. We initially hypothesized that descendants that

inherent structure-dependent functions would be preferred over descendants that inherent structure-independent functions. Instead, we found a cross-over interaction between function type and function preservation (see Figures 2 and 3). Function preservation had a larger effect on identity for structure-independent functions compared to structure-dependent functions. We suspected that this finding could be explained in terms of whether the entity was construed as object or construed as substance (Prasada, 2004). Structure-independent functions often originate from the properties of the substance that the entity is made of. For example, consider bath salts, which can be used to soften bathing water because salt dissolves in water. Loss of this function implies a fundamental change in the salt's chemistry. In Experiment 2, we showed that object/substance construal was a mediator of function type, which supports our hypotheses.

Here is a sketch of how object/substance construal could affect identity judgments. When a structure-dependent function is presented, a causal explanation is established from the entity's structure to the function; in the case of a structure-independent function, a causal explanation is established from substance to the function. After the original entity is split into two parts, the loss of function in descendants provides information about the nature of the alteration. When a structure-independent function is lost, this implies that drastic changes occurred to the substance in the original entity, a more fundamental alteration than changing the physical structure of the entity. This echoes the idea that substance exists before object formation and after the object goes out of existence in causal histories of objects (Ingthorsson, 2022). The influence of object/substance construal on identity judgments also suggests that "entity identity" may be a more suitable term for the research problem than "object identity," though the latter term has been used frequently in previous literature. While substance construal does not refute the existence of an object, it's likely that different construals lead to different ways of reasoning about identity when alterations occur over time.

How important are teleological factors?

Overall, we showed the importance of teleological information in identity judgments, findings that can be interpreted under the causal history framework of object identity (persistence).

Some researchers suggest teleological factors can be explained away by other causal factors like sustaining forces and emergent forces (Rips, in press). One challenge that this account faces is that teleological factors seem intuitive. Kelemen and colleagues have shown that children endorse teleological explanations over explanations that involve "shaping" physical forces (Kelemen, 1999a, 1999b). Adults, under timed conditions, show a similar preference (Kelemen & Rosset, 2009). Moreover, sustaining forces and emergent forces often require more domain-specific knowledge than teleological ones. Consider the case of explaining why magnets (which attract certain substances) exist. People might recall how magnets are used: they can be used to fasten

notes to a fridge; therefore, magnets were created with the intention of fastening certain objects (a teleological factor). However, fewer people know that this property is due to an intangible magnetic field, or that magnetic fields arise from how particles in ferromagnetic materials are arranged (sustaining and emergent factors). The problem is further complicated by the fact that understanding physical forces is difficult. Children often think of physical force as a substance or property of an object, instead of as a process (Reiner et al., 2000). However, teleological explanations may not be satisfactory in terms of explanatory depth in the context of scientific theory, compared to emergent and sustaining forces (see Dink & Rips, 2017). Taking these considerations together, it is likely that when knowledge about sustaining and emergent forces is inaccessible or impoverished, teleological explanation may play an important role in reasoning about objects. This preference may go away when sustaining and emergent forces are given (Rips, in press) or when people have sufficient domain knowledge.

Other researchers believe folk teleology is at the core of object concepts, linking teleological factors to causal essence (Rose & Nichols, 2019). This view has been challenged in subsequent experiments (Joo & Yousif, 2022; Neufeld, 2021), which show that participants may be using teleological information to make inferences about the nature of internal changes. For example, participants were likely to judge a bee acting like a spider to actually be a spider. However, they had mixed intuitions when the stimuli explicitly stated that the insides (e.g., DNA) of the bee remained unchanged, and were more likely to say it is still a bee. We adopt a stance similar to Neufeld (2021) in this study, where teleological information serves as a tool to infer the nature of the alteration. In Experiment 2, we showed that structure-independent functions are more likely to prompt substance construal. We suggest that the loss of structure-independent function is taken as evidence that the substance has undergone very drastic internal changes, after which the descendant is no longer considered to be the original.

To summarize, teleological information is important for understanding identity because it is widely available and provides some evidence about the nature of the alteration.

Notes on materials and measures

In this study, we presented figures to show the shapes of the original entity and its descendants. Some of the earlier studies on folk teleology only included text, and it is possible that different participants visualized entities in different ways. We believe that in identity judgment tasks (especially when physical alterations occur), providing illustrations helps decrease the ambiguity in text descriptions (Korman & Charmichael, 2017).

Another major change is that we measured identity-judgments on a 5-point scale in the current study. In other studies, participants judge identity in a binary way. However, a continuous measure may be suitable as evidence of uncertainty as to whether the descendants count as the original. The causal history of objects is often unclear, and

inferences are based on fragmentary information. In this sense, identity judgments are more like hypotheses than assertions, and the probabilistic nature of the hypotheses can be captured by continuous measures.

Limitations

The current study has some limitations. First, in Experiment 1 the function type was assigned by the experimenter, but participants' conception of function type may not always align with the experimenter's. This limitation was addressed in Experiment 2, where we used the participants' responses to the function type question as a predictor for the identity judgment scores. Individual differences in people's conception of function type may be due to ambiguity in language. For example, "X can be used to make candles", could refer either to the material (a ball of candle wax) for making candles, or to the tool (mold) for making candles. The former has a structure-independent function while the latter has a structure-dependent function.

Also, all the original entities used in this study were drawn as standard geometric shapes, which may have increased the likelihood of object construal (Prasada et al., 2002). We note, however, that using entities with more arbitrary structure may create difficulties for assessing structure-dependent functions, because structures that serve a specific function usually have some structural regularity.

Another limitation is that we considered each descendant separately in our statistical analyses. The underlying assumption is that the properties of one descendant does not influence the identity judgment of the other descendant. It is possible that some participants may have been comparing the descendants. Because we counterbalanced the properties of descendants, such effects (if they exist) would not affect the overall conclusions of the current study. However, future research may explore whether descendants compete in identity judgments.

Conclusion

The notion that objects sometimes persist through alterations is intuitive, yet it is unclear how people reason about the identity of objects over long periods of time. One possible explanation is that people construct causal explanations of change, on the basis of sustaining, emergent, and teleological causal forces (Haslanger, 1989; Rips, in press).

In this paper, we present experimental results showing that two forms of teleological information (function type and function preservation) influence identity judgments of an entity that splits into two descendants. Descendants that preserve the original function, and descendants that have a structure-dependent function are more likely to be judged as the original. Interactions between the two factors are also significant, which we explain as the result of the different function types prompting participants to reason about the internal composition or the external structure of the entity.

References

- Chi, M. T. H., Roscoe, R. D., Slotta, J. D., Roy, M., & Chase, C. C. (2012). Misconceived causal explanations for emergent processes. *Cognitive Science*, *36*(1), 1–61. <https://doi.org/10.1111/j.1551-6709.2011.01207.x>
- Dink, J. W., & Rips, L. J. (2017). Folk teleology and its implications. In D. Rose (Ed.), *Experimental Metaphysics* (pp. 207–236). Bloomsbury Academic. <https://doi.org/10.5040/9781474278645>
- Haslanger, S. (1989). Persistence, change, and explanation. *Philosophical Studies*, *56*(1), 1–28. <https://doi.org/10.1007/BF00646207>
- Inghorsson, R. D. (2022). A causal theory of constitution and persistence. In M. Szatkowski (Ed.), *E. J. Lowe and ontology* (pp. 290–310). Routledge.
- Joo, S., & Yousif, S. R. (2022). Are we teleologically essentialist? *Cognitive Science*, *46*(11), e13202. <https://doi.org/10.1111/cogs.13202>
- Kelemen, D. (1999a). Function, goals and intention: Children's teleological reasoning about objects. *Trends in Cognitive Sciences*, *3*(12), 461–468. [https://doi.org/10.1016/S1364-6613\(99\)01402-3](https://doi.org/10.1016/S1364-6613(99)01402-3)
- Kelemen, D. (1999b). Why are rocks pointy? Children's preference for teleological explanations of the natural world. *Developmental Psychology*, *35*(6), 1440–1452. <https://doi.org/10.1037/0012-1649.35.6.1440>
- Kelemen, D., & Rosset, E. (2009). The human function compunction: Teleological explanation in adults. *Cognition*, *111*(1), 138–143. <https://doi.org/10.1016/j.cognition.2009.01.001>
- Korman, D. Z., & Charmichael, C. (2017). What do the folk think about composition and does it matter? In D. Rose (Ed.), *Experimental Metaphysics*. Bloomsbury Academic. <https://doi.org/10.5040/9781474278645>
- Koslicki, K. (2008). *The structure of objects*. Oxford University Press.
- Meyerhoff, H. S., Papenmeier, F., & Huff, M. (2017). Studying visual attention using the multiple object tracking paradigm: A tutorial review. *Attention, Perception, & Psychophysics*, *79*(5), 1255–1274. <https://doi.org/10.3758/s13414-017-1338-1>
- Neufeld, E. (2021). Against teleological essentialism. *Cognitive Science*, *45*(4), e12961. <https://doi.org/10.1111/cogs.12961>
- Noles, N. S., & Bloom, P. (2006). The ship of Theseus: Concepts and identity. Poster presented at the Association for Psychological Science, New York.
- Prasada, S. (2004). Being near the ceramic, but not near the mug: on the role of construal in spatial language. In L. Carlson & E. Van Der Zee (Eds.), *Functional Features in Language and Space* (1st ed., pp. 205–218). Oxford University Press. <https://doi.org/10.1093/acprof:oso/9780199264339.003.0014>
- Prasada, S., Ferenz, K., & Haskell, T. (2002). Conceiving of entities as objects and as stuff. *Cognition*, *83*(2), 141–165. [https://doi.org/10.1016/S0010-0277\(01\)00173-1](https://doi.org/10.1016/S0010-0277(01)00173-1)
- Pylyshyn, Z. W. (2009). Perception, representation, and the world: the first that binds. In D. Dedrick & L. Trick (Eds.), *Computation, Cognition, and Pylyshyn* (pp. 3–48). The MIT Press. <https://doi.org/10.7551/mitpress/8135.003.0004>
- Reiner, M., Slotta, J. D., Chi, M. T. H., & Resnick, L. B. (2000). Naive Physics reasoning: a commitment to substance-based conceptions. *Cognition and Instruction*, *18*(1), 1–34. https://doi.org/10.1207/S1532690XCI1801_01
- Rips, L. J. (2011). Split identity: Intransitive judgments of the identity of objects. *Cognition*, *119*(3), 356–373. <https://doi.org/10.1016/j.cognition.2011.01.019>
- Rips, L. J. (in press). *Taking Shape: Mental Concepts of Physical Objects*.
- Rips, L. J., & Hespos, S. J. (2015). Divisions of the physical world: Concepts of objects and substances. *Psychological Bulletin*, *141*(4), 786–811. <https://doi.org/10.1037/bul0000011>
- Rips, L. J., & Hespos, S. J. (2019). Concepts of objects and substances in language. *Psychonomic Bulletin & Review*, *26*(4), 1238–1256. <https://doi.org/10.3758/s13423-019-01613-w>
- Rose, D. (2015). Persistence through function preservation. *Synthese*, *192*(1), 97–146. <https://doi.org/10.1007/s11229-014-0555-6>
- Rose, D., & Nichols, S. (2019). Teleological essentialism. *Cognitive Science*, *43*(4), e12725. <https://doi.org/10.1111/cogs.12725>
- Rose, D., & Schaffer, J. (2017). Folk mereology is teleological. *Noûs*, *51*(2), 238–270. <https://doi.org/10.1111/nous.12123>
- Rose, D., Schaffer, J., & Tobia, K. (2020). Folk teleology drives persistence judgments. *Synthese*, *197*(12), 5491–5509. <https://doi.org/10.1007/s11229-018-01974-0>
- Scholl, B. J. (2007). Object persistence in philosophy and psychology. *Mind & Language*, *22*(5), 563–591. <https://doi.org/10.1111/j.1468-0017.2007.00321.x>
- Spelke, E. S. (2022). *What Babies Know: Core Knowledge and Composition Volume 1* (1st ed.). Oxford University Press. <https://doi.org/10.1093/oso/9780190618247.001.0001>
- Wasserman, R. (2016). Theories of persistence. *Philosophical Studies*, *173*(1), 243–250. <https://doi.org/10.1007/s11098-015-0488-z>