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PERCEPTION AND INTERPRETATION: POINTS OF FOCUS IN DESIGN SKETCHES

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ABSTRACT

During the design of a product, designers may show a potential customer or other stakeholder a drawing of a design concept in order to elicit feedback that can be used to inform further development of the design. Designers may desire feedback on specific aspects of a concept, such as its shape or size, but viewers may in fact focus on other elements of the drawing itself, such as color or surface texture. Viewers translate their visual perception of these representations into perceived understanding, but how can we know whether their interpretations are consistent with the designer's intention? This paper evaluates the translation of four different product sketches by 163 participants. This study also considers how aesthetic preference and concrete information might influence a viewer's opinion of an object. Results suggest that viewers were likely to recall physical aspects from a sketch of a product (material, shape) as well as its function. Findings also suggest that individuals preferred images that were overall more informative rather than aesthetically pleasing. Additionally, our research suggests that individuals were more likely to recall the texture, material or perceived efficiency of an object than recall the name of the object, its function, or its shape.

INTRODUCTION

User-centered approaches to the design and development of products focus on determining the real needs of users and addressing them through design [1, 2]. A key step in user-centered design is the elicitation of feedback from users on a design concept in order to inform and drive the design process [3, 4]. Similarly, feedback on design concepts can also come from other stakeholders in the design process, such as management, manufacturing, engineering, and marketing. Though the designer may intend to gather specific feedback about the design (such as the design's appearance, function or use) through the sketch, comments from users and other stakeholders may be highly dependent on the individual's interpretation of a design concept's representation [5, 6]. According to Houde and Hill, "prototypes are not self-explanatory: looks can be deceiving" [7]. They suggest three key forms of communication to a broad audience: role, look and feel, and implementation. The "role" of a prototype is how a user might use the design. Its "look and feel" is the appearance or styling of the design, and "implementation" reflects the functionality or technical performance of the design. Houde and Hill propose targeting one of the three aspects at a time to best articulate a product, but this theory is not without its issues. Case studies suggest that focusing on one aspect of a prototype does not ensure that a viewer will be guided toward the intended purpose of the product, and in fact many prototypes embody two or all three of these aspects [8, 9].

For example, a designer of a mobile phone may want to obtain feedback on how a user might engage with the buttons on its interface (role), and thus spend his efforts on that particular aspect of the prototype. However, the user may respond to very different aspects of the prototype, such as its styling or color (look and feel). For the designer, this means that he does not obtain the feedback he wants. Practicing designers have developed some strategies to help users focus their attentions on the desired features of a prototype, in particular leaving out unnecessary details in a prototype, but these do not always lead the user in the desired direction. The ability to target a viewer's attention is thus important for driving design process and optimizing design resources. It is important to note that there can be enormous value in obtaining feedback on aspects of a concept that were not intended by the designer.

In fact, one of the key aims of user-centered design is to assist the designer in understanding foreign points of view. For example, the designer may desire user input on the industrial design of a product, but feedback instead suggests that the user doesn't understand the product's function. In this paper, we limit our scope to designer intent with respect to visual elements of a representation.

Sketches of design concepts can communicate the basic features of an idea, and are relatively quick and inexpensive to produce. Other models such as physical prototypes and CAD renderings are also used to elicit feedback, though they are not the subjects of this study. An earlier study on this topic by Macomber and Yang considered only the role of sketch finish on the responses of users [10], but sketches may in fact be perceived in a far more varied set of criteria. This study focuses on how several aspects of a sketch's appearance are perceived, and may provide some insights for designers on how to maximize their efforts when building and articulating prototypes.

In this study, the perception of four sketches of physical products was explored. It compares the initial perceptions of an image, the features that remain prominent with the passage of time and the final translation of an image when given an additional amount of time to view it.

This paper considers the following research questions:

- *What visual elements of a sketch do viewers remember?*
  Sketches of a product can evoke many possible aspects of its physicality, such as the material, texture, and finish of the product. Are any of these elements more likely to be recalled by users after viewing?

- *How confident are respondents about their interpretations of a sketch?*
  Hand sketches of a product can leave some aspects of the design's details ambiguous. This may be because the design has not been completely thought out yet, or perhaps because the style of the drawing itself. Such ambiguity may introduce some questions about the accuracy of an individual's interpretation of that drawing. In the face of ambiguity, how confident are viewers of their interpretation of a sketch?

- *Are there relationships between different ways that a product may be described?*
  A product sketch may spark a wide range of responses from viewers, from simple descriptions of the product's behavior or function to the emotions that a viewer might associate with the product. Are there ways to classify such descriptions, and do certain types of descriptions tend to occur together?

- *Which has greater importance in an image - the accuracy of the image or its aesthetic appeal?*
  A sketch may be defined by the level of accuracy in the way it represents a product (e.g., the realism of the sketch), and it may also be considered by the aesthetics of the sketch itself (e.g., how "beautiful" the product is). These two may sometimes be at odds with each other. Can we determine which of these two are more important to viewers?

RELATED WORK

This paper draws on literature that considers how individuals perceive images and the nature of how those images (sketches) are generated in the design process.

Visual Perception

Research on the study of visual perception has proven difficult with many differing theories on the role of preconceived notions in the deciphering of an image [11-14]. The Basic Law of Visual Perception states, "any stimulus pattern tends to be seen in such a way that the resulting structure is as simple as the given conditions permit" [15]. In other words, as humans we try to simplify the structures around us; however this theory does not account for memory and ambiguity. Although we may simplify an object in order to understand it, we often associate it with stored memories [13]. According to Shepard [12], perception can be broken into two subcategories: normal perception and unconstrained imagery. Normal perception is the idea that the majority will see the same image, whereas unconstrained perception has "radically different potentialities". Can investigation into conventional perceptions shed light in guiding viewers' unconstrained imagination when exposed to a new innovation?

Understanding the importance of texture, color, and overall perception of an image regardless of preconceived notions suggests that "normal" perception is relatively universal and thus visual cues can be harnessed and implemented in order to guide a viewers' attention. Instead of focusing on aspect A of a prototype, we can guide their analysis to that of aspect B. Additionally, when evaluating a drawing's aesthetics viewers typically preferred complete drawings with some differentiation in stylized finished designs [10]. Sketch preference is crucial to the success of an idea; however, understanding the perception of information in an image may also skew a viewer's preference and eventual fate of a design.

Sketching in design

The act of sketching is considered core to the design process [6]. Sketches of design concepts preserve ambiguity inherent in early design exploration [16] and offer a way to evaluate designs in a low overhead way [17].

Types of sketches. McGown et al. [18] and Rodgers et al. [19] have outlined categories for the basic elements of sketches by level. These range from simple line drawings (Level 1) to realistic drawings that include shading and annotation (Level 5).

Ferguson [20] observes that sketches can be described by their purpose, including thinking sketches for design reflection, prescriptive sketches that instruct how to proceed on design work, and talking sketches to be shared among stakeholders.

Sketch style. Kurosu [21] and Tractinsky, et al. [22] conducted work in the field of user interface design that found that an interface's visual appeal had a greater influence on the

interface's perceived usability than the interface's actual usability. Yang and Cham [23] explored the role of a designer's sketching skill in design outcome and found a broad range of realism in the sketches that engineers produced, though this did not relate to the quality of design outcome. Yang [24] found that the exploration of dimensioned drawings early on in the design cycle correlated with design outcome. Song and Agogino [25] determined a relationship between both 3D and shaded sketching and design outcome.

Sketching and commitment. Higher fidelity, more realistic prototypes tend to require more time and design skill to produce. A common strategy for designers is to create prototypes as quickly as possible, though the prototypes should still provide the desired information [9, 26]. However, it has been observed that high fidelity sketching may lead to increased "buy-in" to a design by the sketcher [8, 16]. In a case study, Gerber [27] found the value of minor changes to a prototype ("small wins") as a strategy for building a designer's commitment to a project.

Sketch and user feedback. Sketches and so-called paper prototypes are used by user interface designers to garner user feedback [28]. Hannah, et al. [29] investigated the role of engineering drawings, solid models, and prototypes in helping stakeholders assess whether design requirements would be met.

This existing literature has explored fundamental elements of perception, and also emphasized the value of sketching in design process and in eliciting user feedback. However, there is limited work on considering what visual elements of a sketch viewers perceive and recall in product sketches. This paper seeks to bridge that gap in research.

METHODS

This study consisted of an online survey that presented various aspects of sketches to respondents. 163 participants, approximately 45% male and 55% female, completed a 20-minute online survey through Amazon Mechanical Turk (https://www.mturk.com), a site that enables individuals to create and post tasks known as Human Intelligence Tasks (HITs) for others to complete. In this study, respondents were United States residents 18 years or older with a history of HIT approvals of 90% or higher. According to a study by Paolacci et al. [30], Mechanical Turk reaches a broad demographic in terms of socio-economics, education and age which makes it as reliable a source of data as populations that are traditionally used in social science research. Paolacci et al. also suggested that more females than males typically participate in Mechanical Turk. However, the first release of our survey produced a much higher percentage of males, so the survey was reposted to only females until the female-male distribution was more balanced. Each participant was paid $1.50, which is a slightly higher hourly wage than most HITs on Mechanical Turk.

The survey consisted of four drawings of mechanical products [Figures 1-4]. Each drawing was tailored to determine what aspects of an image a person would focus on in the first moments of viewing. Each respondent was allowed to view the

image for three seconds, and was then asked to identify the object and describe it as if to a blind person using free form text. The three second duration was intended to give the respondent sufficient time to perceive the sketch but not enough to study it in detail. In pilot tests prior to the survey, it was found that two seconds was not enough time for the viewer, and four seconds gave the viewer too much time to get a clear impression of their initial reactions. The goal of this exercise was to obtain the respondent's unbiased, descriptive, visceral response. Next, they were asked specific questions to assess their understanding of the object, responding with multiple choice "yes," "no," or "cannot tell."

- Have you ever used this kind object before?
- Would you expect this object to work like others you may have encountered in real life?
- Could this object withstand three years of weekly use given what you saw the drawing?
- Is this object larger than the average laptop computer?
- How would this object feel in your hand if you were to pick it up: (yes, no, cannot tell)
  ...Rough? ...Soft? ...Squishy? ...Hard? ...Smooth? ...Sharp? ...Sticky? ...Slippery? ...Elastic? ...Stiff?
- How much do you think this object would weigh? (Keep in mind that the average laptop computer weighs roughly 4-5 lbs)
  0-5 lbs, 5-15 lbs, 15-25 lbs, 25-35 lbs, 35+ lbs
- Is the material of this object... (yes, no, cannot tell)
  ...Cold? ...Warm? ...Glossy? ...Matte? ...Reflective? ...Waxy? ...Permeable?
- What color is this object? (free text)

After Images 2, 3, and 4, there was an additional question:
- Please indicate which drawing you prefer most thus far in the space provided. (i.e. If you prefer the first drawing to the rest type a "1" in the box). You are currently on image X.

A. Product material. Image 1 (Figure 1) was intended to be the most straightforward sketch of the four. The hand-held eggbeater was meant to evaluate the use of shading and 3D perspective in communicating the texture and materials of the object.
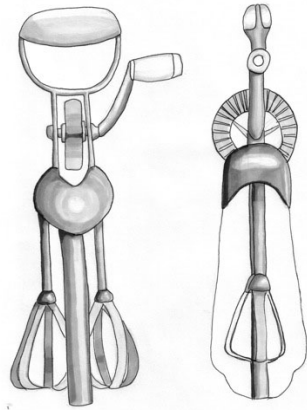
Figure 1: Egg Beater

B. Scale of a product. Image 2 (Figure 2) was of a pair of scissors drawn to look as if the blade and handle were the same length. Next to the scissors, however, was a scale that suggested a 2:1 ratio between the blade and handle. The image was intended to assess whether viewers would read annotations, or would instead consider the image alone.
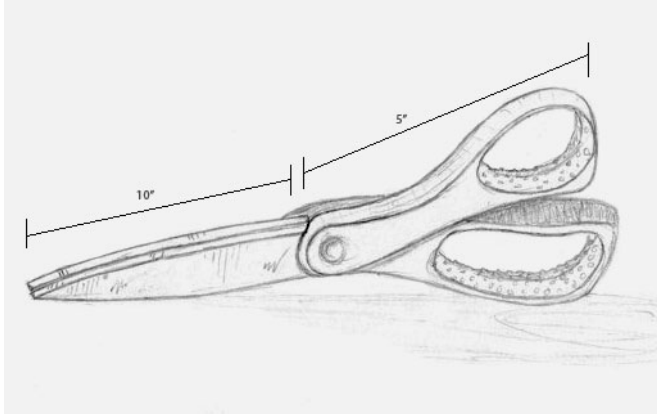

Figure 2: Scissors. Note the marked dimensions are different than the scale of the drawing would suggest.

C. Product function: bias of familiarity. Image 3 (Figure 3) is of a green bicycle that is non-functional, without spokes, gears, or a chain. It is the only one of the four images with color. A bicycle is familiar object, and it was anticipated that some viewers might assume that the bike was functional based on a cursory glance. As a result this image allows us to better understand how much preconceived notions or stereotypes of a product might influence the viewer.

Figure 3: Bicycle. The bicycle lacks spokes, gears or a chain, and would therefore be non-functional.

D. Ambiguity. Image 4 (Figure 4) is of an egg slicer. The image is a simple line drawing, intentionally void of detail and drawn in incorrect perspective. It was assumed that many viewers would not have interacted with the device, and would be more uncertain in their responses.
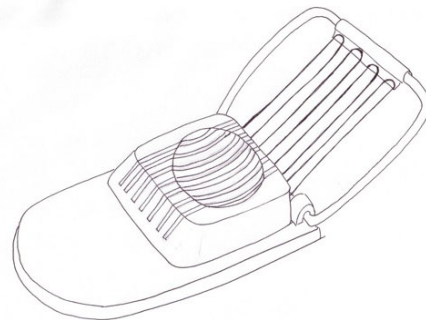
Figure 4: Egg Slicer

Descriptors of product sketches. To further assess how respondents interpreted each image, the next section of the survey asked people to provide five adjectives for each image from memory, without the images in front of them. What aspects of an image remained prominent with time?

Representational accuracy vs. aesthetics. The final section of the survey allowed the participant to view all four images for as long as they wanted. They were then asked to rank the images in three categories: aesthetic preference, accuracy of the information conveyed by the image (that is, could the respondent imagine building a product based on the sketch?), and overall preference. This ranking was intended to provide insights on what qualities of image provided product information in an effective way.

RESULTS

What do viewers remember about a sketch of a product?

After participants viewed each image for three seconds and completed the multiple-choice questions, they were asked to describe each image in five words. Overall, respondents came up with a total of 3,119 words.

The two authors independently reviewed and categorized the terms. There was substantial overlap among the reviewers categorization, and these were distilled into nine categories:

1) Words describing the **action** of the product
   - completable tasks or descriptions of movement
      ex. Cutting, moving, robotic, kinetic
2) Adjectives describing **sensory** aspects of an product
   - relating to a sense of touch or sight
      ex. Blue, rough, heavy, old
3) Adjectives referring to the **cost** of the product
      ex. Costly, cheap, expensive
4) Terms that identify **components** of a product
      ex. wheel, handle, brakes, base, top
5) Terms that **categorize** the product
   - a clear classification of the object
      ex. Bike, mixer, chopper
6) Adjectives that ascribe an **emotion** to the product
      ex. Scary, dangerous, good
7) Terms that describe the product's **behavior**
      ex. Efficient, useful, resistant, quickly
8) **Word Association**
   - nouns that were related to the item, but were neither the object itself nor an aspect of the object
      ex. Cake, kitchen, outdoors
9) **Miscellaneous** terms
   - words that did not fit in any category
      ex. Gubernatorial

The next step was to determine which of these categories was more important in the viewers' minds. We assumed that respondents entered the five terms roughly in the order of importance to them, meaning that the first of the five words was most important, and so forth. A binomial cumulative distribution test was performed to determine the probability of a certain category occurring first, second, third, fourth, or fifth. Our null hypothesis was that each category had an equal likelihood of occurring in the first through fifth positions so that $1/k = 1/9$ where k is the number of categories of terms. Our calculations were done on a position-to-position basis. In the following tables, only categories with p-values equal to or less than .05 were documented.

Three of the categories consistently had $p<0.05$. "Sense Descriptors" (category 2) had $p = 0$ for all positions. This is not surprising as we are taught to describe things using adjectives, which will primarily fall into this category. "Behavior" (category 7) proved significant in the second, third, and forth words used in a given person's recall. This may suggest that

people tend to remember how they may have used an object (ex. "useful," "efficient," "helpful"). Emotional descriptions (category 6) also proved to be statistically relevant in the fifth word used in the recall process (Table 1). Our speculation is that people may have struggled to come up with a fifth word and as a result resorted to emotional associations they had created with an object.

Table 1: P-Values Overall: All 9 Categories.

	Word 1	Word 2	Word 3	Word 4	Word 5
Sensory	0	0	0	0	0
Emotion					1.59 e-004
Behavior		.0067	2.60e-004	5.99e-006	

We then sorted the "sense descriptors" into three sub categories and again performed a binomial cumulative distribution:
1) Visual texture, Material, Color
2) Physical Texture
3) Shape, Size, Weight

The overall results showed that people most frequently used physical textures and visual descriptions over shape and size (Table 2).

Table 2: P-Values Overall: 3 Sub-Categories

	Word 1	Word 2	Word 3	Word 4	Word 5
Feel	5.47e-011	8.090e-007	9.44e-005	.0324	
Visual Texture	.0085		.0504	3.66e-004	
Shape					

A. Egg Beater:

Intended as the most straight forward of the images, the Egg Beater may be considered as a baseline comparison for the other images. For this image, respondents were most likely to describe visual and physical textures (Table 4). Additionally, respondents were more likely to describe how efficient or useful the egg beater was (Table 3), suggesting that people's preconceived ideas of a product are significant and must be taken into account when prototyping. Both of these are consistent with the overall trends suggesting that respondents are most likely to make assumptions about a product's feel and how it is used (Table 1). The breakdown of subcategories was not consistent with the overall trend (Table 4). Neither feel nor visual texture were as dominant as in Table 2, suggesting that perhaps people were more evenly dispersed amongst the categories.

Table 3: P-Values Egg Beater: 9 Categories

	Word 1	Word 2	Word 3	Word 4	Word 5
Sensory	0	0	0	0	0
Behavior	.0372	.0195	8.858e-004	.0043	.0013

Table 4: P-Values Egg Beater: 3 Sub-Categories

	Word 1	Word 2	Word 3	Word 4	Word 5
Feel	9.11e-005				.0541
Visual Texture				.0232	

B. Scissors: Understanding Scale

The scissors were drawn with a ratio of 1:1 between blade and handle, but the scale written below indicated that the blade was twice the length of the handle. This image was meant to test if viewers noticed the skewed scale. Only 8.4% of participants mentioned the dimensions of the scissors, suggesting that people did not notice the numbers written on the image, but instead perceived the image first and were not immediately drawn to the indicative scale. Mechanical Turk may foster an urge to take the test quickly, but this impulse may also be representative of how a potential customer might view a product on a store shelf or catalog.

In the recall section, participants predominantly used words associated with feel and visual response (Table 5). This is consistent with the overall trend, but also somewhat surprising. Given the familiarity most have with scissors it would stand to reason that participants would be likely to mention how it is used, yet in the first four recall slots, "use" was not statistically significant. Delving deeper, it is also surprising that shape/size did not occur more often (Table 6). One would hypothesize that the dimensions on the image would provoke an association with size, but no such dominance exists within the first four instances of recall. One might conjecture that scissors are such a ubiquitous product in respondent's lives that their responses go beyond mere function to sensory and behavior description.

Table 5: P-Values Scissors: 9 Categories

	Word 1	Word 2	Word 3	Word 4	Word 5
Sensory	0	0	0	0	0
Behavior					.0363

Table 6: P-Values Scissors: 3 Sub-Categories

	Word 1	Word 2	Word 3	Word 4	Word 5
Feel	1.97e-006	6.19e-004	.0018		
Visual Texture				1.034e-004	
Shape					.0334

C. The Bike Test: Bias of Familiarity

The bike (Figure 2) has no spokes, pedals or chain. It would be impossible for this bike to move yet people often described how a bicycle should work rather than describe the bicycle presented. Instead of noticing that the wheels had no spokes and no chain connected the pedal to the wheels, people proceeded to describe how the bike moved when force was applied to the pedals. Some of this may be due to people's familiarity with bikes and the short amount of time they had to view the image. However over half (52%) of the participants described the bike's movement without reference to the actual image presented. 28% of participants even insisted that applying force to the pedals would propel the bike and only 2.6% commented on the lack of mechanisms. These results suggest that people did not perceive the true image, but instead connected it or replaced it with a past experience with a bicycle. It is also possible that some respondents did not understand how a bike actually works. One possible conclusion from this is that designing a product already familiar to the general public may require radical changes to its styling, or more than just images to convey a subtle change.

During the recall section, participants demonstrated a higher level of emotional description (Table 7). This may pose a possible answer to why people did not notice that the bike was not functional. Objects like bicycles, and possibly others with similar attachments, may have too many preconceived notions and emotional ties for viewers to process what is in front of them rather than rely on past experiences.

Looking more closely at the breakdown of visual, physical and shape descriptors, visual textures dominated in the first two recall slots (Table 8). This was the only time that visual textures appeared statistically significant even in the overall data, indicating that the green color of the bike may have had a noticeable influence on people's perceptions and recollections of the object.

Table 7: P-Values Bike: 9 Categories

	Word 1	Word 2	Word 3	Word 4	Word 5
Sensory	0	0	3.31e-014	0	4.44e-016
Emotion	.0027		3.42e-004	.0152	1.48e-004

Table 8: P-Values Bike: 3 Sub-Categories

	Word 1	Word 2	Word 3	Word 4	Word 5
Feel			.0220		.0551
Visual Texture	1.08e-005	.0476			
Shape			.0220	.0430	

D. The Egg Slicer Test: Ambiguity

The image of the egg slicer (Figure 4) was purposefully left unfinished. The point of this image was to see what sorts of extrapolations viewers would make about textures for a

black and white, unshaded picture. It was expected that people would be more likely to answer "cannot tell" in regards to color and texture. Although there was an increase in responses that indicate ambiguity (i.e. overall roughly equal parts answered "yes" or "no"), the number of people who answered "can not tell" was consistent compared to the other images. This suggests again that people are willing to form opinions without specific visual evidence. In the free response section, however, only 9% of participants mentioned anything regarding texture. This suggests that respondents were initially fixated on the function of the tool, instead of its material. This suggests that if one wants the focus to be function, an image lacking in much detail will cause the viewer to first consider its use (Table 9).

It is curious that people recalled the physical aspects of the egg slicer over the shape (Table 10). Given the lack of detail the only defined aspect of this black and white drawing is the shape, yet describing how the object might feel in one's hand dominated. This suggests that when recalling in times of ambiguity people may fill in blank space, and thus inaccurately remember an object.

Table 9: P-Values Egg Slicer: 9 Categories

IMAGE 4	Word 1	Word 2	Word 3	Word 4	Word 5
Sensory	0	0	0	0	1.27e-004
Emotion					.0056
Behavior		.0022	.0039		2.036e-004

Table 10: P-Values Egg Slicer: 3 Sub-Categories

	Word 1	Word 2	Word 3	Word 4	Word 5
Feel	5.89e-006	5.89e-006	.0359	.0200	.0374

### How confident are respondents about their opinions of a sketch?

In our study, participants were asked multiple-choice questions about each sketch with the following options: "yes", "no", or "cannot tell." An answer of "yes" or "no" was considered to be definitive whereas "cannot tell" was assumed to reflect indecision. Answers were compared among the images and a pattern became apparent. Often, responses were confident even if the opinions as a population suggested ambiguity. In some instances, 45% of respondents answered "yes", while 50% answered "no" and only 5% answered "cannot tell." Given the stark contrast between "yes" and "no" it would stand to reason that the question asked was ambiguous and that the correct answer should have been "cannot tell." This result suggests that either respondents were answering definitively when they should not have, or that overall people were more likely to extrapolate with confidence (Figures 6-8).

The study also showed that, overall, both men and women were unsure and answered "cannot tell" for questions regarding

adjectives that described visual textures rather than ones perceived through touch (Figure 5). Given that their only exposure to the object was through a visual image it is curious that people were more willing to make assumptions about how an object felt in their hands than how the object looked.
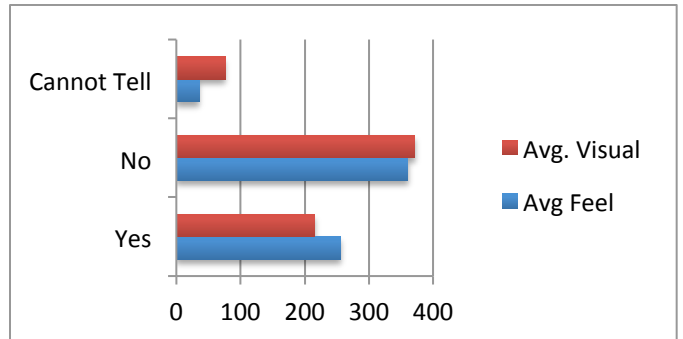
Figure 5: Bar Graph Avg. Feel and Visual Texture Response
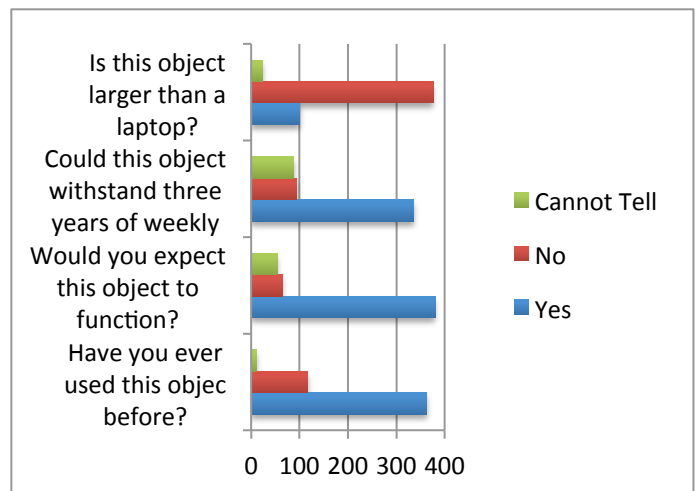
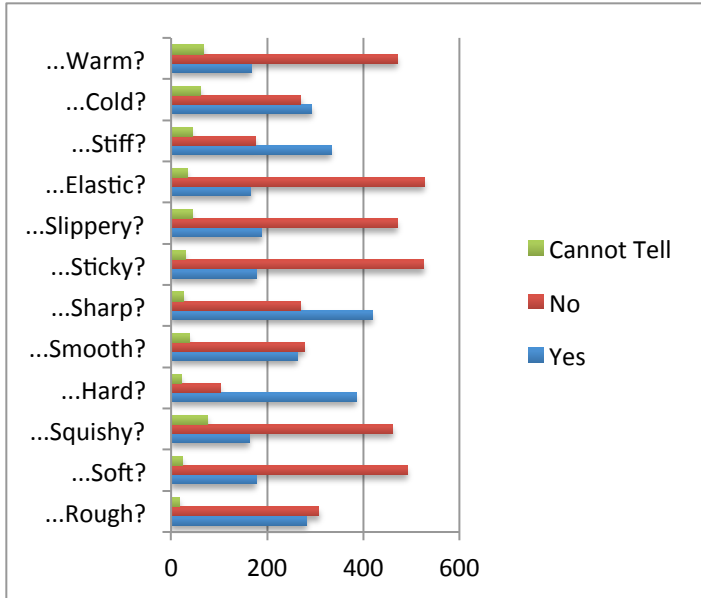**Figure 6: Bar Graph of Miscellaneous Question Response**

Figure 7: Bar Graph of Each Texture Response
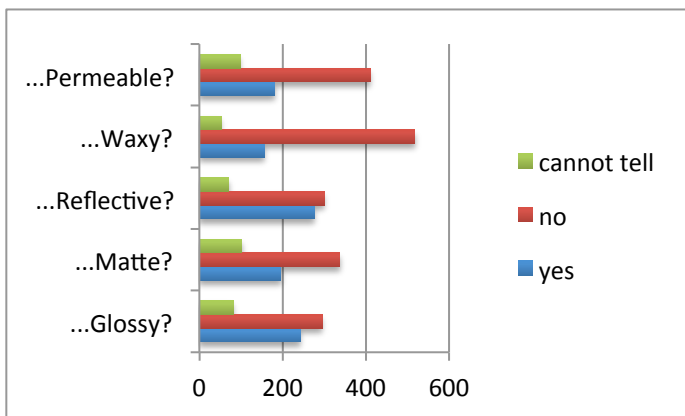

Figure 8: Bar Graph of Each Visual Aspect Response

Are there relationships between categories of descriptors?

The standard apriori algorithm [32] was applied to determine a pattern or trend among respondents' use of categories. In this case, apriori did not test for successive logic (i.e. if person A used Category 1 as the first adjective, how likely were they to use that category in the second?) but instead tested for trends in repetition of certain categories of words or overall pairings of certain categories. For example, if person A used Category 1 twice how likely were they also to have used Category 2? In this way we were able to determine if participants could be grouped by the types of words they used. Our results indicated the following logic patterns:

1) All respondents were more likely to use visual and physical descriptors. This is consistent with the results calculated using the binomial cumulative distribution test.

2) 59% of participants who used one sensory descriptor were likely to also use two. Of those who used two sense descriptors, 43% were likely to use three sense descriptors.

3) Males and females who used emotional descriptors were equally likely to use sensory descriptors.

Which has greater importance in an image - the description of information within an image or the aesthetic appeal of that image?

In this study, participants were asked to rank each image in three ways. The first asked them to rank an image based on how helpful the information in the image was presented as if the respondent was going to recreate the object. The second asked them to rank the images based on the aesthetics of the images themselves. The third asked for their overall preference. Our expectation was that the aesthetics of a sketch would be valued over information. However, using the method of Ordinal Logistic Regression [33], we discovered that information has a greater influence on the overall ranking than aesthetics. Given the importance of preserving an ordinal characteristic, it would have been difficult to transform the independent variable into a Gaussian or binomial regression. Additionally, logistic regression accounts for the upper and lower bounds (1 and 4 in this case), where a linear regression could predict an unrealistic ranking above or below our bounds.

Table 11: Aesthetics vs Information

	Value	Std. Error	t-value
Aesthetics	1.022	0.09198	11.11
Information	1.367	0.10053	13.59

Given the calculated values, standard error, and t-values, it appears that information's influence is in fact statistically significant (Table 11). This discovery may shed some light on Macomber and Yang's [10] conclusion that, stylized, often less informative images were preferred less than completed, but unstylized images.

CONCLUSIONS

What do viewers remember about a sketch of a product?

In general, participants were likely to remember physical aspects of an object (i.e. feel, material, shape, etc) and how the object could be used to complete a task. This suggests that participants are likely to make assumptions about the product's efficiency and use more often than expected. This may prove crucial when prototyping. If people are likely to recall notions of ease and usefulness, it may be in a designer's best interest to clearly articulate the efficiency of an object in the early concept process.

It appears that participants were more prone to perceive and recall tangible aspects of an object, and be more definitive about these perceptions. How an object might feel in one's hand seems to be more salient than its perceived visual texture

or size? Given the increased visual descriptions in the recall section of the bike, however, it may stand to reason that a single, eye catching visual element, such as a bright color, could have a greater influence on audience. Further investigation into the value of strong visual focus in prototypes may be merited in future research.

Overall, respondents appeared to pay little attention to the dimension and scale of an object both initially in free response and later in recall. There was little emphasis on the size and scale of the object suggesting that in the early prototyping and focus group stage, designers may not need to put as much detail into ensuring that the scale of the object is correct.

How confident are respondents about their opinions of a sketch?

An overwhelming number of participants were decisive even when the population as a whole was split between answering "yes" or "no" for a given question. Some of this may be caused by a deeper societal pressure to understand and appear informed, but regardless people are more likely willing to express an opinion about texture, feel, etc. There was a slightly higher response of "cannot tell" in questions pertaining to visual aspects of an object, suggesting that participants were more open-minded toward characteristics such as material, reflection, etc. When determining how much time to spend on an image or object, designers may want to concretely articulate the core physical elements of an object and spend less time concerned about detailed aspects of an image, such as its texture or material.

Are there relationships between different ways that a product may be described?

There does not appear to be specific types of descriptors that are linked. Respondents were not readily categorized into specific groups, but apriori did provide some insight into smaller subsets. Almost 60% of respondents who use a sensory related descriptor were likely to use another sensory related descriptor. Perhaps if you were trying to provoke a response using word association within a focus group this could be applied to keep the topic within specific category of descriptor. Understanding the applications of these findings might be a place for future experimentation. It was found that respondents tended to favor physical or behavioral descriptors when describing an object, and emotional descriptors were most often used in the final words of recall suggesting that people may have been struggling to describe what they had seen and had instead resorted to stored memories.

Which has greater importance in an image - the accuracy of the image or the aesthetic appeal of the image?

Information influenced participants' overall rankings of an image. In the early design stage, providing and audience with multiple images with varying degrees of information may determine the overall preference regardless of completion and overall aesthetics. In our study an informative image proved more influential in the overall preference of an image, though future work should consider larger sets of images for evaluation.

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