

## How Words Get to Be Names

Eliana Colunga and Linda B. Smith  
Indiana University

*When the world ends, it will  
be like when the names of things  
are changed during the peyote  
hunt. All will be different, the  
opposite of what it is now.*

-Huichol Proverb

The relation between an object and its name is special. This is recognized in writings across cultures and times and seems true in the minds of children as well. The developmental evidence, however, suggests that names acquire their special status as children learn words.

One critical finding was reported by Woodward and Hoyne (1999). They presented children with two novel objects and labeled one of them (the target object). In the Word condition they paired the target object with a word (This is a tomato), in the Sound condition they paired the target object with a non-linguistic sound, such as a tone. Children were then asked to Get the tomato or Get the <tone> to test whether they had associated the label with the object. They asked: Do children treat only words as possible names or do they accept tones as possible names? Their results indicate that the answer to this question depends on the developmental level of the child. Thirteen month-old infants will associate both a word and a non-linguistic sound with a target object. In contrast, 20-month-olds will associate a word to a target object, but not a non-linguistic sound. Namy and Waxman (1998) have similar results for 18- and 26-month-olds contrasting words and gestures. While the younger group will associate both a novel word and a novel gesture with a target object (object category) the older will only associate the word to the object, not the gesture.

Both teams of researchers suggest that the older children did not associate nonwords with the objects because older children knew that nonwords were not possible names. The idea is that words become privileged as possible names; that the forms a name can take are open at the beginning and become more restricted with development. But how do words become names and thus privileged? What determines what counts as a name? What counts as a name? What makes a word a name?

In this paper we attempt to answer these questions. First, we offer an explanation of a mechanistic basis of this developmental trend. Then we present a first experiment that tests our explanation.

## 1. An Associationist Account

In the experience of a child, many events co-occur with attention to objects. Objects can be associated with expressions such as "look!" with gestures such as pointing, with actions related or unrelated to the nature of the object, with words related or unrelated to the object, with noises, etc. With experience, children learn that it is words, as object names, that predict category membership better. Hearing the name of the object brings the category to mind in a way that perceiving other correlates of the object does not. This, we propose, is because of the special way words correlate with categories. Importantly it is not simply strength of correlation. One's thumb and index finger co-occur systematically, but one cannot say that one refers to the other.

By our account, there are two parts to this specialness of the correlations that make words into names. First, there is one name (more or less) that goes with each category (more or less). So, the name of the category is a feature that all members of the category have in common while at the same time the name is a feature that distinguishes instances from members of other categories. This is illustrated in Figure 1. The word "ball" typically co-occurs with members of the category BALL, but not with members of the category DOG. Similarly, the word "dog" co-occurs with members of the category DOG, but not with members of the category BALL. In contrast, events like pointing and hearing "look!" will just as likely co-occur with both balls and dogs. Thus, it is the object names that are systematically linked to object categories, and not events like pointing or the word "look!"

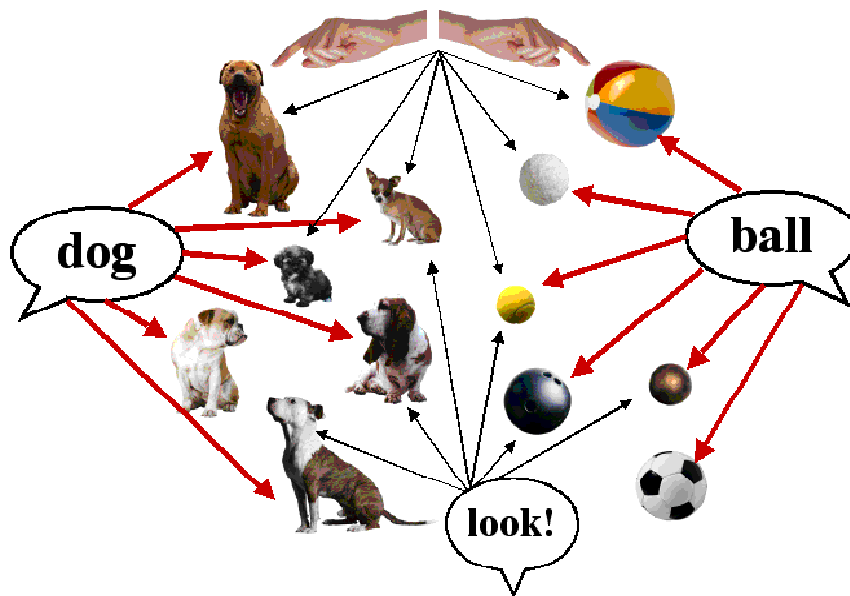


Figure 1. Object names systematically correlate with object categories.

It could be argued that there is something about all dogs that makes them a dog independent of having a name for the category. After all, even 3-4 month-old infants can distinguish pictures of dogs from, for example, cars. Whether infants have the category or concept of DOG or CAR or not, the fact remains that there is something about dogs and cars perceptually that allows them to distinguish members of the two categories. Why isn't the feature "dogness" or "catness" that is predictive of category membership not something that can be taken as a name, like a word?

By our account, being predictive is necessary but not sufficient. Being predictive of category membership is not enough. The second component that makes words special according to our proposal comes from the fact that words *as a domain* have this special function. In other words, if there were just one word that correlated with a category, words in general would not get an advantage. The fact that there are many words that point to categories is what helps children generalize this expectation to novel words.

So far we have made the case for words being special because of the way they correlate with categories. But what is it exactly that correlates with object categories in this way? What counts as a word —an object name—for children? According to our proposal, a name is simply the bundle of signals that systematically co-occurs with categories. These could be properties such as being a speech sound with particular spectral and prosodic forms, being produced by people, coming out of mouths, or co-occurring with pointing and eye gaze to the object. We propose that these are the properties that, with language learning, come to define what counts as a name for children.

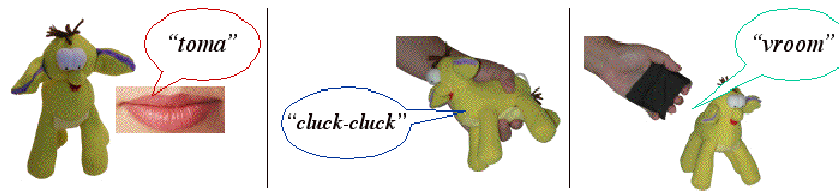
In summary, in our account what makes words privileged as names for objects is that they point to object categories, and any other features that systematically accompany words in this way will become relevant to being a name.

Thus, we make the following predictions:

**1. Events that co-occur systematically with object categories come to refer --- to be usable as names.** According to our story, any event domain that systematically predicts category membership will be taken as a name as well. Fortunately for the experiment we report here, in children's experiences include a domain in which something other than words co-occurs systematically with categories --- the domain of animals. Animal category correlates with animal sound: dogs bark, cats meow, elephants trumpet and so on. Thus our first prediction is that animal sounds should be taken as names for animals.

**2. What defines a name is the cluster of features that systematically co-occurs with categories.** This means that any strongly correlated feature of a name, even beyond what we think of as a word, will become an integral part of what is a name. For young children who rely on spoken language, words emanating from mouths is a highly systematic property of names. Therefore children should take coming from a mouth as one of the defining features of being a name. Thus, our second prediction is that if a word comes out of a place other than a mouth, young children will not take it as a name. Conversely, young children may take a non-word as a name if it emerges from a mouth.

We tested these two predictions. We selected children to participate who by Woodward & Hoyne and Namy and Waxman studies should already treat words as the only privileged naming events. To test the first prediction (that animal sounds can be used as names for animals) we named animal toys with different kinds of sounds: a word, an animal sound, and a mechanical sound. To test the second prediction (that emanating from the mouth was a defining feature of being a name) we made the names emanate from different sources: from the experimenter's mouth, from the toy animal itself, from a nearby object.



**Figure 2. The three starting canonical conditions.**

The three canonical conditions are shown in Figure 2. First, we had a spoken word used to name a toy. These are systematically correlated in the naming experience of children, since we normally use spoken words to name things. Second, we had an animal sound emanating from a toy animal when it was squeezed. These are also highly correlated because animals and animal sounds co-occur, but notice that the correlation is not so tightly tied to the source of the sound: animals make sounds; people also mimic the sounds animals make when they talk to children. Finally, we had an arbitrary sound (a mechanical motor sound) emanating from an arbitrary source (a small noisemaker held close to the toy animal). These should not be systematically correlated, since we don't use noisemakers to refer to things and since animals and mechanical sound do not usually go together.

In these three canonical conditions, two things are co-varying: the kind of sound (a word, an animal sound, an arbitrary sound) and its source (from the mouth, from the toy animal, from another object, the noisemaker). For our experiment we completed the 3x3 design as shown in Figure 3. Each child was exposed to three naming situations, one with each kind of sound (word, animal sound, arbitrary sound) all of them coming from one of the three sources (mouth, animal, noisemaker). So, for example, children in the Mouth condition saw and heard the experimenter say the word *toma* imitate the animal sound and imitate the mechanical sound as names for three different animal toys.

Note that, from Woodward and Hoyne study, we know what will happen in the Word-Mouth cell and in the ArbitrarySound-Noise-maker cell. Children should take the word as a name in the first case and reject the sound as a name in the second case. The questions are: will they accept the animal sound as a name? Will they accept any kind of sound emanating from the mouth as a name? Will they accept the word as a name regardless of where it comes from, or will the source matter?




		Source		
		Mouth	Animal	NoiseMaker
Sound	Word			
	Animal Sound			
	Arbitrary Sound			

Figure 3. The experiment had three different kinds of sound (Word, Animal Sound, Arbitrary Sound) as within-subject conditions and three different sources (Mouth, Animal, Noisemaker) as between-subject conditions.

## 2. The Experiment

### 2.1 Methods

**Subjects.** 36 20-26 month-old children participated in the experiment.

**Design.** We used a 3x3 mixed design with the three different sources (mouth, animal, noisemaker) as a between-subject variable and the three different sounds (word, animal sound, arbitrary sound) as a within-subject variable.

**Stimuli.** The stimuli consisted of two sets of six novel toy animals. The animals in the two sets were the same in all respects except in color, and one was used as the generalization of the other. All the animals fitted a small recorder inside them. The sounds used as names were the word 'toma', a recording of a frog sound as the animal sound, and a recording of a motor sound as the arbitrary sound.

**Procedure.** The experiment was preceded by a training phase. The goal of the training phase was to make sure that the child understood the task and could make clear choices. In this phase we presented the child with a familiar object (a ball, a spoon, a flower) and asked the child to 'get the ball' or 'spoon' or 'flower'. Once the child had done this, we put two familiar objects on the tray and asked the child to get one of them. The training was considered successful if the child retrieved the correct object twice from the tray with a distracter.

Each child heard three different kinds of names (Word, Animal Sound, Arbitrary Sound) in three blocks. Each block consisted of a Familiarization phase and a Test phase.

In the Familiarization phase the child was shown two toy animals and a name was supplied for one of them—the target object. The two objects were presented twice, one animal at a time. First the target animal was presented and named, and then the distracter animal was presented with the same phrases but

without a name. Then the target animal was presented and named again followed by the distracter animal.

In the Mouth condition, children heard the three kinds of label coming from the experimenter's mouth. When presenting the target object, the experimenter named it saying, "Look at this toma. Wow! See this toma? Look! Toma." In the Word condition, imitated the animal sound in the Animal condition ("Look at this <frog-like clucking>") and imitated the mechanical sound in the Arbitrary condition ("Look at this <motor-like sound>"). In the Animal condition all the names came from a tape recorder placed hidden inside the animal. For the Word condition we used a recording of the experimenter saying the word "toma" for the Animal Sound and Arbitrary Sound conditions we used recordings of the frog sound and motor sound respectively. Finally, in the Noisemaker condition the three kinds of sounds came from cloth-covered recorders that were held close to the toy animal being named. The distracter objects were always presented with the same phrases as the target objects, but without the name: "Look at this! Wow! See this? Look!"

In the Test phase the child was presented with two choices on a tray and asked to retrieve the target object. The test question was asked in the same manner as the naming in each condition. There were four test trials for each kind of sound; two test trials used the same animals as the ones used in the Familiarization phase and the other two were generalization trials, using the animals that matched the familiar ones in all aspects except for their color. Each child got a total of 12 trials.

The toys were randomly assigned to each condition for each child. The order of the three type-of-sound conditions was counterbalanced.

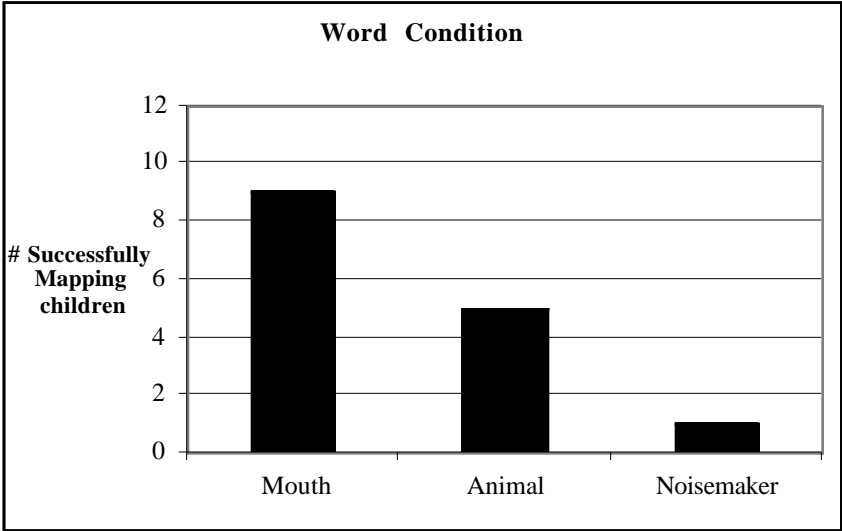
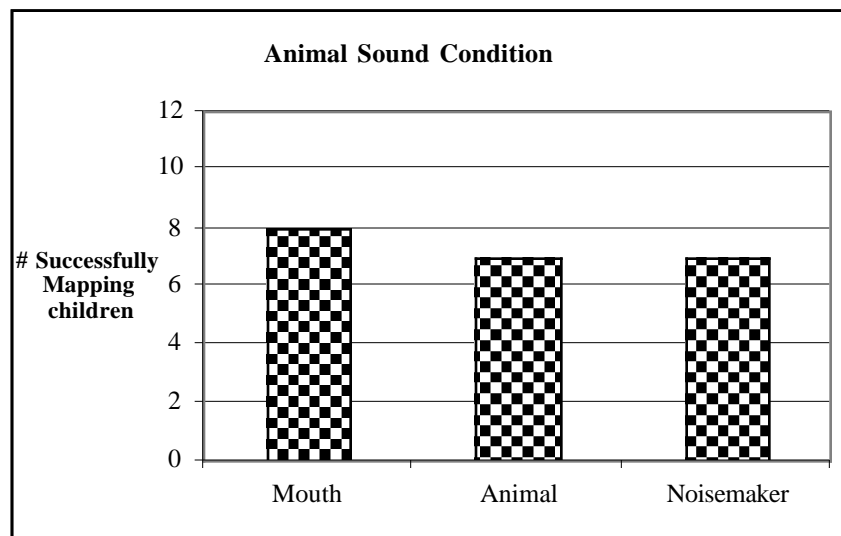


Figure 4. Children only accept the word as a name when it emanates from a mouth

## 2.2 Results

We coded children's choices as the first object they touched or took from the tray. Figures 4, 5 and 6 show the number of children who successfully mapped the name to the object category in the Word, Animal Sound and Arbitrary Sound conditions. We classified children as Successfully Mapping if they picked the target object when asked on three or more of the four trials.

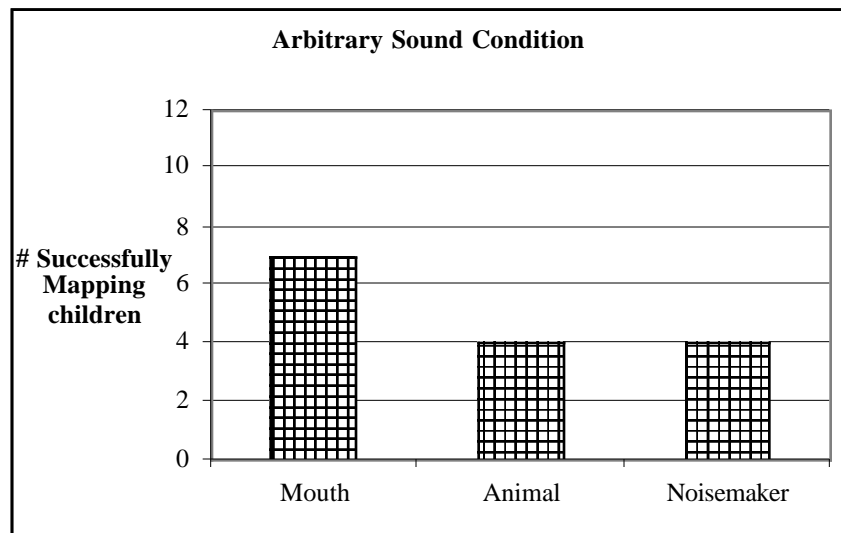
Figure 4 shows children's performance in the Word condition. Most children (9 out of 12) successfully mapped the word to the animal category when the word came from the experimenter's mouth. The number of children that successfully mapped the word to the animal category in the Mouth condition was reliably more than would be expected by chance ( $p < .01$ ). In contrast, the number of Successfully Mapping children in the Animal condition did not exceed chance ( $p > .1$ ), while the number of Successfully Mapping children in the Noisemaker condition was almost reliably below what would be expected by chance. In fact, only one child consistently retrieved the target object when the name was a word coming from a handheld noisemaker ( $p = .06$ ). Thus, children *only* accept the word as the name of an animal category when the word emanates from the mouth of the experimenter.



**Figure 5. Animal Sounds are accepted as names for animal categories regardless of the source of the sound.**

Figure 5 shows the results for the Animal Sound condition. The number of the Successfully Mapping children exceeded what would be expected by chance in all three conditions (Mouth:  $p = .01$ , Animal and Noisemaker:  $p = .03$ ). Children successfully associated the animal sound to the animal category regardless of the source of the sound. They did so whether the sound came from

the experimenter's mouth, from inside the animal or from a handheld noisemaker. So, children always accept the animal sound as the name of an animal category, regardless of the source from which the animal sound emanates.



**Figure 6. The arbitrary sound is accepted as a word only when it emanates from the mouth.**

Figure 6 shows children's performance in the Arbitrary Sound condition. When the sound used as a name was the arbitrary sound -- the mechanical motor sound -- the number of children successfully mapping the sound to the animal category only exceeded what would be expected by chance in the Mouth condition ( $p < .05$ ). The number of children that successfully mapped the mechanical sound with the animal category when the sound came from the Animal or from the Noisemaker did not reliably exceed chance ( $p > .2$ ). Arbitrary sounds are only accepted as names when they emanate from a mouth.

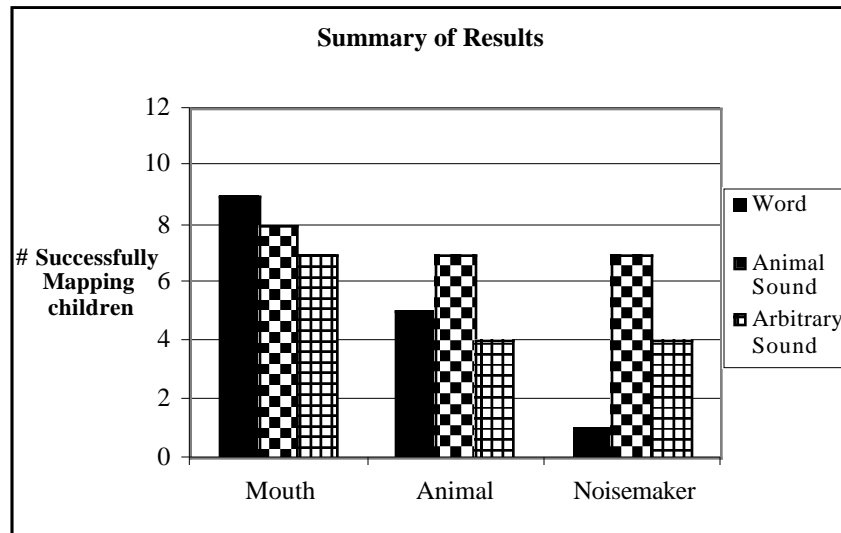
Figure 7 shows another view of the results. In short, any sound emanating from the mouth is taken as a name and animal sounds are taken as names regardless of where they come from.

### 3. Discussion

Our results replicate Woodard and Hoynes' study: words emanating from mouths are associated with object categories and arbitrary sounds emanating from handheld noisemakers are not associated with object categories. Furthermore, we have shown that words are *only* accepted as names when they come from the speaker's mouth, and not when they come from other sources, such as the object being named or a second object. We have also shown that



even an arbitrary sound, such as the buzz of a motor, will be taken as a name if it is produced by a human mouth. Thus, our experiment suggests that, for children at this age, it is not words that are taken as the privileged form of naming, but rather sounds made by a human mouth.



**Figure 7. Sounds from the mouth are always accepted as names; animal sounds are always accepted as names.**

Why are sounds emanating from mouths always taken as words? According to our account, this is because emanating from a mouth is one of the most systematically correlating features of naming situations. Another possibility that needs to be explored is that perhaps when produced by a human mouth even an imitation of a mechanical sound stops being arbitrary. Being made by a mouth may make any sound word-like (or animal sound-like).

Why are animal sounds taken as names for animal categories? According to our proposal, this is because animal sounds correlate with animal categories in much the same way as words correlate with object categories in general: one animal sound corresponds to one animal category, and animals typically are associated with a sound they make. However, one difference in our results between words and animal sounds is that the source of the name matters for the word, but not for the animal sound. This also fits with our associationist account: in children's experience, animal sounds are not specific to a source. They emanate from the mouths of real animals, from the inside of stuffed animal toys, and from mouths of people imitating animals. In contrast, words — as object names -- are typically produced by human mouths, and not by real or toy animals. Therefore the source will be part of what defines a word as a name, but not of what defines an animal sound as a name for an animal category.

#### 4. Conclusions

We have shown that words are only good as names when they emanate from mouths; that, in fact, any sort of sound emanating from a mouth will be taken as a name; and that animal sounds are good as names regardless of the source from which they emanate. Why this pattern? We believe that this pattern reflects the systematicity with which events correlate with categories in the world. Sounds from mouths typically name things, so they are taken as names even when they have unusual properties such as the imitation of a mechanical sound does. Animal sounds systematically correlate with animal categories, so these kinds of sound—from mouths, from the inside of toys or from noisemakers—are accepted as names.

Perhaps, before language learning, there is nothing special about words as names and there is nothing special about reference. All that a word is is a bundle of highly correlating features. All that reference is, is the association between a name—the bundle of highly correlating features -- and a category. Maybe children learn what is reference as they learn names, and they learn names as they experience words referring to object categories.

With more learning, what counts as a name should get more and more abstract, to the point in which emanating from a mouth may no longer be a crucial feature. However, this may be where it starts; in the systematicity with which events, such as spoken words or animal sounds, refer to categories. This systematicity may be the source of our belief in the deepness of the tie between names and things.

#### References

- Namy, L. L., & Waxman, S. R. (1998). Words and Gestures: Infants' Interpretations of Different Forms of Symbolic Reference. *Child Development, 69*, 295-308.
- Woodward, A. L., & Hoyne, K. L. (1999). Infants' Learning about Words and Sounds in Relation to Objects. *Child Development, 70*, 65-72.