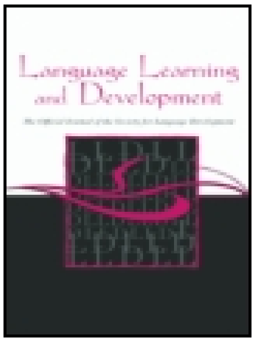

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An Object Lesson: Objects, Non-Objects, and the Power of Conceptual Construal in Adjective Extension

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ABSTRACT

Despite the seemingly simple mapping between adjectives and perceptual properties (e.g., color, texture), preschool children have difficulty establishing the appropriate extension of novel adjectives. When children hear a novel adjective applied to an individual object, they successfully extend the adjective to other members of the same object category but have difficulty extending it more broadly to members of different categories. We propose that the source of this difficulty lies at the interface of the linguistic and conceptual systems: children initially limit the extension of an adjective to the category of the object on which it was introduced. To test this hypothesis, we manipulated whether participants construed images as "pictures of things" (objects) or "blobs of stuff" (non-objects). For both 36-month-old children (Experiments 1 and 2) and adults (Experiment 3), the conceptual status of an image influenced how they extended an adjective applied to that image. Children extended novel adjectives more successfully when they construed the images as non-objects than when they construed the same images as objects. Similarly, adults were faster to make adjective extensions when construing the images as non-objects rather than objects. Learners of all ages must navigate this linguistic-conceptual interface in assessing whether and how novel adjectives should be extended to new individuals.

Introduction

To acquire the meaning of a new word, learners must successfully identify the novel word in the input and map it to its intended meaning. Establishing such a mapping requires coordination between our linguistic and conceptual systems of representation (Carey, 2004; Miller, 1990; Spelke, 2003; Waxman & Gelman, 2009). Perhaps, then, the words that are most easily acquired will be those referring to stable, enduring properties of objects that are readily perceived by infants and young children, such as objects' color or surface patterns. John Locke (1690) articulated this idea succinctly, proposing that "the same color being observed today in chalk or snow … [the mind] considers that appearance alone, and having given it the name whiteness, it by that sound signifies the same quality wheresoever to be imagined or met with."

Although elegant in its simplicity, this proposal is not borne out in children's early adjective learning. Instead, when it comes to mapping novel words to properties like color, infants and young children encounter a serious obstacle. When young children hear an adjective applied to an object (e.g., "white," applied to a white cup), they successfully extend that adjective to other white objects if they are members of the same object category (i.e., to other white cups). But in contrast to Locke's proposal, children show no such facility extending that same adjective broadly to other objects from different categories (e.g., from a white cup to a white shoe). This phenomenon has been robustly

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demonstrated and lasts well into the preschool years (Hall et al., 1993; Klibanoff & Waxman, 2000; Mintz, 2005; Mintz & Gleitman, 2002; Waxman & Klibanoff, 2000; Yoshida & Hanania, 2013).

In the paradigmatic demonstration, children see a single target exemplar (e.g., a white cup) labeled with a novel adjective (e.g., "This is really *daxish*") and are then asked to extend that adjective to one of two new test exemplars, only one of which shares the target property (e.g., whiteness). If these test exemplars are members of the same object category as the target (e.g., a white cup and a blue cup), then children successfully extend the adjective to the property-matched test exemplar; however, if the test exemplars are members of a different object category (e.g., a white shoe and a blue shoe), children perform at chance. Finally, children's difficulty extending a novel adjective broadly to members of different object kinds is not restricted to the property of color; the same difficulty obtains for properties including texture and surface pattern (Klibanoff & Waxman, 2000; Waxman & Klibanoff, 2000).

Critically, children's difficulty in extending a novel adjective broadly across different object kinds results from neither limitations in visual perception nor sensitivity to grammatical cues. Within their first year of life, infants successfully use properties such as color, size, and texture to distinguish among objects and reason about them (e.g., Baillargeon et al., 2012; Wilcox, 1999; Xu & Carey, 1996). By around 13 months of age, infants are sensitive to the grammatical cues that distinguish novel nouns ("This one is a *blick*") from novel adjectives ("This is a *blick* one"); they expect that words presented as nouns, but not adjectives, refer to objects and object kinds, not to surface properties such as color or texture (Booth & Waxman, 2009; Keates & Graham, 2008; Waxman, 1999; Waxman & Booth, 2001).

Instead, the obstacle in extending a novel adjective broadly across different object kinds lies in the interface between language and cognition. Children initially constrain the extension of a novel adjective (a linguistic element) to other objects within the same category on which it was introduced (a conceptual element). In some situations, this conservative pattern of extension could be advantageous. After all, the extension of many adjectives (e.g., "red") varies depending upon the object, and object category, they describe (compare, e.g., a red Ferrari and a red Irish setter). However, such an initially conservative approach is clearly and readily surmounted: children eventually do extend adjectives broadly across different object categories. This raises the question of what additional information – either conceptual or linguistic – learners require to successfully extend a novel adjective broadly across different object kinds.

There is now considerable evidence documenting the benefits of providing information from the conceptual side of the interface. When a new adjective is applied to two (or more) objects from different basic level categories (e.g., a white cup, a white cat), children then successfully extend the adjective broadly to members of new object categories (e.g., to a white shoe) (Klibanoff & Waxman, 2000; Mintz & Gleitman, 2002). Comparing two (or more) exemplars from different object categories permits children to identify the target property they share (e.g., color) and to eliminate alternative candidate properties that they do not share (e.g., shape, texture, animacy, size). Likewise, when children observe that a new adjective, applied to one individual (e.g., a white cup), cannot be extended to another individual from that same object category (a blue cup), children then successfully extend the adjective broadly to members of new object categories (e.g., to a white shoe). Comparing two members of the same object category thus clarifies the target property, enabling children to rule out the other properties that these objects do share (Waxman & Klibanoff, 2000).

There is also considerable evidence documenting the benefits of linguistic support for adjective extensions. Most notably, when a novel adjective is presented in conjunction with a lexically specific head noun naming each of the exemplar objects' categories (e.g., "Look at the white *cup*", "Look at the white *cat*") rather than a lexically less specific pronoun (e.g., "Look at the white *one*"), 2- and 3-year-old children more successfully extend the adjective broadly to other categories (Mintz, 2005; Mintz & Gleitman, 2002; see also, Yoshida & Hanania, 2013). Mintz (2005) posited that including the lexically specific head noun may have helped children to rule out other candidate adjective meanings, including some (like shape) that are likely associated with the object category.

Taken together, the force of the evidence reveals that children's difficulty extending novel adjectives lies at the interface of the linguistic and conceptual systems: children initially fail to extend adjectives beyond the category of the object on which they are introduced. This finding invites a bold prediction: if children's extension of a novel adjective is initially constrained by their *conceptual* construal of the individual to which it is applied, then blocking their construal of that individual as an object, and thus as a member of an object kind, should lift this initial constraint on adjective extension.

Waxman (2002) provided preliminary support for this prediction. She asked preschool children to extend adjectives from one image to another, manipulating the conceptual status of these images by describing them either as "pictures of things" (objects) or "blobs of stuff" (non-objects). As predicted, when the images were described as objects, children failed to extend novel adjectives broadly. In contrast, when the very same images were described as "blobs of stuff" (non-objects), children were marginally more successful in extending novel adjectives broadly. Thus, the conceptual status of the images influenced children's adjective extension.

Here, we subject this provocative hypothesis to a series of increasingly stringent tests with both children (Experiments 1 and 2) and adults (Experiment 3). If the extension of a novel adjective applied to an individual is constrained by that individual's conceptual status as an object, and therefore a member of an object kind, then children and adults should more readily and broadly extend novel adjectives if they construe the target individual as a "blob of stuff" (a non-object) rather than a "picture of a thing" (an object).

Experiment 1

The goal is to provide a strong test for the hypothesis that the conceptual status of an individual as an object constrains the extension of a novel adjective, applied to that individual, to other objects across different basic level kinds. With Waxman's (2002) design as a starting point, we advance the evidence in four ways. First, we replicate the original marginal finding and extend its generalizability by creating a new set of images that children construe flexibly as either "pictures of things" or "blobs of stuff." Second, we introduce a control condition to assess baseline performance in the task. Third, we focus specifically on children's extensions of novel adjectives describing color. This provides a rigorous test because young children's difficulty with acquiring color terms is well-documented (Bornstein, 1985; Rice, 1980; Wagner et al., 2013) and because in Waxman (2002), children had considerably more difficulty extending novel adjectives referring to an object's color than its texture. Finally, we examine for the first time whether and how children's adjective extension changes over the course of the task.

Methods

Participants

Fifty-one toddlers (21 female, 30 male, M_{age} = 36.0 months, SD = 3.6 months) were recruited from the Evanston/Chicago area. All were native speakers of English. Two additional toddlers were excluded for completing less than 75% of the trials. Sample size for Experiments 1 and 2 was determined by a power analysis with a goal of 80% power and assuming an effect size of approximately d = 1, commensurate with the difference between successful and unsuccessful conditions in Waxman's (2002) Experiment 1.

Materials

We selected 12 2-dimensional *flexible* images (see Appendix) that 3-year-old children identify flexibly as either objects ("a picture of a thing") or non-objects ("a blob of stuff") (for details, see LaTourrette & Waxman, 2017). For the introduction phase, we used two additional images: an *unambiguous* image of a familiar object and an *unambiguous* image of a non-object.

Procedure

Children were tested individually in the lab and randomly assigned to either the Object, Non-object, or Control conditions.

Introduction phase. To begin, the experimenter introduced a book, keeping it closed. In the Object condition, she explained that the book was "full of pictures of things" and had no "blobs of stuff," using the unambiguous object and non-object stimuli to illustrate these descriptions. In the Non-object condition, she explained that the book was "full of blobs of stuff" and had no "pictures of things." In the Control condition, she explained that the book was "full of pages," referencing both the unambiguous object and non-object as examples. At this point, she opened the book and the experimental phase began.

Experimental phase. See Figure 1. Children completed 12 trials, each depicting three flexible images: a target (e.g., a green, mitten-shaped image) and two test images. The test images, which differed in form from the target image, were identical to one another except for color. The matching test image (e.g., a green, comb-shaped image) was the same color as the target image; the non-matching test image (e.g., an orange comb-shaped image) was a different color than the target image. Each trial featured a different pair of colors. Across trials, all 12 flexible images appeared as both target and test images.

All children viewed precisely the same images on each trial; what varied among conditions was how the images were described. On each trial, the experimenter first revealed the target image, saying either "Look at this picture! This is a *blickish* one" (Object condition), "Look at this blob! This is a *blickish* one" (Non-object condition), or "Look at this page" (Control condition). She then revealed the test images, asking, "Can you find another one that's *blickish?*" (Object and Non-object conditions) or "Can you find another one like it?" (Control condition). Children responded by pointing. The experimenter praised children for making choices but gave no corrective feedback. All data collected for this and subsequent experiments are available at https://osf.io/3h2eb/.

Predictions

If conceptual status influences adjective extension, then children who construe the images as objects (Object condition) should show the classic constraint against extending novel adjectives broadly across basic level kinds. In contrast, for children who do not construe the images as objects (Non-object condition), this constraint should be lifted: they should successfully extend novel adjectives broadly to any image of the same color. Performance in the Control condition, in which children engaged in the same task but without learning adjectives, should reflect their behavior in this task in a context that does not involve word learning.

Model fitting

We used maximal-likelihood mixed effects logistic regression because, in contrast to traditional ANOVAs, these models respect the binomial nature of our data – children chose between either the matched (correct) or the mismatched (incorrect) test image on each trial (Quené & van den Bergh, 2008). Here and in all subsequent experiments, traditional ANOVAs yielded the same pattern of results.

Participants' and items' estimated intercepts were entered as random effects; all other factors were entered as fixed effects with random slopes where appropriate for the design (i.e., including condition-by-item and trial-by-participant random slopes) (Barr et al., 2013). All factors were evaluated using −2 log-likelihood ratio tests (Baayen et al., 2008). Preliminary analyses in this and all subsequent experiments revealed no effects of sex or stimulus order, ps >.05; we therefore collapse over these factors.

Results and discussion

The results, depicted in Figure 2, offer evidence for the role of conceptual status in young children's extension of novel adjectives. Although children in all three conditions viewed precisely the same images, their extension of novel adjectives differed sharply as a function of their conceptual construal of the images.

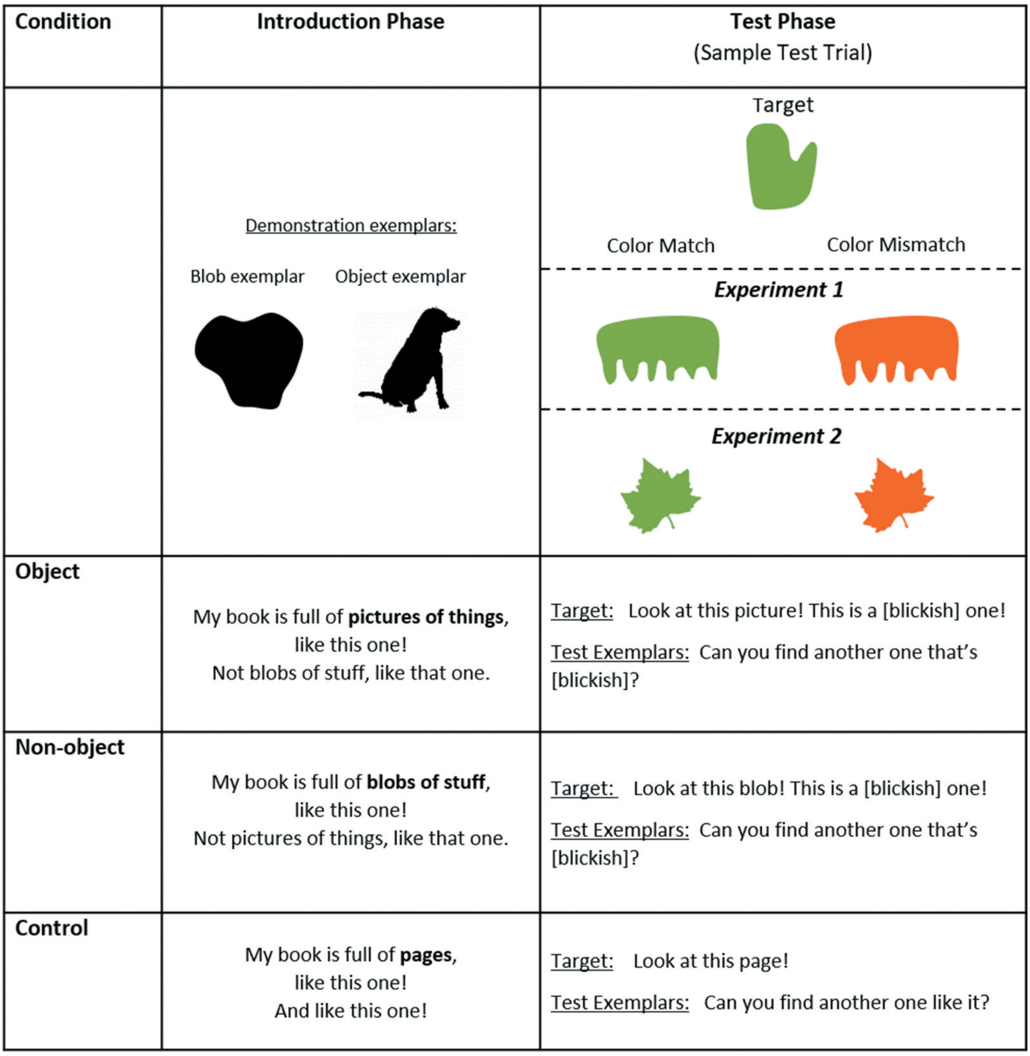

Figure 1. Design for Experiment 1 (object, non-object, and control conditions) and Experiment 2 (object and non-object conditions). After the introduction, all participants saw 12 test trials. In the object and non-object conditions, children were asked to extend a novel adjective from the target (e.g., the "mitten") to one of the test stimuli. Test stimuli were either flexibly construed images (Experiment 1) or unambiguous object images (Experiment 2).

A mixed effects model with condition and age as fixed effects and participant and item as random effects with condition-by-item random slopes revealed no effect of age, $p > .2$, but the predicted effect of condition, $X^2(2) = 9.24$, $p = .0099$. Children in the Non-object condition were considerably more successful in selecting the color-matched test image ($M = .90$, $SD = .17$) than those in either the Object ($M = .77$, $SD = .28$), $X^2(1) = 4.42$, $p = .035$, or Control conditions ($M = .71$, $SD = .25$), $X^2(1) = 9.45$, $p = .0021$. Performance in these latter two conditions did not differ, $X^2(1) = .76$, $p = .38$, and performance in all conditions was significantly above chance, $ts > 2$, $ps < .05$.

Next, to assess whether and how children's performance evolved in real time, we added linear and quadratic effects of trial to our mixed-effects model. This revealed only a main effect of condition, $X^2(2) = 7.56$, $p = .023$, qualified by a significant interaction of condition with the linear effect of trial, $X^2(2) = 9.42$, $p = .009$. See Figure 3. Critically, children's extensions became more accurate over trials in

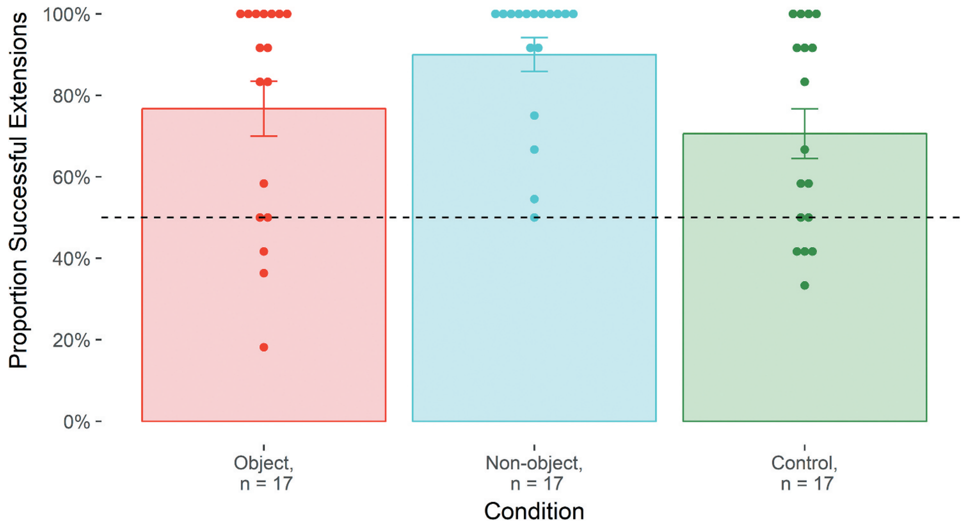

Figure 2. Proportion of trials on which children in Experiment 1 successfully selected the color-matched test image in each condition. Points indicate individual participants. Error bars represent ± 1 SEM.

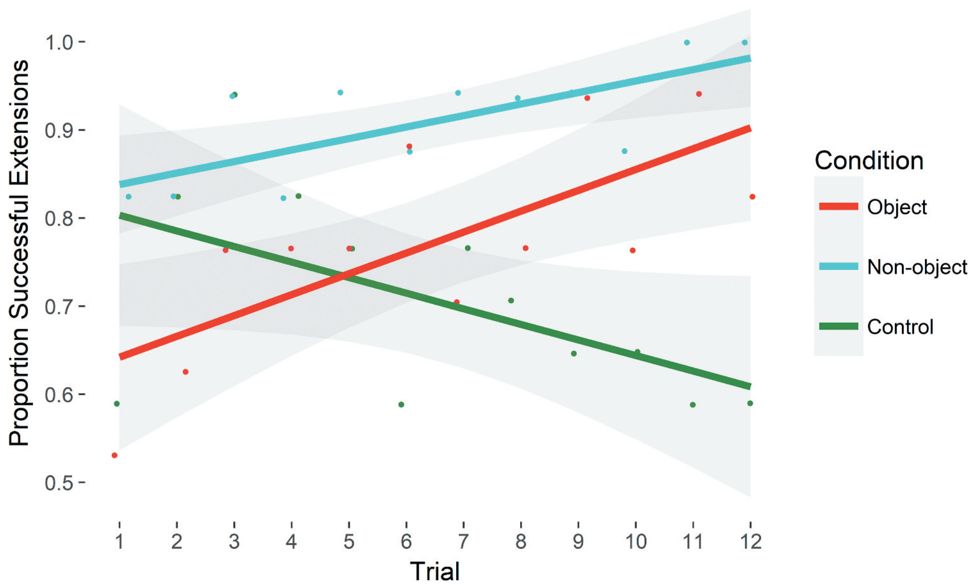

Figure 3. Experiment 1 performance plotted over trials. Points represent participants' average performance on each trial. Shaded regions represent ± 1 SEM.

both the Object and Non-object conditions, but not the Control condition.[1] Although children in the Object condition eventually did map adjectives broadly in this task, they struggled to do so on the early trials and ultimately were less successful overall than children in the Non-object condition, who

[1]To demonstrate this statistically, we created two orthogonal contrast codes, one contrasting the Object and Non-object conditions, and the other contrasting both with the Control condition. When we conduct our growth curve analysis with these codes, we observe a significant interaction between the Control vs. Other code and the linear effect of trials, $X^2(1) = 9.34$, $p = .002$. The Object vs. Non-object code's linear interaction term is not significant, $p > .4$, suggesting that the Condition x Trial interaction is driven primarily by the linear improvement in both the Non-object and Object conditions but not the Control condition.

extended novel adjectives broadly and accurately from the start. However, the improvement over trials in the Object condition likely accounts for children's overall above-chance performance, aggregated across trials. Learning over trials may have been facilitated to a greater degree here than in previous experimental designs which tested children's extension of novel adjectives referring to not only colors but other surface properties including texture, pattern, and color (cf. Mintz & Gleitman, 2002; Waxman, 2002; Waxman & Klibanoff, 2000).

Children in the Control condition showed a different pattern: their performance varied substantially across trials but showed no systematic increase over trials (e.g., performance is equivalent on the first, last, and midpoint trials). Children may have performed above chance in this condition because they were free to construe the intentionally ambiguous images either as objects or non-objects. Moreover, their lack of improvement over trials in this condition suggests that children's increasing accuracy over time in the Object and Non-object conditions was not related to performance factors inherent in the task itself but was specific to learning novel adjectives. Repeated engagement in adjective learning opportunities may have helped children identify the property (color) to which the adjectives referred.

Experiment 2

We next asked how, and how robustly, children in the Non-object condition represented the meaning of the newly learned adjective. Did they form a fragile mapping, one that supported extending the novel adjective from one non-object to another, but that was not sufficiently robust to support extending that novel adjective from a non-object to an object? Alternatively, perhaps children in the Non-object condition formed a more robust initial representation, one that would permit them to extend the novel adjective broadly from a "blob of stuff" to an unambiguous object. In Experiment 2, we address this directly, examining how successfully children in the Object and the Non-object conditions extended novel adjectives to new objects.

Method

Participants

We recruited thirty-nine toddlers (20 female, 19 male, M_{age} = 35.6 months, *SD* = 3.2 months), all native speakers of English from the Evanston/Chicago area, in accordance with the projected effect size of $d = 1$ and 80% power. Another 3 toddlers were excluded because they completed less than 75% of trials. Children were randomly assigned to either the Object or Non-object condition.

Materials and procedure

See Figure 1. Children again participated in 12 novel adjective extension trials, featuring the same flexible target images as in Experiment 1, followed by a matching- and non-matching test image. In contrast to Experiment 1, the test images were images of objects familiar to young children and were described as "pictures of things."

Results and discussion

As in Experiment 1, we constructed a model including a fixed effect of condition with random effects of item and participant and condition-by-item random slopes. The fixed effect of age was excluded after failing to predict performance in Experiment 1; in a preliminary analysis, we also observed no effect of age or interaction with condition, *p*s > .1. Our model revealed a significant effect of condition, $X^2(1) = 3.95$, $p = .047$: children in the Non-object condition ($M = .94$, $SD = .09$) were more successful than those in the Object condition ($M = .75$, $SD = .32$) at extending novel adjectives broadly, to familiar objects. See Figure 4. A growth curve analysis including linear and quadratic terms revealed only a significant linear improvement over trials, $X^2(1) = 7.93$, $p = .005$, with no Condition x Trial

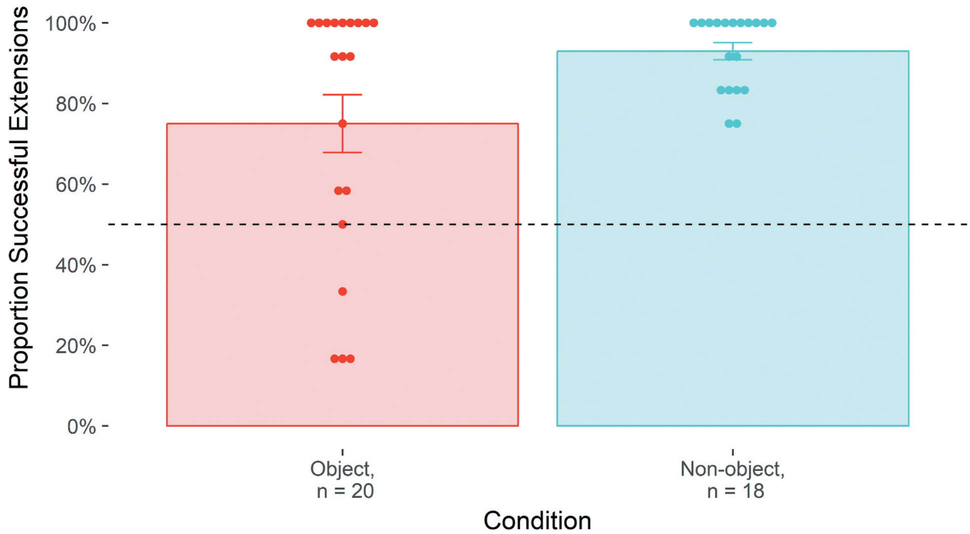

Figure 4. Proportion of trials on which children in Experiment 2 successfully selected the color-matched test image in each condition. Error bars represent ± 1 SEM.

interactions, *ps* > .1. As in Experiment 1, children in both the Object and Non-object conditions improved systematically over time, and children in both the Object, $p = .003$, and Non-object, $p < .0001$, conditions again performed significantly above chance overall.

Taken together, Experiments 1 and 2 provide evidence that the conceptual status of an individual plays a mediating role in children's extension of novel adjectives.[2] When children construe the referent of a novel adjective as an object, this poses an obstacle to extending that adjective broadly across different object kinds. When they construe the referent of a novel adjective as a non-object, however, children robustly extend novel adjectives broadly to new exemplars – even to new objects, and even without any additional conceptual or linguistic support.

Experiment 3

In Experiment 3, we adopt a wider developmental perspective, asking whether traces of this phenomenon might be evident even in adulthood. Adults are consummate adjective learners: there is no doubt that adults successfully extend adjectives broadly across different basic level kinds. It is possible, however, that conceptual status is so fundamental to the process of mapping adjectives to properties that it plays a role in the extension of novel adjectives for adults, as well as for children. We therefore predicted that adults would extend novel adjectives successfully, whether they were applied to objects or to non-objects, but that they would do so *more quickly* when construing the images as non-objects.

Method

Participants

Seventy-nine adult participants, all living in the U.S., were recruited from Amazon Mechanical Turk and paid .50 USD to complete a 3- to 5-minute study. Twelve additional participants were excluded, 6 for completing the study multiple times and 6 for browser incompatibility. Each participant was randomly assigned to either the Object or Non-object condition.

[2]Indeed, an analysis across studies found no main effect of experiment and no Experiment x Condition interaction, *ps* >.9. However, the combined analysis did reveal the predicted effect of condition, $X^2(1) = 4.78$, $p = .029$, and a positive linear effect of trial, $X^2(1) = 8.78$, $p = .003$.

Materials

Six sets of target and test images were drawn from Experiment 1. In addition, we constructed two filler trials for each condition. Each filler trial contained a target and two test images, but these images were *unambiguous*: images of familiar objects for the Object condition and images of amorphous blobs for the Non-object condition.

Procedure

In contrast to children, adult participants (i) read the instructions on the screen, and (ii) responded by pressing either the left or right arrow key as quickly and accurately as possible. In the introduction phase, we explained that they would be learning new words in a "mystery language" and that "children who knew the language had selected the exemplars of each word for them." As in Experiments 1 and 2, the novel words were novel adjectives referring to colors. All participants viewed the same images; what varied was whether they were described as "pictures of objects that children had painted" (Object condition) or as "blobs of paint that children had created by dumping the paint onto a big canvas" (Non-object condition).

Next, in the experimental phase, participants viewed a series of six experimental trials as well as 2 filler trials. See Figure 5. In each trial, participants first saw a target image, a written naming phrase with a novel adjective (e.g., "This blob/picture is blickish."), and a test question (e.g., "Which of these blobs/pictures is blickish?"). After 3 seconds, the matching and non-matching test images appeared; participants indicated their choice with a keypress. Trials were presented in one of two random orders. After every two experimental trials, we also included a filler trial. Filler trials, structured identically to test trials, were designed to maintain participants' construal of the images as either objects or non-objects. In the Object condition, the filler images were unambiguous objects; in the Non-object condition, the filler images were unambiguously not objects (i.e., amorphous blobs). On filler trials, the novel adjectives presented in both conditions described a surface property other than color (i.e., "striped," "dotted").

In all trials, we recorded both the image that participants selected and their reaction time. Trials with response times exceeding 5 seconds were excluded (<4% of all trials). Response times were log-transformed for analysis with linear models.[3]

Results and discussion

As predicted, adults were uniformly successful in extending novel adjectives broadly to the color-matched images in both the Object (M = .97, SD = .08) and Non-object (M = .99, SD = .05) conditions. Inaccurate trials were excluded from the subsequent response time analysis.

Also as predicted, adults' response times revealed the influence of their conceptual construal of the images. We constructed a model including fixed effects of condition, linear time and quadratic time, as well

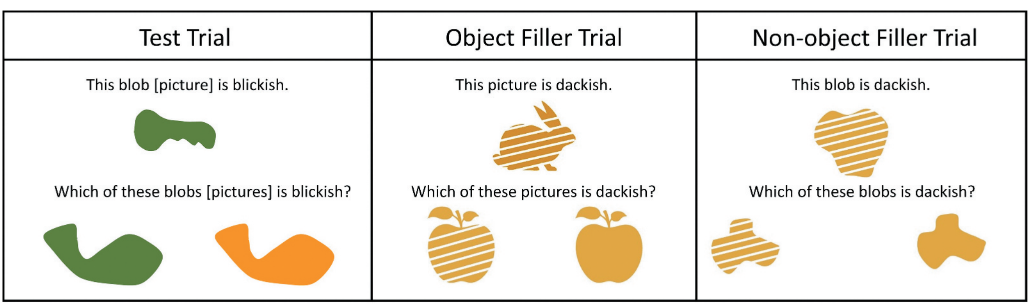

Figure 5. Sample trials from Experiment 3. Each participant completed the same six test trials, as well as two filler trials determined by the condition.

[3]Identical results are obtained with the inverse square root transformation suggested by a Box-Cox transformation.

as random effects of subject and item, with time-by-subject and condition-by-item random slopes.[4] This model revealed significant effects of linear and quadratic time, X^2s > 15, *ps* < .0001, suggesting adults improved over trials, as had children in Experiments 1 and 2. In addition, the effect of condition approached significance, $X^2(1) = 3.40$, $p = .065$, with adults in the Non-object condition (*M* = 1119 ms, *SD* = 466) showing a non-significant tendency to respond more quickly than those in the Object condition (*M* = 1293 ms, *SD* = 582). Moreover, these main effects were qualified by a significant interaction between condition and quadratic time, $X^2(1) = 6.22$, $p = .013$. See Figure 6. Over trials, reaction times in the Non-object condition decreased more quickly than those in the Object condition.[5] Post-hoc analyses revealed a significant effect of condition on Trials 3 and 4, *ts* > 2, *ps* < .05; on all other trials, *ps* > .1. This outcome suggests that construing an individual as an object may also interfere with adults' ability to extend an adjective broadly from that object.

General discussion

Taken together, the three experiments reported here demonstrate that the conceptual status of an individual (as either an object or a non-object) has consequences for the extension of a novel adjective applied to that individual. The extension of a novel adjective is governed not only by perceptual similarity between exemplars (cf. Locke, 1690) but by the way exemplars are conceptually represented. For both children (Experiments 1 and 2) and adults (Experiment 3), the conceptual status of an individual influenced the extension of novel adjectives. In each experiment, participants viewed

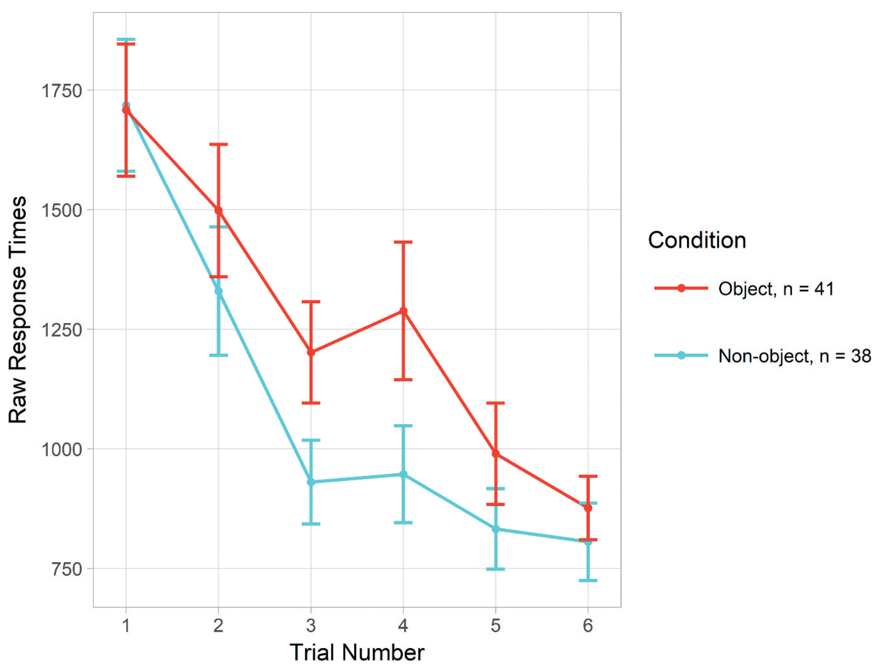

Figure 6. Adult reaction times in experiment 3, plotted over trials. Raw reaction times are plotted, though analyses were conducted with log-transformed reaction times. Error bars represent ± 1 SEM.

[4]Preliminary model fitting suggested that the quadratic time effect significantly enhanced model fit over a model with only linear time, $X^2(4) = 21.4$, $p = .0003$.

[5]While the comparison of interest was the effect of condition on the perceptually matched ambiguous stimuli trials analyzed above, we also observe a significant effect of condition on the filler trials that is consistent with the prediction. Adults extended adjectives significantly more slowly in the Object condition, when filler trials featured unambiguous objects, (*M* = 1652 ms, *SD* = 1013) than in the Non-object condition, when filler trials features unambiguous blobs (*M* = 1155 ms, *SD* = 664), $X^2(1) = 10.6$, $p = .001$.

precisely the same images in all conditions. When participants construed an image as an object, this presented an obstacle to extending an adjective from that image to others. In contrast, when participants construed the very same image as a non-object, learners extended the novel adjective broadly and swiftly. Remarkably, this effect persisted even when children were asked to extend an adjective from a "blob" to an unambiguous object. This reveals that construing the *target* image as a non-object enabled children to form a robust representation of the adjective-property mapping.

Moreover, to the best of our knowledge, children's broad extension of novel adjectives in the Non-object condition of Experiment 2 constitutes the first experimental evidence that 3-year-old children successfully and consistently extend novel adjectives from a single individual to exemplars of new object kinds. Until now, children had succeeded in extending novel adjectives to new object kinds (i.e., kinds to which the adjective had not been previously applied) only with the considerable support of comparing the adjective's application to other objects (e.g., Klibanoff & Waxman, 2000; Mintz, 2005; Mintz & Gleitman, 2002; Waxman & Klibanoff, 2000; Yoshida & Hanania, 2013). Here, we demonstrate near-ceiling accuracy in children's adjective extensions from a single individual – when that individual is construed as a non-object. Children's remarkably accurate extensions in the Non-object conditions (90% or better in both experiments) provide compelling evidence that adjective extension is broad and robust when its original referent is not construed as an object. Indeed, the force of conceptual status is evident even for adults: although adults nearly always extended novel adjectives correctly, they did so more quickly when they construed the images as non-objects.

These parallel findings for both children and adults provide support for the proposal that the extension of novel adjectives occurs at the interface of our linguistic and conceptual systems. Learners of all ages must navigate this interface, assessing how, and how broadly, a novel adjective should be extended beyond the referent on which it was introduced.

As learners navigate this linguistic-conceptual interface, there are at least two ways in which construing an individual as an object might restrict the extension of an adjective applied to that individual. First, children may struggle to extend that adjective broadly across object kinds because while they have correctly mapped the adjective to its target property, they require additional evidence about how that adjective (e.g., red) applies across diverse object kinds (e.g., to a red car vs. a red dog) (Klibanoff & Waxman, 2000; Mintz & Gleitman, 2002; Waxman & Klibanoff, 2000). If this is the case, then construing the referent as a non-object, and therefore not a member of any object category, should eliminate this restriction, enabling children to extend the adjective broadly. This account is consistent with the evidence reported here; it is also compatible with extensive evidence documenting the powerful role of objects and object kinds in children's learning and reasoning (Anderson et al., 2018; Christie et al., 2007; Gentner & Toupin, 1986; Hoyos et al., 2016; Loewenstein & Gentner, 2005; Markman, 1990).

A second possibility is that construing an individual as an object or non-object has consequences for which of that individual's properties learners consider to be the most likely candidates for a novel adjective's meaning. For instance, because shape properties are associated with many object kinds, shape can be an especially salient candidate meaning for novel words applied to objects (Smith et al., 1992, 2002; Vlach, 2016). However, because shape is not as tightly associated with non-object (substance) kinds, shape may be a less salient candidate meaning for novel words applied to non-objects. As a result, other properties of the individual, including its color and texture, should become more salient (Prasada et al., 2002; Soja et al., 1991). Although this possibility does not directly account for children's performance in previous work (Mintz, 2005; Waxman & Klibanoff, 2000), it may contribute to their performance in the current task.

Moreover, these two alternatives are not mutually exclusive: both may play a role in adjective learning, and both offer plausible interpretations of the results reported here. In future work, it will be important to pursue both alternatives to clarify their relative influences on children's breadth of extension for novel adjectives.

In sum, the current results reveal a clear effect of conceptual status on adjective learning: construing an image as a non-object yielded remarkably accurate adjective extensions in children and faster adjective extensions in adults. These parallel findings illustrate the importance of the interactions between linguistic and conceptual systems throughout development.

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Disclosure statement

No potential conflict of interest was reported by the authors.

Data availability statement

The data that support the findings of this study are openly available on the Open Science Framework at http://doi.org/10.17605/OSF.IO/3H2EB

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Appendix.

Flexible image stimuli for Experiments 1-3

Object construal	**Image**
Ice cream cone	
Flag	
Comb	
Dragonfly	
Mitten	
Whale/Fish	
Key	
Hammer/ Shovel	
Hat	
Spoon	
Car / Turtle	
Flashlight