

VALUING THE HAPTIC: THE CUTANEOUS AND THE KINESTHETIC

AMOS SCULLY

Rochester Institute of Technology, Rochester, NY. USA

ABSTRACT

The haptic aesthetic is a critical aspect of almost every object and environment. Design of objects needs a strong working relationship between the visual semantic with the haptic feedback. Some products have developed over time toward a more subtlety of pressure touch (cutaneous) such as a key click from the electric typewriter maturing to the laptop keyboard. Other products work with humans moving through the world with clumsy determined gusto involving muscular skeletal (kinesthetic) movements such as a punching down a waste can pedal or striking through institutional door lever. Understanding the how users move and haptically engage products plays a key role user empathy. As humans we are often lumbering through our world yanking and slapping as we go, yet we take pleasure from the subtle textures and yielding pressures of tactile experiences. Both of these involve cognition through cutaneous and kinesthetic. Engaging students in the haptic builds depth to their human centred design thinking and gives way to their product semantics. This paper presents the question: What value does human centred design need to place on the haptic?

Keywords: Haptic, cutaneous, kinesthetic, touch, hand tool

1 INTRODUCTION

The use of the term haptic is surprisingly absent from most dialogues in Industrial Design. Even with considerable effort by designers in creating works that are easy to pull, lift, reach, or turn in our human centred approach we take for granted the sense of touch. Industrial Design places ergonomics at the centre of appropriate comfort, sizing, grip, or simply how a product ‘feels’ to use. Haptics in many respects is ‘how we feel’ by the place where our physical form engages with the physical world. Haptics is defined by our own physical form, our boundary, it is where our body ends and the world begins. [1] Simply stated, the haptic is a profound sense of our physical being in much of what we experience with our eyes closed minus hearing, sound, and taste. When we bounce on a bicycle, flop into a chair, or twist clicking a volume knob, each gives us sensory feedback that is vastly experiential. There is cognition, pleasure, and emotion in the haptic. The bicycle feels great because its acute handling is transferred through the fingers and arms as a pleasurable, confidence building, likeable, and even exciting experience. Despite these feedback experiences we are attracted to a designed object through its aesthetics - its performance may be distinct. Performance is often in what we feel, the pleasure of and the bicycles handling and braking, or in the haptic performance feel of a running shoe. Designs work well when the haptic is a significant factor in its appeal. Getting the feel of performance is the haptic gain that is drives the desirable characteristic in a wide variety of product sizes and complexities. Whether the product is a bicycle, vacuum cleaner, or camera - the aesthetics are only part of the measurable success. the materials are appealing to our eye because it predicts our sense of touch. If we like the aesthetics but when we try to twist, push, or reach it and the feel is awkward or difficult, the haptics outweigh the looks and the product is undesirable.

So why in examining the field of industrial design is the haptic a mere footnote? Magnificent books devoted to the core considerations such as *Principles of Design*, or *Delft Design Guide* make no mention of the haptic. The haptic falls into the pragmatism of human factors. Haptics more than simply fitting the reach, grip, or posture; it is an emotional consideration and thus of importance to human centred success. Its importance is in the connection between seeing and feeling. This paper seeks to understand the haptic by asking: ‘Is the visual aesthetic appeal differ from the haptic appeal, and show potential for better feel and cognition?’.

2 HAPTIC FEEDBACK AND COGNITION

Upon viewing an object before we attempt to touch it, we anticipate what our haptic experience will be. This experience varies widely based upon numerous scenarios, object purposes, pleasures, sizes, and materials. Haptics generates experiential feedback that is part of neural processing involving mechanical, sensory, motor and cognitive abilities. These psychophysical primitives exist separately from our visual stimuli that help us help us discriminate what we perceive. [2] This haptic feedback is critical to our understanding of operations one is trying to produce. Haptic feedback of gives understanding, a recognition of biomechanical actions being performed. As we push, pull, or twist the resistance lends an understanding to the work being performed. This is critical to performing what we intend to do. For example, a surgeon who is placing sutures has to feel the resistance of each stitch in order to understand how much pressure is needed for the stitch to hold the tissue they are repairing. When the haptic feedback is removed the surgeon loses understanding. This issue is has become a problem of recent with the technology of robotic /orthoscopic surgery. “Both tactile and kinesthetic feedback are necessary to generate a realistic sensation and give the surgeon more comprehensive sensory information while the robot tool is touching/gripping tissues or objects” [3] With the removal of tactile and kinesthetic feedback surgeons lacked understanding. The kinesthetic is the appreciation of movement by muscles their movement, position, and tension. [4] Without direct use of the tactile finger pressure that robotic movements do not afford the surgeons lost this means of understanding. It is the touch combined with the kinesthetic that offers comprehension.

While a surgeon needs to understand how they are performing, kinesthetic feedback has also been seen in developmental learning. This approach is to advantage an experiential learning instead of a listening learning to create comprehension. Increasingly an understanding of the value of kinesthetic and tactile learning has come to light. This ‘learn by doing’ or hands-on experiential learning offers a way of understanding to children as an educational experience. The pleasure of physical activities can be drivers toward understanding, this could be movement and dance, hopscotch, or large scale tic-tac-toe. [6] This learning is similar to tactual learning through the use of hands.

The importance of haptic feedback a critical to understanding in both a feedback and an educational model underscores its value. Whether the haptic promotes is learning by children or feedback of a surgeon cognitive understanding happens in happens as a part of professional practice or as an educational tool.

3 HAPTIC AESTHETIC

The concept of the haptic aesthetic considers the humanistic attractiveness of the cutaneous and kinesthetic. The word aesthetic commonly pertains to visual compositions appeal and message. If the concept of aesthetic is applied to the domain of the unseen it can describes the pleasure, messaging, and excitement of the haptic. Typically, the haptic appeal is defined by comfort, usability, and ergonomics. While comfort and usability of ergonomics answer the needs of purpose and pragmatism, in this case we consider the higher sense of appeal. The handheld object is most visited design sphere for the haptic. Handheld products range in countless sizes, forms and materials depending on its use. Operationally we may be turning, yanking, pushing, squeezing, lifting etc. As we navigate our daily tasks working through dozens if not hundreds of handheld products in a given day. We grasp countless designs from simple wooden cooking spoons, industrial door pulls, shampoo bottles, styled gaming joysticks, or refined automobile gearshifts. These forms are often designed with the strength of their visual appeal with appropriate sizing. All of these generally involve grasping to perform an intended outcome, but of these and thousands of others there is wide variety in size form and material. Some sizes and materials of handhelds have with little or no variation, such as a guitar neck or golf club grip. A golf club has a very specific tapered cylinder shaft covered in rubber of specific diameter with only minor variation. Others vary widely in form such as computer mice, a kitchen pepper grinder, or door handle.

It seems these variations are geared toward a visual aesthetic not a haptic aesthetic. How much do we value the haptic sense alone? If we were designing for a world where our eyes were closed, would the forms be different? Would the haptic aesthetic drive toward new considerations?

3.1 Haptic Aesthetic Emotions

As we consider the potential of the haptic aesthetic we consider emotional reactions. In haptic interactions we engage the sensitivity of a primary sense of touch, touch (cutaneous) is where our body ends and the world begins, primarily our experience is through our hands. If the expectations concerning our hands

with products are not met with the haptic evaluations experienced surprise will result. [7] The visual preview is confirmed or denied by what we experience on a touch level and on a bio mechanic level (kinesthetic). Imagine your unhappy surprise if you were to grasp a pepper grinder that appears to be stone but is actually soft, and when you attempt to turn it, it moves spins free without grinding. These would be negative haptic aesthetics, they don't meet our expectations. Not meeting expectations is a disappointing haptic aesthetic. Conversely, the expectation of using a grinder that is smooth cold and hard is what we expect from stone. If that grinder fits well in our hand and is particularly comfortable, very intuitive, or tactilely seductive we will be emotionally pleased, it meets or exceeds our desires. An appealing haptic aesthetic may even motivate us to use a product, or give us something to look forward to. Such haptic aesthetic can be considered on a level of engagement that leads to the emotional level. As shown in the chart developed by Carbon and Jakesch (figure 1) displays levels of haptic engagement from low to high; high being emotional attached.

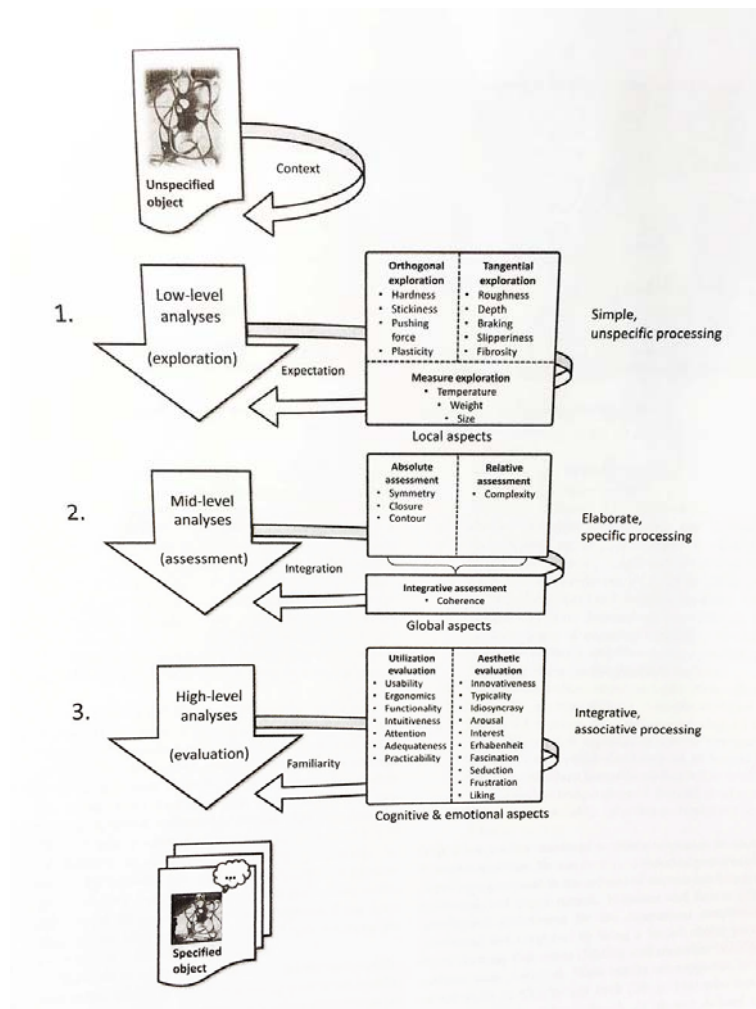


Figure 1. Haptic aesthetic chart

3.2 Aesthetic pleasure

The visual aesthetic is a precursor and can entice or dissuade haptic engagement. But does it command over our cutaneous and kinesthetic experience? When we use a handheld product, certainly there are forms and materials that are more pleasurable, what looks like good quality or poor quality is confirmed or denied by the haptic, it may meet or exceed the expectations of the user. The question is does what we see influence the pleasure of what we grasp? Does grasping have its own pleasure that might differ in appeal than the visual appeal?

4 VISUAL VS HAPTIC

The question of does grasping aesthetic differ in appeal than visual aesthetic was carried out in a simple experiment. The experiment utilised twelve student designs of haptic hand tools each one was cast and fired in porcelain clay. The designs had no moving parts and were somewhat abstract as to their intention. They each had a 'working end' which terminated in a point or flat chisel like edge, that edge was not sharp to the touch. Tools were similar in size and all were a smooth natural porcelain surface.

Each tool had a large white cloth bag it fit inside and marked with an identifying large number 1-12. For the first survey the tools were laid atop their cloth bags with corresponding numbers. Sixteen students who had never seen the designs were asked to judge them for their aesthetic 'appeal' as hand tools. They were instructed to choose the best three without holding them. A second group of sixteen were asked to judge them for their holding 'appeal'. This time the designs were placed inside the bags and students were asked not to hold them. Each time the cloth bag and numbering system was used for consistency (figure 2) Survey sheet (figure 3) was handed to each survey group and allowed to move freely and explore before filling out there three choices. The word 'appealing' was used in both visual survey and the haptic survey. During the survey students participated and were asked for silence as to not influence others opinion.

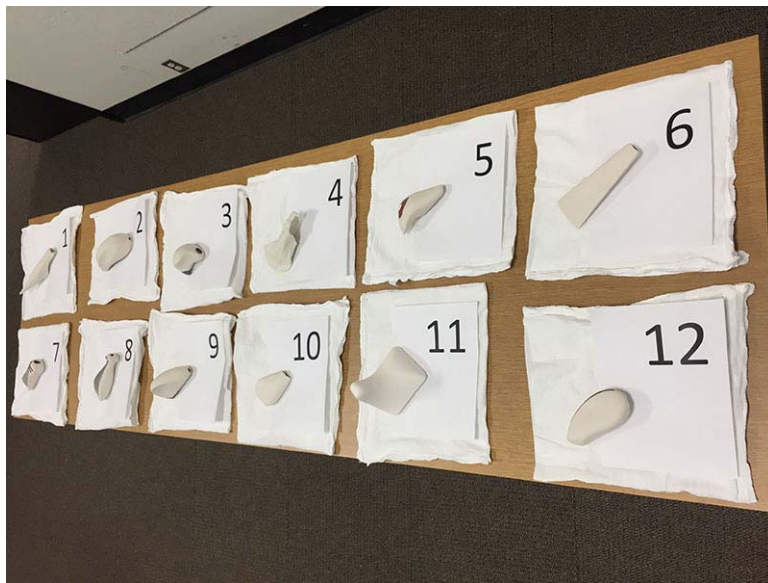


Figure 2. Tools and numbering (visual)

Survey

In front of you are a set of 12 hand tools. Each tool has been designed with a 'working end' that potentially could be used to cut, score, or scoop, scrape, etc.

Considering these forms from a strictly tactile(haptic) consideration, what do you find the three most appealing? Please do not look at them, this is a holding comfort consideration only.

List your three most appealing to hold:

Figure 3. Survey sheet (haptic)

5 RESULTS

The results comparing the visual vs. haptic aesthetic appeal showed a preference for different tools. Since students were asked for three most 'appealing' there was opportunity for consensus on individual designs. Design #5 had large visual aesthetic appeal garnishing twelve out of a potential sixteen votes, whereas this design registered only five haptic votes. Conversely, design #9 garnished eight haptic appeal votes compared to four visual votes. Results plotted in a chart (figure 4) considers the array of responses. Other models lacked appeal in both haptic and aesthetic such as tool #4 with only one vote in each and tool #11 with one vote haptic and no votes aesthetic.

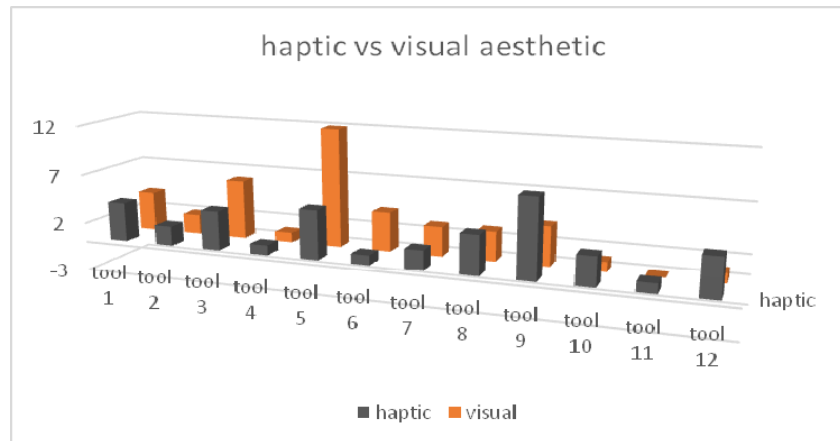


Figure 4. Survey chart

6 CONCLUSIONS

The haptics sensory of cutaneous and the kinesthetic are considerable in their ability to generate emotions, feedback and learning. There is a great importance for sensory 'feel' that we experience on highly professional scenarios such as surgery, and the potential of building understanding through learning based haptics. With all of these in mind, the implication of aesthetics role in haptic forms to provide a greater understanding beyond of functional. In probing the potential of haptic aesthetics the author examined separation of visual appeal vs. haptic appeal by means of survey. While this survey is limited to only thirty-two participants, it benefits from using a single material and colour without the distraction of use application. The survey results demonstrate that some forms have a strong visual aesthetic appeal that sharply contrast the haptic appeal. Yet, other forms can be lack in appeal for both haptic and aesthetic. Finally, some forms are not strongly determinative their appeal. With these results in mind, it seems the field of Industrial Design may benefit from creating guidelines in aesthetic appeal other haptics that do not umbrella under human factors. Certain forms that appeal in one not the other could demonstrate the potential of strictly haptic appeal in the success of a design. A more robust set of participants may prove more conclusive and give more solid evidence.

REFERENCES

- [1] Hatfield, T., Kern, T.A. *Engineering Haptic Devices: A Beginners Guide*. London: Springer-Verlag, 2014.
- [2] Ibid.
- [3] Lim, SC. Lee, H.K. Park, J. *Role of combined tactile and kinesthetic feedback in minimally invasive surgery*. International Journal of Medical Robots and Computer assisted Surgery. Vol11, Issue 3, 2011.
- [4] Bartley, S.H. *Principles of Perception*, Harper: New York. 1958
- [5] Denig, S. J. (2004). *Multiple Intelligences and Learning Styles: Two Complementary Dimensions*. Teachers College Record, 106(1), 96-111.
- [6] Denig, S.J. *Multiple Intelligences and Learning Styles: Two Complementary Dimensions*. Teachers College Record, 01/2004, Volume 106, Issue 1
- [7] Carbon, CC. Jakesch, M. *A Model for Haptic Aesthetic Processing and Its Implications for Design*. Proceedings of the Institute of Electrical and Electronics Engineers. Vol. 101, No. 9, 2013.