Intentionality and the Role of Labels in Categorization

Felix Gervits (Felix.Gervits@tufts.edu)
Tufts University, Human-Robot Interaction Laboratory, 200 Boston Avenue
Medford, MA 02155

Megan Johanson (megan.johanson@gmail.com)
University of Delaware, Department of Psychological and Brain Sciences, 401 Wolf Hall
Newark, DE 19716

Anna Papafragou (APapafragou@psych.udel.edu)
University of Delaware, Department of Psychological and Brain Sciences, 401 Wolf Hall
Newark, DE 19716

Abstract

Language has been shown to influence the ability to form categories. Here we investigate whether linguistic labels are privileged compared to other types of cues (e.g., numbers or symbols), and whether labels exert their effects regardless of whether they are introduced intentionally. In a categorization task, we found that adults were more likely to use labels to determine category boundaries compared to numbers or symbols, and that these effects persisted in all intentionality manipulations. These findings suggest that labels have a powerful effect on categorization compared to other cues; most strikingly, labels (but not other cues) are used during categorization even when people are specifically asked to ignore them. These results provide novel support for the position that labels indicate category membership.

Keywords: categorization; labels; intentionality, category markers

Introduction

The formation of categories is an essential aspect of cognition found to some degree in all animals. Humans, however, are the only species known to incorporate language into their representational categories. Categorization can be defined as the grouping of discriminable properties, objects, or events into classes. It is generally recognized to be a complex process relying on a variety of cues: including perceptual (Oakes & Rakison, 2003), conceptual (Booth & Waxman, 2002) and linguistic (Casasola & Bhagwat, 2007). Though categories can be formed without linguistic labels, it is well-known that the presence of labels facilitates categorization by drawing attention to shared features, relations, or actions (Waxman & Markow, 1995). For instance, when two objects are given the same label, people tend to think of them as more similar to each other compared to when objects do not share a label (Goldstone, 1994). Moreover, people rely more on labels than on perceptual features in making category decisions when the two cues conflict (Deng & Sloutsky, 2012; Sloutsky, Lo, & Fisher, 2001). In cases where perceptual information does not give adequate cues for category formation, a label helps group objects into broad categories based on perceptual features (Johanson & Papafragou, 2016). Even completely redundant labels have been shown to influence the way people learn novel categories (Fisher, 2010; Hoffman & Rehder, 2010; Lupyan, Rakison, & McClelland, 2007).

The studies described above show a powerful effect of labels on the categorization process, but it is not clear whether similar effects will occur in the presence of non-linguistic cues. Some perspective on this issue is provided by Lupyan (2006), who demonstrated that the labeling advantage normally attributed to words can apply to other highly correlated environmental cues as well, and that words are not the only cues that can serve as category markers. Others, however, find support for the idea that labels are indeed privileged as categorization cues. For example, Lupyan et al. (2007) found that adults learned to categorize "aliens" faster after learning novel labels for them compared to seeing behaviors that indicated where the aliens lived. In another study, Lupyan and Thompson-Schill (2012) found that verbal labels (e.g., "dog") activate visual information more quickly and reliably than nonverbal sounds (e.g., a dog barking). Together these data support the view that labels serve as category markers (Gelman & Davidson, 2013). On this position, labels function as an invitation to form categories (Waxman & Markow, 1995): "[e]xactly what makes a dog a dog, or a lamb a lamb, may be unknown [...], but a category label can serve as a placeholder that a reason exists" (Jaswal & Markman, 2007).

Though it has been widely assumed that adults understand the linguistic significance of labels (Markman & Ross, 2003; Yamauchi & Markman, 2000), some argue that labels do not serve to mark categories, but rather are interpreted as highly salient object features (Anderson, 1991; Gliozzi, Mayor, Hu, & Plunkett, 2009; Perfors & Navarro, 2010). In support of this view, Deng and Sloutsky (2012) found that not all adults displayed label-consistent responding when a novel label was pitted against a highly salient feature (moving head) in an induction task. In a categorization task, Perfors and Navarro (2010) found that labels directed attention away from other object features, suggesting that in this way they behave more like salient features rather than cues to category membership. These results suggest that perhaps labels are not always treated as category markers for adults.

At present, however, several issues remain about the potency of labels as categorization cues. Notice that, in virtually all previous studies that have pointed to a strong role for language in categorization, linguistic labels were introduced intentionally by the experimenter. Specifically, labels were almost always presented intentionally alongside a newly-introduced exemplar of a category (e.g., "This is an X") and were explicitly linked to a kind, not to the individual exemplar itself (Deng & Sloutsky, 2012; Lupyan et al., 2007; Yamauchi & Markman, 2000). Since in these studies labels were presented intentionally as part of the task instructions, it is perhaps not surprising that adults took the labels to be relevant to the task. It is possible that participants in a similarity judgment task may develop a strategic bias to respond to the expectation that items that have just been labeled alike should belong to the same category without actually integrating the information from labels with perceptual cues and other information about the categorical structure of the stimuli (Goldstone, Lippa, & Shiffrin, 2001). A more stringent test of the theoretical position that labels are interpreted as category markers would involve dissociating the information carried by the labels from the intentional act of labeling the stimuli during the categorization task. Furthermore, it is important to compare labels to other symbolic (but non-linguistic) cues under the same intentionality conditions to ascertain that labels produce unique and powerful effects on categorization.

To our knowledge, there have not been any studies that addressed this problem in adult categorization. A relevant study from the child literature showed that 4-year-olds were influenced by the communicative intent of an adult speaker in making categorical inferences (Jaswal & Markman, 2007). For example, children were willing to accept that a cat-like animal was a dog only if the speaker made this explicit (e.g., "This is actually a dog"). This suggests that intentionality of verbal cues can have a powerful influence on the formation of categories. Other work has shown that young children learned to associate novel words and even nonverbal sounds to objects, but only when these stimuli were presented in a referential context (Campbell & Namy, 2003; Tomasello & Barton, 1994). These findings are important because they disentangle intentionality from the cues, showing that the manner in which the cues are presented is as important as the linguistic (or non-linguistic) nature of the cue.

Present Study

In this paper, we present the first study to examine the role of intentionality on adults' reliance on labels (and other cues) during categorization. We presented adults with a task in which they had to form categories for novel natural kind exemplars (e.g., flowers or birds) that were perceptually equidistant (perceptual information gave no indication of category membership) from two Standards. We asked whether a shared novel label (noun) might motivate adults to group such perceptually ambiguous stimuli with one of the two Standards. We also compared the usefulness of labels to other cues such as numbers and symbols that do not refer to object kinds. We chose numbers because, unlike nonsense labels, they are familiar and meaningful - yet numbers may lack the referential capacity that labels possess. We chose arbitrary symbols (which were simply the number cues rotated 90 degrees horizontally) because, unlike labels and numbers, they have little or no meaning (even though in terms of low-level perceptual features they were identical to the numbers). A crucial difference from previous studies was that the cues were presented in written, not auditory, format and were never explicitly introduced by the experimenter (e.g., labels never appeared in sentences such as "This is an X"). This design allowed us to manipulate global information about the intentional relevance of the cues given to participants in the beginning of the experiment, such that cues were presented as intentional, accidental or neutral (unspecified).

The present design also allowed us to address specific - but currently untested - hypotheses about the role of language in adult categorization, especially in the absence of convergent perceptual cues about the structure of a category. If human beings treat labels as category markers, adults' use of labels should be sensitive to the intentionality (and hence task-relevance) of the naming contexts; there is evidence that, at least in children, this is the case (Campbell & Namy, 2003). Cues such as numbers or symbols might also function as an invitation to form categories when intentionally introduced alongside novel exemplars of a category. Crucially, however, adults' reliance on such cues should be limited compared to labels across intentionality manipulations: unlike labels, numbers and symbols cannot be referentially linked to the natural kind categories in the experimental stimuli. The potency of numbers or symbols should diminish or disappear altogether when these cues are not accompanied by clear communicative intent.

Methods

Participants

A total of 180 English-speaking adults were used as participants in the study. They were recruited from Introductory Psychology courses at the University of Delaware and were given partial course credit for participating.

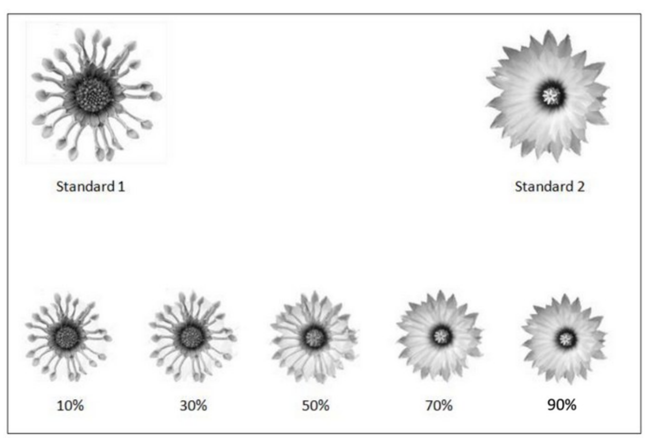

Figure 1: Sample set of Standards and Target

Stimuli

Four sets of black-and-white stimuli were created: one set of birds, two different sets of flowers, and one set of fish. Each of these sets consisted of photographs of two stimuli (Standards) that were morphed through a commercial morphing program into 5 different stimuli (Targets) along a scale of varying similarity to the originals (Johanson & Papafragou, 2016). Each Target was 10%, 30%, 50%, 70% or 90% similar to one of the Standards (see Figure 1). The 10% and 30% Targets were always perceptually closer to Standard 1, whereas the 70% and 90% Targets were always perceptually closer to Standard 2. The 50% Target was perceptually ambiguous, i.e., equidistant from the Standards. To confirm these rankings, a separate group of 13 adults was presented with triads consisting of the two Standards and each of the Targets and was asked which of the Standards each Target went with. People in this group were highly accurate with the 10%, 30%, 70% and 90% (unambiguous) trials (M = .96) but were at chance with the 50% (ambiguous) trials (M = .58).

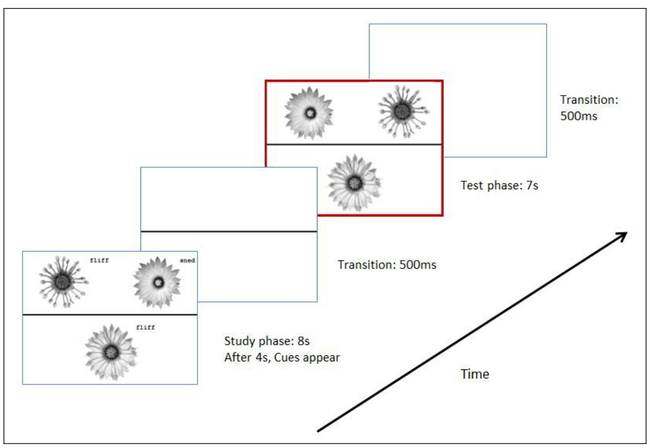

Figure 2: Sample ambiguous trial

Within each of the four stimuli sets, there were five trials for a total of 20 trials. Each trial included a triad display, with the two Standards on top, and a morphed Target image (the 10%, 30%, 50%, 70%, or 90% Target) at the bottom, separated from the standards by a solid line. This triad display was presented for 8 seconds (Study phase). Then the objects disappeared for 500ms but the solid line remained. The objects reappeared with a red border surrounding the display and stayed on the screen for 7 seconds (Test phase). All five trials within a set were presented in block sequence. The fourth trial in each set was always the ambiguous (50%) trial, but the order of the unambiguous trials varied randomly for each set. Blank screens marked transitions between trials within a set (500ms) and between sets (2s). For half of the participants, the left-right position of the Standards was switched in the Test phase so as to prevent any side associations.

Within each set, visual cues appeared 4 seconds (halfway) into the Study phase for the ambiguous trial and for one additional, randomly selected trial that came before the ambiguous one (Cue Trials). Three cues appeared simultaneously within each display, with each one being matched to one of the natural-kind exemplars (Standards and Target) in a triad. Each cue would appear in the top-right corner of each exemplar, blink twice and then stay on for another 2s until the end of the Study phase for that trial. The cue for the Target was identical to the cue for one of the Standards. In the ambiguous Cue trials, the cue for the Target arbitrarily matched that of either the left or right Standard. In the unambiguous Cue Trials, the Target cue always respected the perceptual similarity between Target and Standards. The assignment of cues to Standards and Target was counterbalanced across participants. See Figure 2 for a sample trial progression.

Table 1: Sample cues

Cue	Example	
Label	lorp	pim
Number	3	6
Symbol	Ш	Г

There were three types of Cues: Labels, Numbers, and Symbols. Participants were randomly assigned to one of three groups depending on Cue type. The labels were “lorp” and “pim” (bird set), “fliff” and “sned” (1st flower set), “blick” and “dax” (2nd flower set), “hep” and “moof” (fish set). The numbers were 6 and 3, 1 and 5, 2 and 7, 8 and 4 for the corresponding sets, presented in a distinctive font. The symbols were the number cues rotated 90 degrees clockwise and hence were identical to numbers in terms of low-level visual properties (Lupyan & Spivey, 2008). See Table 1 for examples of the cues.

Procedure

Participants were tested in small groups in front of a projector screen which displayed the stimuli. Within each Cue group, participants were randomly assigned to one of three Conditions (Neutral, Accidental, Intentional) depending on the instructions given to them in the beginning of the session. Instructions were read aloud to all participants. In the Neutral condition the instructions were as follows: “In this experiment you will be presented with a series of slides, each containing three images. Your task is to determine as best you can which of the two top images the bottom image best goes with. Each slide will appear twice. The first time, you will have 8 seconds to inspect the slide. The slide will briefly disappear and reappear again with a red border around it. Your task then will be to mark down on your answer sheet which of the top two images the bottom image on the slide best goes with. Mark L if the bottom image goes with the top left image or mark R if the bottom image goes with the top right image. Pay attention as the position of the top two images may have been switched around between the first and second time you see the slide. Please only write your answers when you see the red border around the slide". In the other two conditions, there was additional information at the end of these instructions. People in the Accidental condition were casually told: "We've been having issues with our software this week so occasionally you might see random messages displayed on the screen. These are actually a glitch from another experiment so please disregard them as they are irrelevant to your task". People in the Intentional condition were told: "Pay attention to all information on the screen as it will be helpful in your task". Participants marked their responses sequentially on an answer sheet.

Results

We first examined the percentage of correct responses for unambiguous trials (10%, 30%, 70% and 90%). On these trials, correct responses were those that conformed to perceptual similarity. As expected, performance was highly accurate on the three unambiguous trials per set that were presented without cues in all Cue (M_L = .99, M_N = .98, M_S = .97) and Condition subgroups of participants (M_N = .99, M_A = .98, M_I = .98). Similarly, for the one unambiguous trial per set that were also presented alongside cues, performance was at ceiling across Cue (M_L = .99, M_N = .99, M_S = .97) and Condition sub-groups of participants (M_N = 1.00, M_A = .99, M_I = .97). Thus participants were successful in categorizing the unambiguous stimuli with or without additional cues.

We then looked at ambiguous (50%) trials (see Figure 3). A two-way ANOVA was carried out using the percentage of cue-based responses on these trials as the dependent variable and Cue (Label, Number, Symbol) and Condition (Neutral, Accidental, Intentional) as between-subjects factors. The ANOVA revealed a significant main effect of Cue, $F(2, 171)$ = 14.898, $p < .001$; M_L = .80, M_N = .65, M_S = .58. Planned comparisons with Bonferroni corrections showed that Labels led to better categorization performance compared to Numbers ($p < .005$) or Symbols ($p < .001$) but there was no significant difference between Numbers and Symbols (p = .265).

The analysis also returned a significant main effect of Condition, $F(2, 171)$ = 13.779, $p < .001$; M_I = .79, M_N = .68, M_A = .58. Planned comparisons with Bonferroni corrections showed that performance in the Intentional condition was significantly higher than either the Accidental ($p < .001$) or the Neutral condition ($p < .05$). Moreover, performance in the Neutral condition was higher compared to the Accidental condition (p = .05). Interaction effects between Cue and Condition were not statistically significant, $F(4, 171)$ = .922, p = .452.

As Figure 3 shows, performance with Labels was significantly different from chance in all conditions (Neutral: M_L = .84, $t(19)$ = 9.0, $p < .001$; Accidental: M_L = .71, $t(19)$ = 4.07, $p < .005$; Intentional: M_L = .86, $t(19)$ = 10.72, $p < .001$). By contrast, performance with Numbers and Symbols was at chance-level in both the Neutral (M_N = .60, $t(19)$ = 1.90, p = .072; M_S = .59, $t(19)$ = 1.38, p = .185) and the Accidental condition (M_N = .55, $t(19)$ = .89, p = .385; M_S = .46, $t(19)$ = -.62, p = .545), and differed from chance only in the Intentional condition (M_N = .81, $t(19)$ = 7.11, $p < .001$; M_S = .70, $t(19)$ = 4.29, $p < .001$). In sum, all cues were used at above-chance levels when presented intentionally. However, labels were the only cue to be utilized at above-chance levels in all intentionality conditions.

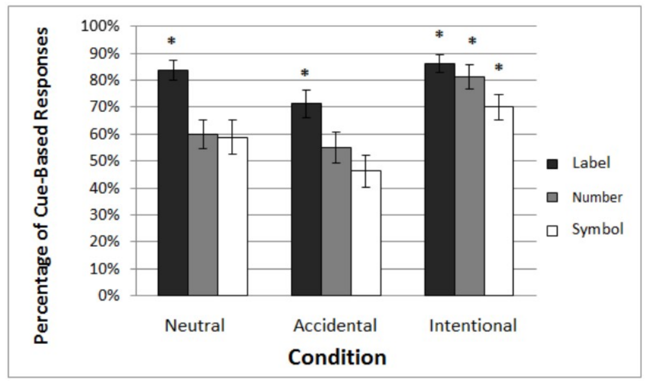

Figure 3: Percentage of cue-based responses for ambiguous trials. Error bars represent standard error of the mean. * reflect significant difference from chance (50 %) performance ($p < .05$)

General Discussion

Summary of Results

In most, if not all, prior demonstrations of the role of labels on adult categorization, the contribution of the representational content of the labels cannot be easily distinguished from the experimenters' intention to direct attention to the labels (and possibly their task relevance) within the categorization task. For the same reason, the potency of labels in adults remains to be compared to that of other, intentionally communicated cues. The present study was the first to compare the role of different levels of intentionality and different cue types (labels, numbers, symbols) in adult categorization.

Overall, we found that labels were particularly potent in influencing category decisions about perceptually indeterminate exemplars of novel natural kinds when compared to other cues such as numbers and symbols. Furthermore, for all cues, intentionality affected peoples' willingness to treat the cues as task-relevant. A particularly interesting finding was that the role of labels persisted throughout various levels of intentionality. People used novel labels to constrain their categorization decisions even when the labels were not tied to a specific communicative intent (Neutral condition). Perhaps most strikingly, people used novel labels even when they were instructed to ignore them (Accidental condition). By contrast, numbers and symbols were used only when their relevance to the task was explicitly highlighted (Intentional condition). These findings break new ground by providing novel support for the position that labels indicate category membership.

Labels as Category Markers

Clarifying the source and boundaries of the effects of labels on category formation is theoretically important, especially for the widely held perspective that labels are inherently category markers and have a privileged connection to kinds because of their representational, or semantic, content (Balaban & Waxman, 1997; Gelman & Davidson, 2013; Gelman & Markman, 1986). This position can naturally accommodate the fact that the use of labels during categorization should depend on the nature of the intentional context in which the labels are presented, and that other cues might shape categorization of novel kinds if accompanied by strong intentional indications. Crucially, however, this position expects that labels (because of their representational nature) should shape category formation even if the experimenter does not direct participants' attention to the labels and/or their potential significance within the task. Furthermore, this view predicts that, across contexts that differ in intentionality, adults should assume that labels are uniquely helpful for categorization compared to other symbolic cues that do not have a privileged representational connection to kinds. All of these predictions of the position that labels are category markers were confirmed in our data.

Taken together, our findings show that the effect of labels during categorization cannot simply be attributed to broad effects of intentional communication that could be achieved with any symbolic representation. Even though communication in general carries a presumption of relevance and is therefore expected to yield "cognitive effects" for the hearer (Sperber & Wilson, 1986), linguistic labels create the expectation of a specific type of cognitive effect - here, kind reference - that is not readily shared by other symbols. By the same token, our findings show that adults do not approach the categorization task through a strategy to use whatever cue they are presented with to base their category decisions (Goldstone et al., 2001). For similar reasons, our results cannot be explained solely by the idea that labels function by directing peoples' attention towards certain kinds of groupings of exemplars over others and encouraging the extraction of similarities (Smith, Jones, Landau, Gershkoff-Stowe, & Samuelson, 2002), since in principle all cues in our studies could function in that way. The specific and unique effects of labels suggest that adults use sophisticated and rich conceptual reasoning to determine which kinds of information are relevant to kind membership and under what circumstances - exactly as predicted by the position that labels are privileged types of invitations to form categories.

The fact that a newly-presented label was used to guide the categorization of unfamiliar stimuli even when people were given reason to treat the label as accidental might appear surprising, even unexpected, under the theoretical position that humans treat labels as category indicators. We believe that the reason participants did not completely disregard accidental labels was that, despite global information about the lack of intentionality of the experimental cues, the labels appeared to have properties compatible with intentional status: most importantly, they accompanied stimuli that could still be taken as their referents (since there was no mismatch between the labels and the visual evidence for the structure of the novel categories).

This interpretation of our findings is reminiscent of evidence of sensitivity to speaker intent in the developmental literature on categorization which suggests that when the intentional link between a label and a category is drastically severed (e.g., when the source of the label is non-human), even very young learners recognize that labels should not be linked to categories. In one demonstration, 15-month-old infants used labels to form categories only when the labels were presented orally but not when they were presented by a voice recorder (Fulkerson & Haaf, 2003). Similarly, 13- and 18-month-old infants learned to associate novel words and even nonverbal sounds to objects when the objects were embedded in a referential context (e.g., named by the experimenter), but not when they were embedded in a non-referential context (e.g., named through a baby monitor) (Campbell & Namy, 2003).

One alternative interpretation of our results is the possibility that labels were used to such a high degree because they were taken to denote the natural kind depicted by the stimulus. Notice that, unlike past experiments, labels in the present study were presented visually, were not introduced intentionally (Accidental condition), and were not even identified as linguistic stimuli. As a result, we cannot be sure that participants interpreted the novel letter strings we presented them with as labels. Thus it remains possible that the special status of labels could be due to alternative factors that do not have to do with their representational potential (but rather with, e.g., the ease of associating visual stimuli of flowers or birds to word-like forms compared to numbers or symbols, or the greater salience of labels compared to the other cues). Investigating these factors should provide a promising direction for future studies. One other direction for future work is to better disentangle the effects of attention from intentionality. For example, it is possible that people in the Accidental and non-label conditions of our study simply did not pay attention to the cues. However, if attentional mechanisms are responsible for the effects we observed, then it is unclear as to why nonsense labels, but not other cues, were consistently attended. Future studies will need to examine different types of label cues to see if these cues are similarly attended to, and affected by intentionality.

Conclusion

In support of previous findings, we demonstrated that labels have a privileged role in categorization and are used to group objects into broad categories. The present study also included novel manipulations of intentionality that were purposefully removed from actual interactions with an interlocutor. Nevertheless, we found that when participants' attention was directed towards a symbolic cue (a number or an arbitrary symbol) through global linguistic information about the experimenter's intent, participants treated these cues as guides to kind membership at rates above chance; in the absence of intentional information, these cues were not reliably used. Labels were used during categorization in all intentionality manipulations, and even when people were specifically asked to ignore them. These findings lend support to the position that labels serve as category markers for adults, and also confirm the strong role of intentionality (especially in communicative contexts) for learning novel information.

Acknowledgments

This work was partly supported by NSF grant BCS-0641105 to A.P. that supported the graduate research performed by F.G.

References

Anderson, J. R. (1991). The adaptive nature of human categorization. *Psychological Review*, *98*(3), 409.

Balaban, M. T., & Waxman, S. R. (1997). Do words facilitate object categorization in 9-month-old infants? *Journal of Experimental Child psychology*, *64*(1), 3–26.

Booth, A. E., & Waxman, S. (2002). Object names and object functions serve as cues to categories for infants. *Developmental Psychology*, *38*(6), 948–957.

Campbell, A. L., & Namy, L. L. (2003). The role of social-referential context in verbal and nonverbal symbol learning. *Child Development*, *74*(2), 549–563.

Casasola, M., & Bhagwat, J. (2007). Do Novel Words Facilitate 18-Month-Olds? Spatial Categorization? *Child Development*, *78*(6), 1818–1829.

Deng, W., & Sloutsky, V. (2012). Carrot-eaters and moving heads: Salient features provide greater support for inductive inference than category labels. *Psychological Science*, *23*, 178–186.

Fisher, A. V. (2010). Whats in the name? or how rocks and stones are different from bunnies and rabbits. *Journal of Experimental Child Psychology*, *105*(3), 198–212.

Fulkerson, A. L., & Haaf, R. A. (2003). The influence of labels, non-labeling sounds, and source of auditory input on 9-and 15-month-olds' object categorization. *Infancy*, *4*(3), 349–369.

Gelman, S. A., & Davidson, N. S. (2013). Conceptual influences on category-based induction. *Cognitive Psychology*, *66*(3), 327–353.

Gelman, S. A., & Markman, E. M. (1986). Categories and induction in young children. *Cognition*, *23*(3), 183–209.

Gliozzi, V., Mayor, J., Hu, J.-F., & Plunkett, K. (2009). Labels as features (not names) for infant categorization: A neurocomputational approach. *Cognitive Science*, *33*(4), 709–738.

Goldstone, R. L. (1994). The role of similarity in categorization: Providing a groundwork. *Cognition*, *52*(2), 125–157.

Goldstone, R. L., Lippa, Y., & Shiffrin, R. M. (2001). Altering object representations through category learning. *Cognition*, *78*(1), 27–43.

Hoffman, A. B., & Rehder, B. (2010). The costs of supervised classification: The effect of learning task on conceptual flexibility. *Journal of Experimental Psychology: General*, *139*(2), 319.

Jaswal, V. K., & Markman, E. M. (2007). Looks aren't everything: 24-month-olds' willingness to accept unexpected labels. *Journal of Cognition and Development*, *8*(1), 93–111.

Johanson, M., & Papafragou, A. (2016). The influence of labels and facts on children's and adults' categorization. *Journal of Experimental Child Psychology*, *144*, 130–151.

Lupyan, G. (2006). Labels facilitate learning of novel categories. In *The sixth international conference on the evolution of language* (pp. 190–197).

Lupyan, G., Rakison, D. H., & McClelland, J. L. (2007). Language is not just for talking redundant labels facilitate learning of novel categories. *Psychological Science*, *18*(12), 1077–1083.

Lupyan, G., & Spivey, M. J. (2008). Perceptual processing is facilitated by ascribing meaning to novel stimuli. *Current Biology*, *18*(10), R410–R412.

Lupyan, G., & Thompson-Schill, S. L. (2012). The evocative power of words: activation of concepts by verbal and non-verbal means. *Journal of Experimental Psychology: General*, *141*(1), 170–86.

Markman, A. B., & Ross, B. H. (2003). Category use and category learning. *Psychological bulletin*, *129*(4), 592–613.

Oakes, L., & Rakison, D. (2003). Issues in the early development of concepts and categories: An introduction. *Early category and concept development: Making sense of the blooming, buzzing confusion*, 3–23.

Perfors, A., & Navarro, D. J. (2010). How does the presence of a label affect attention to other features? In *Proceedings of the 32nd annual conference of the cognitive science society.*

Sloutsky, V. M., Lo, Y.-F., & Fisher, A. V. (2001). How much does a shared name make things similar? linguistic labels, similarity, and the development of inductive inference. *Child Development*, *72*(6), 1695–1709.

Smith, L. B., Jones, S. S., Landau, B., Gershkoff-Stowe, L., & Samuelson, L. (2002). Object name learning provides on-the-job training for attention. *Psychological Science*, *13*(1), 13–19.

Sperber, D., & Wilson, D. (1986). *Relevance: Communication and cognition*. Oxford: Blackwell.

Tomasello, M., & Barton, M. E. (1994). Learning words in nonostensive contexts. *Developmental psychology*, *30*(5), 639.

Waxman, S. R., & Markow, D. B. (1995). Words as invitations to form categories: evidence from 12- to 13-month-old infants. *Cognitive Psychology*, *29*(3), 257–302.

Yamauchi, T., & Markman, A. B. (2000). Inference using categories. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *26*(3), 776.