Iconicity Sources and Feature Selection in the Visual-Manual Modality*

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Abstract: Unrelated sign languages share a lot of iconic signs that appear to be similar either due to cultural motivations or due to the features of the referent they represent. In this study, I investigate factors that might lead to favoring some features over others in iconic representations (and thus leading to the overlap in sign forms cross-linguistically). I investigate this by having hearing, sign-naïve native speakers of English invent gestured names for easily recognizable objects. I find that objects belonging to the same conceptual categories tend to share the sources of iconicity they are represented with. I conclude that naming in the visual-manual modality is a form of categorization, and the source of iconic motivation for an individual sign comes from a restricted set of category-specific properties.

Keywords: iconicity, sign language, gesture, handshape, patterned iconicity

1 Introduction and Rationale

Sign languages exhibit a significant number of signs whose form is motivated by their meaning – that is, they are iconic. Some researchers believe that those signs are remnants of the early stages of lexicon creation and will gradually disappear with time (Frishberg 1975); however, this does not explain why even the oldest known sign languages have a high proportion of such signs, and why certain signs appear to be very similar cross-linguistically. In this study, I investigate the question of how meaning can motivate the form of signs. I do this by looking at signs created by sign-naïve hearing people. This approach avoids linguistic influences, and in some respects at least, recreates the early stages of sign language development.

Early sign language linguists were under pressure to prove the linguistic status of sign languages, which resulted in them emphasizing everything that could show parallels with the spoken modality (syntactic constructions, minimal pairs, etc.) and downplaying anything that could be seen as "gestural". One such downplayed feature was **iconicity**, that is, a non-arbitrary relationship between the signifier and the signified. Since one of the "prototypical" features of spoken languages is arbitrariness of association between the form and meaning of words (see Saussure 2011, Hockett 1960), iconicity was mentioned as an interesting but irrelevant phenomenon, chiefly existing because the properties of the visual-manual modality affords such curiosities of form. However, more recently, iconicity in language has started to attract more attention from both spoken- and signed-language researchers (see, for instance, Kendon 2014). The newly emerging consensus seems to be that if languages exhibit iconicity, then iconicity must be a property of language; and sign languages exhibit more of it simply because they can (see Perniss, Thompson and Vigliocco 2010). This greater ability for iconic representation also leads to a greater overlap of similar signs in unrelated sign languages: it has been estimated that there is 20%-30% overlap in the core lexicon of unrelated sign languages (McKee & Kennedy 2000, Guerra Currie et al. 2002). This claim has been supported by some recent studies: for instance, Kastner, Meir, Sandler and Dachkovsky (2014) compared 161 sign pairs from Israeli Sign Language (ISL), Al-Sayyid Bedouin Sign Language (ABSL) and Kfar-Qasem Sign Language (KQSL) and found that between 9% and 19% of the signs were *identical* (articulated with the same handshape, location, movement, and orientation), and between 23% and 36% were *similar* (differing in only one of their parameters). This intriguing overlap can be partially explained by shared culture (ABSL and KQSL signs are more similar to each other than to ISL, presumably because their signers are from a similar cultural background, as opposed to ISL signers), but

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not completely, meaning some other factor is also involved. And explaining such similarities by affordances of the manual modality is not completely satisfactory either. If the manual modality is more iconicity-friendly, it explains why sign languages have more iconic signs, but it does not explain why certain concepts have iconic signs in unrelated sign languages, or why such signs look very similar cross-linguistically.[1] Such overlaps in both concepts that are prone to iconicity and forms that are chosen to represent those concepts suggest that some force, perhaps semantic in nature, motivates those iconic signs.

That is the overall topic addressed by my study. More specifically, I investigate how specific meanings might affect which aspects of the referent gets encoded in an iconic representation. I hypothesize that referents that have some common conceptual trait will get encoded in a similar way to each other, and by analyzing several groups of conceptually related referents I can uncover such iconic patterns of naming. If my hypothesis is not correct, however, I foresee two possible outcomes. If there is no underlying force that can cause conceptually related referents to be labeled in similar ways, then participants in my study would produce responses that are radically different from each other, with no trends or tendencies. If, on the other hand, something else besides conceptual similarity can cause similarity in labeling objects, the responses should be very similar to each other, even if the referents are not conceptually related. In this latter outcome, I should see similarities across different conceptual groups and such similarities would have a basis other than the meaning they represent. The basic idea is that people pay attention to or see as important different aspects of different *kinds* of things - they see different traits as being important for/indicative of membership in that group - and that these differences in what people focus on will impact which conceptual features are encoded in an iconic representation.[2]

To investigate my hypothesis, I asked sign-naïve participants to create signs of their own. While it was possible participants would create completely arbitrary forms, I anticipated that at least some of the invented signs would be iconic. Analyzing their signs can uncover semantic motivations behind sign-creation (what features are most salient and/or crucial for naming a particular object), articulatory motivations (what features are chosen because they are easier to be represented given the anatomy our species has), as well as cultural variations. I assume that both signers and sign-naïve gesturers are similar in their perception of objects and share similar experiences interacting with those objects, which can lead to them creating similar representations (also see Kendon 2004: 307-325 for a discussion on various features of visible bodily actions that speakers and signers share in common). At the same time, signers use signs that are part of a particular linguistic system, which will have led to language-specific pressures also shaping the forms (e.g., phonotactic constraints). Such pressures can cause iconicity to "submerge" (as termed by Klima and Bellugi 1979). Therefore, analyzing signs of sign-naïve people can presumably shed more light on the basic sources of iconicity than analyzing signs from actual languages.

I tested my hypothesis by classifying participants' made-up signs according to the iconicity sources that motivated those signs. Even though no one has attempted to summarize all potential conceptual motivations behind iconic signs, some researchers have attributed similarities in certain groups of signs to their common semantics (Padden, Meir, Hwang, Lepic, Seegers and Sampson 2013) or to their salient dimensional properties (Emmorey 2000). For example, it has been observed that man-made objects tend to be articulated with grasping handshapes that correspond to human hands when people interact with such objects (see Padden et al. 2013). Based on such claims in the literature, I came up with the following broad conceptual categories that I suspect could lead signs to share structural similarities: man-made objects versus natural objects; living versus non-living objects; and animate versus inanimate

[1] For example, the website www.spreadthesign.org has signs for "cat" from 26 different sign languages, of which 14 use the image of whiskers to represent this animal, and those 12 signs can be grouped into just four variants.

[2] I do take into account the possibility that something in my experiment design will also cause responses to look similar to each other, something that has nothing to do with either semantics of the referents or cultural background of the participants. However, if there is an additional pressure for signs to be similar to each other, I assume this pressure to have a similar effect on all my participants, and thus making itself manifest in some way. I will discuss this issue in Methodology and Discussion.

objects. Man-made objects were further divided into moving (e.g., car) and non-moving objects (e.g., cup), since movement is a salient feature of many such objects, and because movement is also a feature easily encoded in the manual modality. We therefore can expect some people to incorporate movement features into their gestural representations of man-made objects. Natural objects, on the other hand, were divided into living and non-living, on the assumption that this fundamental conceptual difference might influence their representation (as is seen in many native American languages, see Young & Morgan 1987). Living objects were further divided into animate versus inanimate, as animacy is a feature that is often encoded cross-linguistically (e.g., with different pronouns as in many Indo-European languages, different case markings as in Slavic languages, or numeral classifiers in many African and Asian languages, see Adams & Conklin 1973). Finally, all objects, both man-made and natural, varied according to their size: they were all either big (human size or bigger) or small (half-human size or smaller). That was done because size is often encoded in the manual modality (for example, with so-called size-and-shape specifiers, Supalla 1986, Emmorey 2000).

To classify the responses, I needed a classification system capable of capturing the recurrent patterns in sign form/meaning pairs. Unfortunately, such system is yet to be designed. Even though iconic signs are often assumed to be less complex than arbitrary signs, they turn out to be notoriously hard to describe formally. There have been a few attempts to come up with explicit models of iconic representations (see Boyes-Braem 1981 and Mandel 1977 for some early proposals), but the most widely accepted is that of Taub (2001), which was developed to describe the way iconic signs are coined, and which I adopt here. Taub's model is based on the observation that iconicity is not objective: the fact that one form is chosen rather than the other is an outcome of both universal experiences of humans interacting with the referent object as well as culture- and individual-specific experiences. Taub therefore conceives of the process of sign creation in terms of conceptual images the referents invoke in the coiner's mind. She distinguishes three different stages: *image selection, schematization*, and *encoding*. First, one possible image is chosen over any other possible image of the referent (e.g., cats are animals with whiskers as opposed to animals with claws or animals that hunt mice). Second, the image is schematized: a small number of features are selected to stand for the entire image (e.g., whiskered animals are reduced to the image of whiskers). This choice of features depends both on universal factors such as anatomy (we have two hands, so we can represent whiskers on both sides of the face; or we have five fingers, that can stand for multiple whiskers) and specific factors such as the phonotactics of a sign language (not every handshape is permitted) and culture (certain handshapes are taboo in certain cultures). And third, the image is encoded into its linguistic/gestural form. At this stage, each part of the schema chosen is encoded with some articulatory feature. This is the iconic form-meaning pairing. In my study, I am focusing on the first and the last of Taub's stages: by examining features chosen to encode the referent, I determine the source of the image chosen to represent the referent.

The specifics of my coding system are based on Poggi (2007). Based on her corpus study of gestures, Poggi (2007) proposed that iconic gesture has four major sources of representative features: a referent's shape, a referent's location, a referent's typical action, and an agent's action with the referent. I adopt those four categories and add one more, that of a referent's prototypical visual feature, since the sensory image encoded in manual modality is a visually perceived feature.

These classifications were chosen based on the assumption that to name a referent not physically present/visible at the moment of sign creation, people would focus on some property of the referent they assume would help a potential addressee identify that referent, provided this property is easily depicted by hands (Poggi 2007). The visual-manual modality allows for an easy representation of shapes, spatial arrangements, and movements (Perniss et al. 2010). Therefore, it is reasonable to expect participants to exploit those properties of the modality, and to come up with signs that represent the referent's shape (either by delineating the space with hands or by tracing its shape), the referent's location (either by pointing to a prototypical location or by using the gestural space to convey location schematically), the referent's action, or the (human) agent's prototypical action with the referent (by embodiment, or using the signer's body to represent human's action with an object). The classification I added, the referent's feature, is an extension of the shape category. However, whereas the shape classification focuses on the shape of the referent in its entirety, or its outline, feature focuses on the shape of a part of the referent, the part that is most salient perceptually or conceptually. For example, cat whiskers are not the biggest part of the cat, but they are quite noticeable and are one of the characteristic features of cats.

The specific predictions are about the *kinds* of objects that I expect to group together in terms of their iconic sources. That is, I predict that the invented forms referring to, for instance, living things will be similar to each other in terms of iconic representations, as well as systematically different from the invented forms referring to non-living things, and vice versa. I predict that the likelihood of responses being classified into five classifications (shape, feature, location, action, and agent's action) will be different in man-made objects as opposed to natural objects, in living versus non-living objects, and in animates versus inanimates. More specific predictions can be seen in Table 1.

In the following section, I elaborate how the conceptual categories targeted and classifications chosen for encoding them informed construction of elicitation materials. I then describe the experiment design in full detail, provide results of the study and discuss what those results tell us about the questions I ask.

Table 1: Predictions of the expected iconic sources for conceptual categories

Category	Predicted primary response classification
Man-made	Agent's action
Natural	Shape, feature
Living	Action
Non-living	Location
Animate	Feature
Inanimate	Shape

2 Methodology

The present study aims to contribute to the question of forces that drive iconicity by focusing on the choices that people make when they create a sign for some object. I hypothesize that participants' choices for representing objects will reflect certain properties of the objects they are naming in predictable ways, that is, the choice of a certain strategy for a specific meaning component will show some consistency across objects sharing that meaning component. By examining such consistencies in naming I hope to reveal tendencies of naming that are not influenced by the grammar of any specific language.

2.1 Participants

Fifty hearing, sign-naïve people participated in the study, 33 female and 17 male. Their ages ranged between 18 and 72 years (mean=28, sd=11). All participants were native speakers of English (defined as having learned English by the age of 3, and being the language they know best). Twenty-three were also native speakers of some other language (12 different languages[3], most commonly Mandarin, Cantonese, and Korean). Participants were either students at the University of British Columbia who participated in the study for a class credit, or volunteers who were paid 6$ for their participation in the study.

In addition to their linguistic background, participants' handedness was assessed using the Edinburgh Handedness Inventory (Oldfield 1971). The inventory assesses hand dominance by asking a series of questions about the person's hand preferences in various everyday activities. Forty-three of the participants were identified as predominantly right-handed, 6 as left-handed, and 1 as ambidextrous.

[3] The other native languages were: Hokkien, Vietnamese, French, Swedish, Farsi, Hindi, Telugu, Bengali, and Malay.

(These data were collected to answer questions not included in this paper, and so these data will not be used in the analyses reported here).

2.2 Elicitation items

Elicitation stimuli were 110 pictures of familiar objects. The objects were divided according to five major conceptual distinctions: man-made versus non-man-made, moving versus non-moving, living versus non-living, animate versus inanimate, and big versus small. There were also pictures of human body parts, which are outside of the classification system just described. The full list of the elicitation items can be found in Appendix 1.

The elicitation pictures were chosen so as to represent a very prototypical example of a specific referent (e.g., to elicit a cat a picture of a tabby cat as opposed to a Siamese cat was chosen). These pictures further aimed to not emphasize any specific part of the referent (e.g., the picture of the cat included the entire animal with all its parts clearly visible as opposed to a cat face with big whiskers or a cat sitting with its back to the viewer and the tail featured in a prominent place). That was done in order to avoid some unintentional priming of any specific feature.

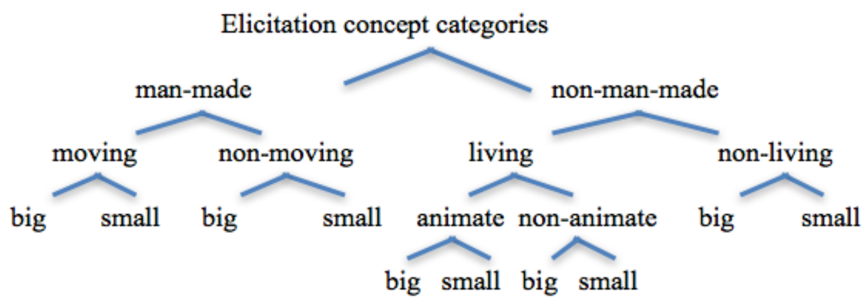

Figure 1: Elicitation categories with examples

2.3 Procedure

Elicitation items were presented to the participants one by one on a computer screen using PowerPoint. Participants were told that they were participating in creating an artificial sign language and instructed to create signs (not fingerspelling) for common objects and entities.[4] They were told that they could use more than one sign per picture, but were asked to remember to invent sign-words and not sentences. No restrictions in terms of manner of naming or time were imposed. Participants were alone in the room after receiving instructions. The room did not have any objects that resembled those they were inventing signs for. This was done to prevent participants from simply pointing at something. Responses were videotaped.

2.4 Coding

The videos were coded manually by one coder for the type of iconic information encoded, as described above in section 2. The coder was not blind to the intended referent, as blinding would have prohibited the coder from classifying signs into iconicity types; despite the fact that iconic signs often seem completely transparent, that is an illusion – the iconic relationship between a sign and its meaning are often clear only when the meaning is known (see Klima & Bellugi 1979, Pizzuto & Volterra 2000, Adams

[4] Fingerspelling, also called dactylology or alphabetic gestures, is a way of representing letters of the surrounding spoken language's alphabet using various handshapes, which may but need not resemble the actual shapes of letters. It is a common way of representing personal and geographical names in the manual modality, as well as loanwords from the spoken language into a particular sign language. Different sign languages have different fingerspelling systems, and their frequency and domains of use also vary from language to language (see Brentari 2001).

et al. 2007). If a response contained more than one sign, each sign was coded for the iconic source type. For instance, if a participant described a ball first by its shape with hands depicting the round object, and then by a human action of bouncing a ball, the response was coded as *shape+agent's action*; note that the order of the signs was preserved in the coding. If a sign had features of more than one category, it was classified as belonging to a mixed category. For instance, if a participant traced the *shape* of a nose on their own face (in a prototypical *location* of a nose), such a sign was classified as *shape/location*. Examples of signs and their coding can be seen in Figures 2-4.

Figure 2: CAT described by an agent's action (petting)

Figure 3: CAT described by a referent's feature (whiskers, claw)

Figure 4: CAT described by a two-sign combination action+feature (walking, ears)

3 Results

3.1 Description of responses

First, I analyzed the responses in terms of whether participants had actually produced something sign-like, as opposed to mime-like. Surprisingly, most of the one- and two-sign responses were strikingly sign-like, with longer responses – not analyzed here – having more mime-like properties (that is, they were reenactments depicting the referent in question). Overall, there were 5469 responses (31 items were missing, all instances where the participant failed to produce any sign). In this paper, I do not discuss data collected for body parts, therefore all results below are for the remaining 100 elicitation items, which comprised 4969 responses: 53.8% were single-sign responses, 37.9% two-sign responses, and 8.3% responses consisting of three or more signs (not included in the present analysis). Of the single-sign responses, 78.3% consisted of signs belonging to a single classification (i.e., shape, location, feature, action, or agent's action), and 21.7% consisted of a single sign belonging to a mixed class (e.g., shape/location). The most frequent class across all single-sign responses was shape (41% of all single-sign responses), followed by action (25.5%) and agent's action (22.9%). The least frequent class of single-sign responses was location (9.5%), with feature being only slightly more frequent (16.4%).[5]

Of the two-sign responses, 90.2% consisted of a combination of two single-class signs, and 9.8% consisted of a combination of one single-class sign and one mixed-class sign. Interestingly, the distribution of iconicity classifications was different in two-sign responses. While shape was still the most frequent class overall (67% of all signs in both positions), the differences between other classifications were not as large (31.5% for feature, 27.3% for agent's action, 23.5% for action, and 21.8% for location). As for the frequencies of occurrence in the first versus last position, shape, feature and location tended to appear in the initial position (71.4%, 73.7%, and 71.7% respectively of their overall occurrences), whereas action and agent's action tended to occur in the final position (75.8% and 75.9% of their overall occurrences). Thus we see interesting tendencies for the use of iconic classes: shape is the most frequent class overall, and it tends to occur either on its own, or in the initial position of a two-sign combination. Action and agent's action tend to occur either on their own, or in the final position of two-sign combinations. And feature and location tend to occur in the initial position of two-sign combinations, but not on their own.

Although I am not analyzing the responses with more than two signs in terms of their iconicity, I noted an interesting pattern that is worth mentioning here, and that is that the man-made category had the highest number of responses of three or more signs, comprising 30% of the responses to items in this category. This suggests to me that participants had a harder time naming man-made objects than natural objects (and so resorted to descriptions). The natural category, on the other hand, had the lowest percentage of responses of three or more signs, 10% of all responses, suggesting that the concepts people were asked to name in this category were much easier to generate novel sign labels for.

3.2 Conceptual contrasts

In this section I examine the variable of primary interest: the distribution of iconicity source classifications for the major semantic distinctions I was examining, namely man-made versus natural objects, living versus non-living objects, and animate versus inanimate objects. The overall distribution of responses across semantic categories and iconic representations can be seen in Table 2. In general, man-made objects were described with responses of shape and agent's action, natural objects and living objects with shape, feature, and action, non-living objects with shape, location, and feature, inanimate objects with shape and agent's action, and animate with feature, action, and shape. If we compare results of pair-

[5] Here and below for the distribution of classes in two-signed responses the percentage adds up to more than 100% because the count includes mixed classes. Because of this, a single response can be included in more than one classification.

wise comparisons of semantic categories, the results become more informative. Below I examine each of the three pairs of semantic categories to see what patterns in iconic representations could be detected.

Man-made vs. natural objects: the elicitation material consisted of 40 pictures of man-made objects and 60 pictures of natural objects. My analysis here is only of the responses with one or two signs. The man-made category had the highest number of responses of three or more signs, 30%, which suggests to me that participants had a harder time naming man-made objects than natural objects (and so resorted to descriptions). The natural category, on the other hand, had the lowest percentage of responses of three or more signs, 10% of all responses.

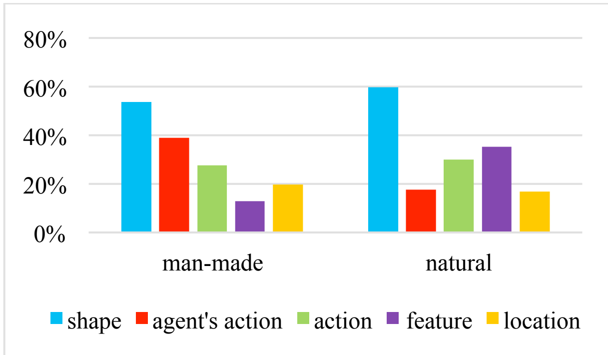

Figure 5: The distribution of responses for man-made and natural objects (chi-square = 432.21, $p < .005$)

The predictions were for man-made objects to elicit responses with agent's action, and for natural objects to elicit responses of shape and feature. In my data, man-made objects were most commonly described with *shape* and *agent's action* classifications. Natural objects were most commonly described with *shape* and *feature* classifications. The two categories differed significantly from each other in terms of the overall frequencies of the various classifications (chi-square = 432.21, $p < .005$), which means that my expectation that these two categories would show systematic differences in responses was borne out. However, the differences are mostly in the less frequent classifications: shape was the most common response type for both natural and man-made objects, and this latter fact (with respect to man-made objects) is contrary to my predictions.

The category of natural objects was both the biggest and the most diverse in terms of referents, so it is interesting that feature classification so clearly surfaced as one of the most common ways to label those referents. The choice of second most common strategies, those of agent's action for man-made objects and feature for natural ones, suggests that man-made objects are conceived as objects that humans interact with whereas natural objects are conceived as objects that are different from each other by virtue of some salient feature.

Living vs. non-living objects: There were 40 pictures of living objects and 20 of non-living ones. Both categories tended to have very few responses with three or more signs: 10.5% for living objects and 13.4% for non-living objects.

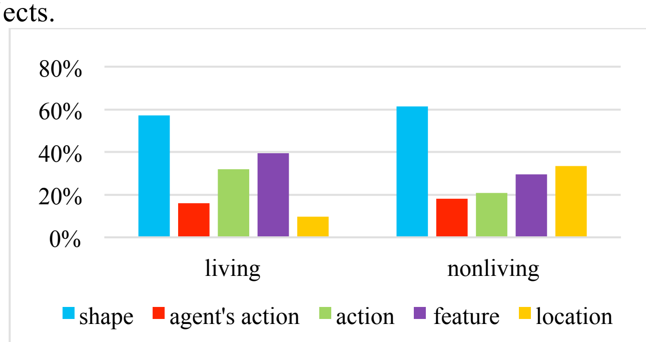

Figure 6: The distribution of responses for living and non-living objects (chi-square = 232.77, $p < .005$)

I predicted that living objects would elicit more action responses, whereas non-living objects would elicit more location responses. This prediction was partially borne out: the living objects category was mostly described with *shape*, *feature*, and *action* classes. The category of non-living objects elicited responses of *shape, feature* and *location* classifications. The two categories differed significantly from each other in terms of the frequencies of the various classifications (chi-square = 232.77, $p < .005$), which means that my expectation that these two categories would show systematic differences in responses was borne out. However, again, shape is by far the most frequent category, for both living and non-living referents.

The frequency of shape and feature classifications was not predicted for those categories, and can probably be explained by the fact that shape is the easiest classification to convey manually, and feature is a prominent classification for natural objects in general. The choice of those classifications appears to be due to the fact that only living objects are capable of independent action (animals can walk and can be represented by walking), whereas non-living (and therefore non-mobile) objects can be characterized by their prototypical locations (e.g., clouds are in the sky and are therefore represented by pointing upwards).

Animate vs. inanimate objects: There were 20 pictures of animate and 40 pictures of inanimate natural objects. Both categories received predominantly one- and two-sign responses (87% and 89%, respectively).

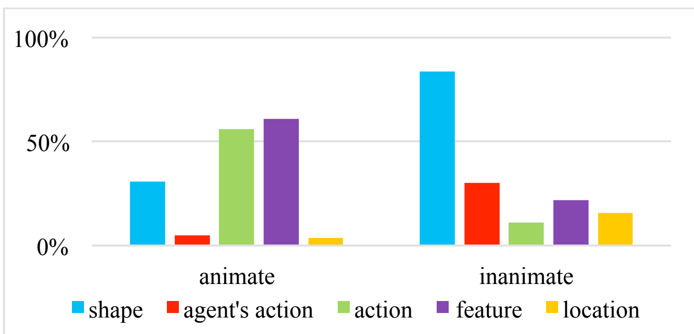

Figure 7: The distribution of responses for animate and inanimate objects (chi-square = 875.37, p < .005)

I predicted that animates would elicit feature responses and inanimates would elicit shape responses. These predictions were only partially borne out, since animates elicited a lot of action responses as well, which was not predicted. A visual inspection of the patterns shows that these two are more different from each other than predicted; unlike the other pairings which always shared the most frequent classification, these two do not. Moreover, unlike the other classifications where shape was always the most frequent classification, for animates it was not, making the overall patterns quite distinct for these two (chi-square = 875.37, $p < .005$).

Animates were the only category for which *shape* was not the most frequent choice. Instead, this category elicited *feature* and *action* responses. Inanimates, on the other hand, were overwhelmingly described with *shape* classification, more than any other category. It appears that the differences in responses for animates and inanimates were again based on more general properties of the category members: animates were described in terms of their salient features and actions, whereas inanimates were described in terms of their shape and humans' interaction with them.

3.3 Results: summary

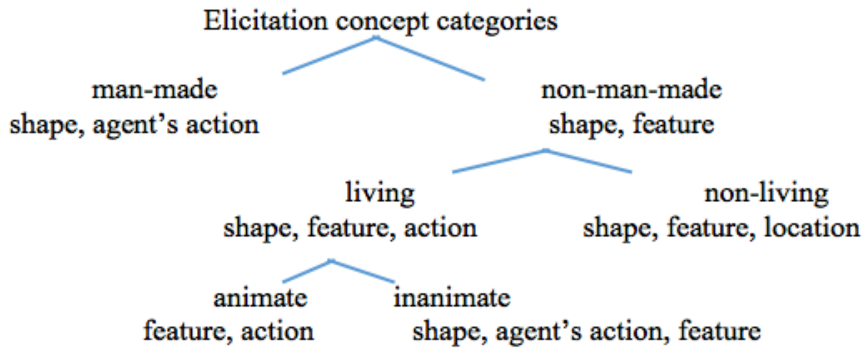

Figure 8: Categories and their most frequent classifications

Overall, almost all categories showed a large tendency towards classification by shape, with animates not sharing this tendency and inanimates demonstrating it very strongly. If we look at the second preferred categories, man-made objects tended to be described with agent's action, and non-man-made ones with feature. Non-living objects favored location more than other categories, and non-animate objects were the only natural objects described with agent's action.

The distribution of classifications across various categories does reveal that conceptually-based categories elicit responses with tendencies for certain ways of naming those objects, as was predicted, although the specific predictions were not often borne out (Figure 8).

4 Discussion

This project asks about the forces behind iconic representations. The data reviewed above suggest that coining a sign, even for an individual referent, is a type of categorization. By choosing a representational form for some object, we classify this object as a member of some conceptual category and focus on properties that conceptually define that category best, be it form, human interaction with an object, or some salient feature of the object. This is true in spite of the fact that signs are coined individually, without participants knowing that there are more similar objects to name, and without obvious surface regularities between the forms they come up with. Many of the signs coined by the participants of this study exist in natural sign languages in the same or similar form, and researchers treat them simply as individual instances of iconic signs. This study demonstrates that these signs have broader underlying regularities, which suggests that the naming processes are closer to what Padden et al. (2013) called **patterned iconicity**, when groups of signs share a common iconic strategy. Padden and her colleagues focused on the more restricted domain of man-made tools and found systematic differences in the form of signs used either as being handled by human agents or as being represented as dimensional objects. The present study suggests that patterned iconicity may manifest in wider semantic domains.

What determines this categorization or, as Lakoff (1986) put it, what domain of experience is relevant for categorization? The data suggest that the experience need not be personal: it is probably true that most of our participants have never operated a crane or interacted with a dinosaur. Nevertheless, they were very similar in their strategies for describing man-made objects and animates. This implies that there are shared cognitive representations of many objects, and that people can rely on those when they need to name such objects. This observation does not mean that all representations will be similar to each other, and, in fact, we see wide variation in naming the same objects both in this study and cross-linguistically. What it does mean though is that variation in naming is probably not random, and is confined to a restricted set of iconic representations suitable for a particular conceptual category.

The existence of such restricted sets of category-specific iconic representations can be more noticeable in cross-linguistic studies and studies such as the present one than in language-specific studies.

I assume so because a language cannot tolerate unlimited variation for individual items if it is to be understood by all members of the community in any context. Based on evidence from young sign languages, Morgan (2015) suggests that the iconic motivation itself can be conventionalized. I wish to expand on her suggestion and propose that the source of iconic motivation for an individual sign comes from a restricted set of category-specific properties which then may or may not get conventionalized with time and use. I propose so because the responses of my participants to individual referents, while different from each other, were nevertheless confined to a small set of conceptual and formational options. Given that the early stages of all sign languages involved coining a lot of signs by people with no first sign language (and often no first language at all), it appears likely to me that what I observe with my participants is also true for those early stages of sign language emergence. Those early stages then were not restricted by any phonotactic restrictions or preexisting conventionalized forms, but they were still restricted by category-specific semantics of the referents, which may explain why even unrelated sign languages display commonalities in iconic representations.

Besides patterned iconicity, the data reveal other tendencies, of which I only have space to discuss only one here. With the exception of animates, the most common classification was shape. Interestingly, shape is special not only in the manual modality, but in classifications used in spoken languages, such as numeral classifiers. In fact, according to Adams and Conklin's (1973) study of 37 African and Asian languages, it is the visual feature of form that plays the determining part in numeral classifications (and not other salient visual features such as color, or other senses such as sound or smell). Shape provides crucial information about the objects, and may also be linked to the mechanics of human vision (Marr 1982). It is not surprising therefore that shape is one of the properties people consistently choose for naming objects (and even this is not universal, as we saw for animates). Alternatively, the prevalence of shape across different conceptual categories may mean that shape is the baseline on which people can fall if they cannot categorize the referents in any specific way. As I discussed in the introduction, if my hypothesis was not correct (that is, if there was no semantic force motivating the form of signs) I expected the responses to be either very different or very similar to each other. The fact that not all of the responses belonged to the shape classification means that semantic forces did influence sign coining, but the fact that half of the responses depicted shape may mean that those semantic forces were not as strong as to affect every sign coined in the study. Additionally, the fact that different categories showed different rates of shape responses (from 30.8% in animates to 83.7% in inanimates) may mean that the semantic forces do not operate in the same way across all categories. How exactly those forces operate across different categories, however, is a subject for future research.

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Appendix 1

The full list of the objects used as elicitation materials was as follows:

Man-made:

Moving: Crane, Truck, Car, Plane, Helicopter, Boat, Satellite, Rocket, Windmill, Merry-go-round, Watch, Wheel, Vacuum cleaner, Robot, Skateboard, Weather vane, Kite, Balloon, Grandfather's clock, Ball

Non-moving: House, Pillar, Monument, Bridge, Pipe, Dam, Lighthouse, Stadium, Tower, Observatory, Hammer, Nail, Saw, Broom, Axe, Needle, Thimble, Camera, Book, Rope

Non-man-made:

Non-living: Iceberg, Mountain, Cloud, Tornado, Boulder, Lightning, Waterfall, River, Lake, Island**,** Stone, Sand, Snowflake, Diamond, Water drop (dew), Piece of ice (hail), Ash, Piece of coal, Gold nugget, Amber

Living:

Animate: Gorilla, Horse, Bear, Ostrich, Crocodile, Dinosaur, Giraffe, Lion, Kangaroo, Whale, Robin, Goldfish, Caterpillar, Bee, Rat, Frog, Snake, Bat, Cat, Dog

Inanimate: Oak tree, Pine tree, Palm tree, Bush, Seafan, Log, Watermelon, Pumpkin, Cactus, Kelp (seaweed), Walnut, Leaf, Strawberry, Flower, Tomato, Egg, Garlic, Pea, Mushroom, Apple