

IT'S UGLY, THAT'S WHY IT WORKS BEAUTIFULLY: AN EXPLORATORY
STUDY USING DESIGN STRATEGIES TO VIOLATE AESTHETIC PRINCIPLES
AS MEANS TO INFLUENCE USAGE BEHAVIORS

A Thesis

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ABSTRACT

This thesis explores how aesthetic violation can be used to influence a user's behavior when interacting with a product. Aesthetic violation occurs when the elements of a design purposely deviate from the aesthetic expectations of the user in order to encourage a behavioral response. This draws from the theory of processing fluency, which suggests that aesthetic perceptions are a function of a perceiver's processing dynamics—the more fluently a perceiver can process an object, the higher the aesthetic response. In this instance, the desire for fluent processing may incite users to escape, minimize, or counteract the violation. A literature review and two workshops were conducted: (1) to generate design strategies and (2) to assess and refine them. The workshops provided insights into the benefits and relevance of aesthetic violation, strategy formation, and integration into the design process.

BIOGRAPHICAL SKETCH

Bethany Welgoss received a B.F.A. in Industrial Design from the Rochester Institute of Technology in 2018, and chose to complement this degree with an M.A. in Sustainable Design Studies from the Design + Environmental Analysis department at Cornell University. She is interested in the intersection of design and research, and how it can be applied to enhancing environmental consciousness in the future.

This thesis is dedicated to Mary Kay Welgoss, Ken Welgoss, Katelyn Sullivan, and Sean Rubenstein. Thank you all for your support throughout this process.

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LIST OF ABBREVIATIONS

HCI: Human-Computer Interaction	12
DfBC: Design for Behavior Change	13
UMA: Unified Model of Aesthetics	18

CHAPTER 1

INTRODUCTION

Take a moment to consider Figure 1. You'll likely notice that one square differs from the others, but how might this impact your viewing of the image? Perhaps you notice your attention is more significantly drawn to the rotated square; maybe the rotated square makes you feel uncomfortable or annoyed. Perhaps, if you had the ability, you would take a moment to correct the rotated square to create a more pleasing pattern. Regardless of your response, the rotated square likely violated your aesthetic expectations formed from the precedent set by the other squares, thus impacting your aesthetic experience with this image. Aesthetic experiences are all around us, including our everyday product interactions. How might we behave differently with our products if our aesthetic expectations are violated? This thesis explores how the violation of aesthetic experiences can be deliberately facilitated, and the beneficial effects in human-design relationships.

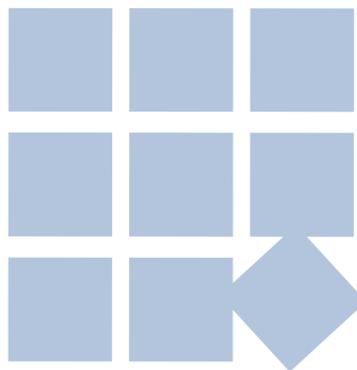


Figure 1. An Imperfect Grid

Design and Aesthetics

While conceptualizations of aesthetic experiences have differed across studies, an emerging literature suggests that certain elements, such as subjectivity, the existence of both positive and negative aesthetic experiences, the ability to perform both conscious and subconscious aesthetic judgments, and the ability to evoke emotional responses, all contribute to a working definition of aesthetics (Palmer et al., 2013). Research has also examined specific aesthetic applications, such as color, shape, and spatial composition preferences. For example, there has been an indication that American and British adults prefer cooler colors to warmer colors (Palmer & Schloss, 2010) the golden ratio is generally found to be aesthetically pleasing (Green, 1995), and the structure of a composition tends to have highest “goodness” ratings near the center, followed by the horizontal and vertical axis (Kovács & Julesz, 1994).

However, the notion of aesthetic beauty extends beyond physical attributes, to those of function, experience, or perception (da Silva Cardozo, 2016; da Silva et al., 2016). Consider the aesthetic experiences associated with using a new smartphone. One might be drawn to aspects of the phone’s appearance, but more significantly, one might be drawn to the pleasing tactile weight, the smooth surface, the intuitive interface, and the device’s perceived ability to meet the user’s needs. An aesthetic judgement not only relates to an object’s appearance but also relates to perceptions of the object’s purpose, meaning an aesthetic judgement is also made if an object is appreciated based on *how* it functions (da Silva Cardozo, 2016).

Aesthetics have also been linked to distinct emotional experiences. It has been proposed that products can be deliberately designed to evoke feelings of awe in users, often with ties to aesthetics, such as perceiving novelty and complexity in the material aspects of a design or linking social identity to a design's hierarchy or presence of power (Ke & Yoon, 2020). From an experiential perspective, Fokkinga and Desmet (2012) theorized that interactions that contain both positive and negative experiences are richer than experiences that are solely positive, and the ways that these experiences are created through product design can have aesthetic ties. For example, the “Life Counter” by Ipei Matsumoto (Figure 2), visually displays the number of years, days, hours, and seconds users have left to live; the visual component associated with the passage of time relates deeply to the experiential and emotional components of using the device (Fokkinga & Desmet, 2012).



Figure 2. Life Counter by Ipei Matsumoto, photo by Hidetoyo Sasaki (Fokkinga & Desmet, 2012), the device visually displays the number of years, days, hours, and seconds users have left to live

Similarly, designing for unpleasant aesthetic experiences has been investigated in Human-Computer Interaction (HCI), with an aim to change perceptions of

experiences [for an overview, see Fogg (2009) and Kelders et al., (2012)]. Benford et al. (2012), explored the possibilities of designing uncomfortable interactions into cultural experiences through the use of technology, thereby increasing the entertainment, enlightenment, or sociality of the experience. For example, Breathless (Figure 3) is a swing that is controlled by respirator sensors attached to a gas mask (Benford et al., 2012). The sensors adjust the tempo of the swing to match the wearer's breathing rate of 12 breaths per minute. Masks are worn by both riders and non-riders, and control of the swing is shifted throughout the course of the ride. In this case, the entertainment and sociality of the experience is amplified by elements of intrigue and discomfort (Benford et al., 2012).



Figure 3. Breathless Swing (Benford et al., 2012), the swing is controlled by respirator sensors inside the gas mask, worn by both riders and non-riders

Design and User Behavior

In addition to aesthetics, design research and practice also focus on user behavior. Many design researchers have started to explore principles and generate methodologies that may enable designers to influence user behaviors. Design for Behavior Change (DfBC) is a broad-scale method that suggests designers not only

have the capability to influence behavior through design and technology, but the ethical obligation to do so (Niedderer et al., 2016). Many other approaches and models fall under the DfBC umbrella, including but not limited to Persuasive Technology (Fogg, 2002), Gamification (Deterding et al., 2011), the Design with Intent Method (Lockton et al., 2010), and Socially Responsible Design (Tromp et al., 2011). Behavioral implications associated with aesthetic experiences have also been investigated. Ludden et al., (2008) showed that the surprise experienced by a product with visual-tactile incongruities generated product recognition and word-of-mouth buzz, while Grinstein et al., (2019) utilized displeasing visuals (e.g., images of a pile of plain, drab sneakers versus a pile of shiny, colorful sneakers) to evoke empathy and encourage prosocial behaviors. DfBC suggests that design can influence behavior changes both intentionally and unintentionally, but these unintentional behavior changes can have unforeseen consequences; for example, cars have positively impacted user mobility but have negatively impacted the environment (Niedderer et al., 2016). Therefore, designers must be conscious of these consequences throughout the design process. To this end, this thesis focuses on violation of aesthetic principles as a means of influencing users through design and technology, with the consequences of usage behaviors in mind.

Research Questions and Structure

As illustrated above, the emerging literature surrounding design aesthetics and design for behavior change opened up diverse opportunities in design research and HCI. This thesis looks to contribute to this work by proposing a link between aesthetics and

behavior change through a design approach we are calling aesthetic violation. Aesthetic violation occurs when the elements of a design purposely deviate from the aesthetic expectations of the user in order to encourage a behavioral response; in this way, the intended behavioral response serves as a key determinant in the design's aesthetic choices. Aesthetic violation is something that designers have used somewhat intuitively and anecdotally. Some examples include a line of conceptual products designed by Karin Ehrnberger and Loove Broms in conjunction with the Interactive Institute, which includes the Puzzle Switch (Figure 4), a light switch that uses graphic misalignment to encourage users to turn off the lights, and the Aware Handle (Figure 5), a radiator handle that presents users with a negative tactile experience when turning up the heat (Turner, 2009). However, to my knowledge, aesthetic violation has neither been systematized nor empirically analyzed for its effectiveness. This thesis aimed to formulate design strategies to help designers systematically use aesthetic violation, addressing the following questions:

1. Under what conditions does a product that violates accepted aesthetic principles encourage users to counteract, escape, or minimize the violation?

This question is primarily addressed in chapter 3.

2. How can a product be designed to violate aesthetic principles to influence users' behaviors? This question is primarily addressed in chapter 4.



Figure 4. The Puzzle Switch (Turner, 2009), the light turns on when the colors are misaligned, but turns off when the colors are correctly aligned



Figure 5. The Aware Handle (Turner, 2009), the radiator handle is comfortable to grab when turning down the heat, but uncomfortable when turning up the heat

The first question aimed to address the qualities that an aesthetic violation may possess. By understanding these qualities, we could begin to develop a systematized set of design strategies. The second question expanded upon the first, but more specifically focused on applying these strategies to the design process. Understanding how designers might use these strategies could help increase their effectiveness. An overview of the research scheme is illustrated in Figure 6.

Phase 1: Aesthetic Violation Generative Design Workshop	Phase 1: Data Analysis & Results	Phase 2: Aesthetic Violation Refinement Workshop	Phase 2: Data Analysis & Results
<ul style="list-style-type: none"> • Discussed existing uses of aesthetic violation • Identified areas of potential usage • Discussed methods of utilization 	<ul style="list-style-type: none"> • Gathered and analyzed 63 relevant ideas and observations • Developed 11 initial strategies, then did a merging and sorting process to result in 6 final strategies 	<ul style="list-style-type: none"> • Assessed usefulness and effectiveness of the strategies from Phase 1 • Discussed strategy usage and suggestions for improvement 	<ul style="list-style-type: none"> • Gathered and analyzed 92 relevant ideas and observations • Refined and improved the strategies, including verbiage adjustments, refined usage guidelines, and broader examples

Figure 6. An Overview of the Research Scheme

This thesis consists of five chapters: (1) an introduction; (2) a review of related work; (3) the development of design strategies; (4) evaluation and refinement of the generated strategies; (5) an overall discussion. The following chapter includes a review of the literature regarding the frameworks of design aesthetics and the implications for the present research, forming this thesis' theoretical foundation. The next chapter reports the process of developing the design strategies, followed by a chapter that reports how the design strategies were refined. The thesis ends with a discussion of applications of the research and avenues for further research.

CHAPTER 2

RELATED WORK: FRAMEWORKS OF DESIGN AESTHETICS

Theoretical Foundation

The theoretical foundation of this research draws on two theories from psychology and empirical arts: (1) processing fluency and (2) the Unified Model of Aesthetics.

Processing fluency is a cognitive process in which individuals perceive an object and quickly form a latent experience around this perception based on how easy or difficult it is to process the object (Reber, Wurtz, & Zimmermann, 2004). This experience enables individuals to form critical judgements of objects based on their evaluations.

In the context of aesthetics, it is suggested that “aesthetic pleasure is a function of the perceiver’s processing dynamics: The more fluently the perceiver can process an object, the more positive is his or her aesthetic response” (Reber, Schwarz, & Winkielman, 2004). Prior research suggests that “core” features of aesthetics, such as symmetry, figure-ground contrast, simple form, etc., have been associated with higher levels of processing fluency, and therefore more positive aesthetic responses (Reber, Schwarz, & Winkielman, 2004; Muth et al., 2019).

The Unified Model of Aesthetics (UMA) suggests that positive aesthetic experiences stem from an evolutionary need to balance safety and accomplishment, and our highest aesthetic experiences occur when we interact with products that strike a balance between these desires (Berghman & Hekkert, 2017). The model is divided into three categories of dichotomy (see Figure 7): perceptual (unity-variety), cognitive (typicality-novelty), and social (connectedness-autonomy). The breakdown of the

model into these three categories addresses aesthetic judgements beyond assessments of beauty or other physical characteristics; the UMA begins to explain how aesthetic judgments may be formed based on a combination of social, cognitive, and perceptual experiences.

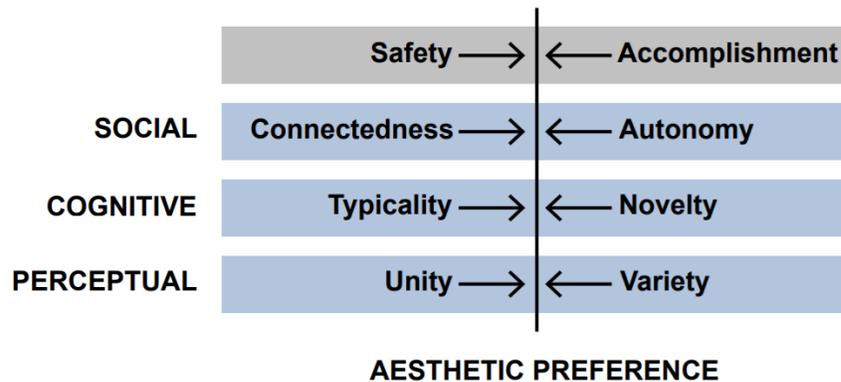


Figure 7. An Overview of the Unified Model of Aesthetics (da Silva Cardozo, 2016; Berghman & Hekkert, 2017)

The present research builds on these frameworks in regard to what an aesthetic violation can be, how it can be manipulated, and why it may successfully influence behavior. Functioning under the assumption that a more easily processed object is more aesthetically pleasing, aesthetic violation proposes a behavioral component: when confronted with an object that is difficult to process, a user may be inclined to escape, minimize, or counteract this experience provided they find the situation manageable—an appraisal that is often referred to as “coping potential” (the degree to which one appraises oneself to have sufficient skills, knowledge, and resources to deal with a situation) (Silvia, 2008). Therefore, it may be possible to induce a behavior by decreasing the processing fluency of the user. In regard to the UMA, this disruption

may apply to the three dichotomies, for creating an imbalance (or violation) within these dichotomies could potentially inspire a behavior. Additionally, criteria for an aesthetic violation was considered beyond physical attributes, to also include experiential and perceptual aesthetic judgments, in accordance with UMA (see Figure 7). It's important to note that UMA has been validated in predicting degree of aesthetic pleasure, but not in regard to implications for user behaviors influenced by products and systems (Berghman & Hekkert, 2017); however, I believe it provides a strong reference point to begin framing aesthetic violation. With this foundation in mind, a set of generative workshops were conducted with designers to begin exploring conditions (research question 1) and uses of aesthetic violation in design processes (research question 2).

CHAPTER 3

PHASE 1: AESTHETIC VIOLATION GENERATIVE DESIGN WORKSHOPS

Goals

The first set of workshops explored the conditions of an aesthetic violation to address the following goals: (1) to discuss existing usage of aesthetic violation, (2) to identify areas of potential usage of aesthetic violation, and (3) to discuss methods of utilizing aesthetic violation. To address the first goal, the workshops investigated existing examples to determine how often this approach was being used in current design practice and how easily designers could recognize its use. The second goal intended to identify what types of problems designers may address with an aesthetic violation. The third goal was intended to help us understand how designers might use aesthetic violation within their design processes.

Method

The generative design workshops (Visser et al., 2005) combined both discussion and brainstorming. They were conducted in small groups, with three sessions including three participants and one facilitator, plus a pilot session with one participant and one facilitator, for a total of ten participants.

Participants and Setting

All participants (five males and five females with ages spanning 20-35) were design students (nine master's and one bachelor's students) recruited from Cornell

University's Design and Environmental Analysis Program. All participants had a design background (ranging from academic to industry experience) and familiarity with the human-centered design process for interactive systems (ISO & Standard, 2010). Design students were deemed an appropriate sample because they were considered knowledgeable about the design process to a point where they could offer valuable insights from the perspectives of designers. They are also immersed in the field to the point of understanding the major theories of human-design relationships and research methodologies used in the design and HCI community. Due to the COVID-19 pandemic, all sessions were conducted and recorded virtually via Zoom with each participant located separately in their own space. Participants were compensated with \$10 gift cards for their contribution.

Procedure

Prior to the workshop, the participants were given information about aesthetic violation via email, including a description and design examples. In order to minimize bias, the examples provided to the participants demonstrated concepts related to aesthetic violation outside of product design (e.g., misaligned floor tiles, incomplete or incorrect patterns, poorly sorted objects, etc.). Then, each participant was asked to brainstorm two examples of existing uses of aesthetic violation and two potential uses of aesthetic violation in the field of design. This step also aimed to minimize bias, for we wanted the participants to consider their own ideas before listening to the ideas of others. The workshop began with a presentation that recapped the workshop goals, and the definition of aesthetic violation with examples that mimicked those sent in the

email. Then, participants shared their prepared examples with the group, followed by a brief discussion of the shared examples. Afterward, the facilitator introduced a design prompt that each participant was to use for independent brainstorming.

The prompt directed the participants to envision and design the “kitchen of the future.” This prompt was chosen because it provided the participants with a design direction without overly constraining their ideas. Also, kitchen experiences are familiar to everyone in some capacity, and this scenario could introduce a series of new design solutions (e.g., interactive appliances, products, and spatial technologies). The participants were encouraged to generate as many ideas as possible rather than to fully develop a small number of ideas, to create a larger data pool. They were also given two tactics to aid in the brainstorming experience. The first was to consider an experience common to the kitchen, then create a brief user-journey map (“Adaptive path’s guide to experience mapping”, 2013) and identify a possible point of intervention with which they could focus their idea generation. The second was to consider a kitchen activity and identify various types of sensory experiences associated with that activity, then brainstorm violations according to the various sensory experiences. Following the introduction of the design prompt, the participants were given 30 minutes to independently brainstorm. Afterwards, the participants reconvened to discuss their ideas with one another. The discussion was loosely facilitated, with occasional probes asking participants to elaborate on their ideas and thought processes. However, the discussions were largely participant driven. Participants generally appeared interested in the ideas of their peers and would draw their own connections that prompted conversation (i.e., “that idea reminds me of. . .”).

Due to the conversational nature of these discussions, the facilitator did not control for time but did ensure that each participant had an opportunity to speak and share ideas. No significant disagreements emerged, perhaps because the workshops were presented as exploratory and therefore participants were willing to consider a wide variety of ideas. All materials produced from the workshops (e.g., photos and scanned images of sketches and notes) were collected at the end of the workshops.

Results

Data Analysis

Data analysis followed a thematic analysis (Braun & Clarke, 2006) and began with generating transcripts from all of the recorded workshop sessions. All transcripts and brainstormed materials were reviewed multiple times, with key portions highlighted and notes taken. These notes and highlighted portions were then developed into a series of codes. The codes were iteratively reviewed and applied to all collected materials for refinement. 63 relevant observations and ideas were gathered and used for analysis. The first round of strategy formation yielded eleven different strategies, representing all ideas that had a connection to aesthetic violation. Ideas with similar codes and/or similar outcomes were grouped together to ultimately form a strategy.

Following the sorting process, a thematic map was created to visualize the trends of the data (see Figure 8). The main strategies are represented within the ovals, while secondary ideas are represented in the rectangles. Strategies and ideas were then connected by lines if participants identified a relationship between them during the workshop sessions. The thickness of the line shows the frequency that an idea or

relationship was discussed, such that the thicker the line, the more frequently it was mentioned.

In the process of analyzing data, overlapping strategies were merged and those that appeared to stray too far from the main goals of aesthetic violation were eliminated. By the end of this sorting process, six strategies remained that fit into three overarching categories. A more in-depth breakdown of this process can be found in this thesis' supplementary materials. Table 1 describes the finalized strategies and guidelines following this first workshop, including design examples to illustrate each strategy.

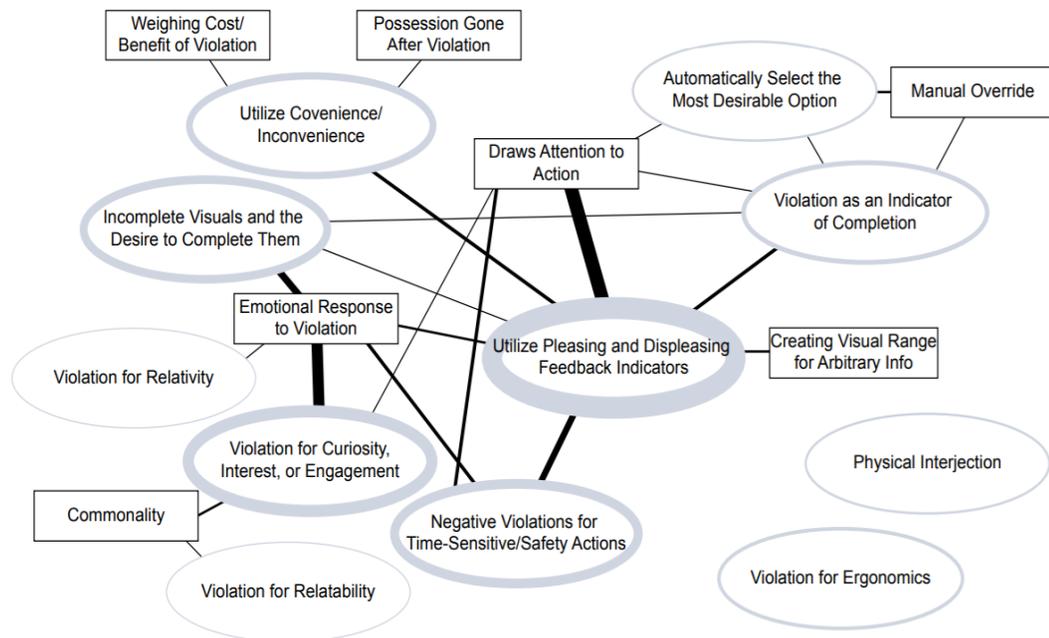


Figure 8. Strategy Formation Thematic Map, the main strategies are represented within the ovals, while secondary ideas are represented in the rectangles

Table 1: The Finalized Set of Strategies from the Aesthetic Violation Generative Design Workshop

Category	Strategy	Description	When to Use	When Not to Use	Example
Violation for Interaction	Create Incomplete Visuals and Provide the Ability to Complete Them	Create a visual that looks incomplete and allow the user to complete the visual. The product should be in the desired state when the visual is complete.	Use this when the object can passively be in an undesirable state. The incomplete visual serves as a reminder to put the object back into a desirable state without causing overt displeasure.	Do not use if the user cannot easily fix the violation, as this will likely lead to feelings of frustration.	The Puzzle Switch (Turner, 2009)
	Violation for Interest or Engagement	Use violations that trigger curiosity or playfulness to encourage users to engage with the violation.	Use in scenarios where novelty is appropriate—most likely in public spaces to attract attention, generate conversation, and encourage people to engage with the design. It is important that the violation looks intentional rather than accidental.	Do not use when it is necessary to sustain the behavior over a long period of time.	Etching a fly inside a public urinal to give users a target to aim at
Utilizing Feedback Indicators	Negative Indicators for Safety or Time-Sensitivity	Use unpleasant or jarring feedback indicators in situations where safety and/or time-sensitivity are important.	Use when the design is intended to keep users safe or to draw their attention to a time-sensitive task.	Do not use unless necessary, as it will likely create feelings of overt displeasure among users.	A car beeps to remind users to wear a seatbelt
	Positive or Neutral Indicators for Attention	Use positive or neutral feedback indicators to draw attention to a behavior.	Use when the design is intended to convey information or draw attention to a behavior without causing overt displeasure.	Do not use if the desired behavior is too important for the user to ignore.	The Aware Handle (Turner, 2009)
Utilizing Convenience	Automatically Select the Most Desirable Option	Automatically set the product to the most favorable settings and require users to manually override these settings.	Use this when the desirable setting lies within a range of settings or in a scenario where the user can easily override the automatic selection if necessary.	Do not use when the manual override option is complicated, or when the most favorable option may be too extreme for most users	If an appliance has a standard mode and an eco-friendly mode, make the eco-friendly mode the default. Require users to select the standard mode if desired.
	Make the Most Desirable Option the Most Tangible	Position the most desirable option to be the most easily acquired.	Use this when there is an array of options to present, but one option is more beneficial than others. All options should still be attainable, just to varying degrees of convenience.	Do not make undesirable options so inconvenient that they become unusable or impractical.	A refrigerator where the fruit and vegetable drawers are the easiest to access

Participant Examples

This section shows three examples suggested by the participants, each corresponding to one of the three strategy categories.

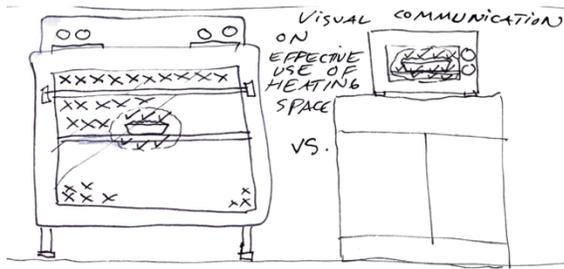


Figure 9. Colorized Oven Window



Figure 10. Fake Runner Rug (Gilmore, 2019)

Example A: Positive or Neutral Feedback Indicators for Attention— Colorized Oven Window

This oven (Figure 9) highlights the ratio of energy used compared to the amount of food heated inside. The window shows check marks on areas of the oven that contain food, and x's on areas that are being heated for no purpose. The intention is to encourage users to use appliances proportional to the task at hand, such as heating small amounts of food with an appliance that is less energy intensive than a full-sized oven. This idea falls into the category “Utilizing Feedback Indicators.”

Example B: Automatically Select the Most Desirable Option—A Shower Handle Button

The participant discussed a shower handle that automatically sets the shower to a temperature of 100 degrees to limit the use of hot water. The handle has a button that the user must press while turning the handle to change the temperature. This example falls into the category “Utilizing Convenience.”

"It's got this visual of where 100 degrees is at. 100 degrees is a pretty standard hot shower, not too hot or cool. It's also got this temperature button, I guess it's either direction, when you're turning the handle, it clicks and locks in at 100, and then you've got to press and hold that button while turning it to make it hotter."

Example C: Violation for Interest or Engagement—Fake Runner Rug

The fake runner rug (Figure 10) was highlighted by a participant for the way the violation both grabbed his attention, and evoked feelings of curiosity and humor. The example falls into the category "Violation for Interaction."

"It's very intentional. If it was a rug, in your mind you'd think 'I can go kick and move it over', but you can't actually do it so it's sort of maddening. I was thinking about the feeling of slight discomfort and curiosity, and then the annoyance and humor about it. The behavior it encourages is looking over [at the corner], and then that directs your attention to [the building]"

Brief Discussion of Strategy Development

The initial strategy development generated several insights, the first being the emergence of the three overarching categories: (1) violation for interaction, (2) utilizing feedback indicators, and (3) utilizing convenience. Additionally, an emotional component to aesthetic violation was identified. Several participants noted that some

aesthetic violations were considered interesting or enjoyable (e.g., the tilt of the Leaning Tower of Pisa), while others caused feelings of annoyance or frustration (e.g., a billboard with part of a word cropped off). Based on observation of the participants, we noted that emotional responses may vary significantly based on the individual or target audience, but the appearance of intentionality may also be an important factor in creating a positive violation. For example, creating a violation that appears to be a “mistake” may be frustrating, whereas a violation that appears intentional allows the viewer to feel as if they are “in on the joke,” generating amusement or piquing curiosity. A sense of control may also play a role. Individuals that are confronted with a violation may have the desire to interact with or resolve the violation. Therefore, not having control over the interaction or the ability to participate in resolving the violation may lead to frustration. This also relates to affordances (Gaver, 1991). Unclear affordances, meaning unclear indications as to how the user should interact with the design, in combination with an aesthetic violation could be potentially frustrating.

Subjectivity was also a frequent topic of discussion, meaning aesthetics are highly subjective so the effects of an aesthetic violation will vary depending on the user. However, the amount of variance may differ depending on the specific violation. For example, a violation invoking amusement may impact a larger audience than a visual violation with a misaligned graphic because certain violations may cater to a broader audience based on varying levels of aesthetic sensitivity (Myszkowski & Storme, 2017; Bloch et al., 2003). The designers generally seemed to recognize that

aesthetic violations had the potential to be complex, multisensory experiences involving either positive or negative outcomes.

Though the development of an initial set of strategies was a starting point, a follow-up study was needed to better refine the strategies. It was also necessary to assess if the generated strategies were clear and understandable to designers, as well as gain feedback about how the strategies fit into their design processes. We also wanted to determine if the strategies could be applied to a prompt in a manner that adequately encompassed the strategic goals and examine how the strategies worked in conjunction with each other. For these reasons, a second set of workshops were conducted.

CHAPTER 4

PHASE 2: AESTHETIC VIOLATION STRATEGY REFINEMENT WORKSHOPS

Goals

The second set of workshops aimed to: (1) assess the usefulness of the strategies to apply aesthetic violation in design conceptualization and (2) improve the strategies based on designers' input.

Method

Workshop Setup

The second set of workshops were formatted similarly to the first set, but with more structured brainstorming. Three workshops were conducted in small groups, each consisting of two participants and one facilitator, for a total of six participants. To assess overall effectiveness of the strategies, a small number of participants was deemed appropriate to collect vivid, rich, and in depth data based on the precedence set by other qualitative studies with similar goals of strategy refinement [e.g., Yoon et al., 2016; Lu & Roto, 2016; Klapperich et al., 2018].

Participants and Setting

All participants (three males and three females with ages spanning 20-35) were design students (five master's and one bachelor's students) recruited from Cornell University's Design and Environmental Analysis program. All participants had a design background (ranging from academic to industry experience) and familiarity

with the human-centered design process for interactive systems (ISO & Standard, 2010). Five of the six participants had participated in the previous workshop, giving them some experience to draw from when proposing refinements and offering feedback. As with the first workshop, design students were deemed an appropriate sample because they were considered knowledgeable about the design process and immersed in the field to the point of understanding the major theories of human-design relationships and methodologies commonly used in the design and HCI community. Due to the COVID-19 pandemic, all sessions were conducted and recorded virtually via Zoom with each participant located separately in their own space. Participants were compensated with \$10 gift cards for their contribution.

Procedure

Prior to the workshops, participants were given information about aesthetic violation via email, including the definition with examples and a brief overview of the design strategies. The workshops began with a presentation that introduced the session's purpose and procedure, then the facilitator introduced the design prompt (to be reused for brainstorming with every strategy), which directed the designers to create an interactive lighting product-service system. This prompt was chosen because it provided a familiar but focused design direction. Following the introduction of the prompt, the designers were presented with the first strategy. A full description, along with an example, was given. Additionally, two questions were provided with each strategy to help participants begin the brainstorming process. For example, for "Create

Incomplete Visuals and Provide the Ability to Complete Them,” the designers were prompted to consider aesthetic violation with the questions: (1) Considering the prompt, what type of visual violation might make sense? (2) How does the physical interaction with the switch impact the visual? The designers individually brainstormed for five minutes using the strategy and the prompt. Then, they were guided to share their experiences using the strategy and the design ideas they generated, prompting a brief discussion. The same process was repeated with the remaining strategies. After all six strategies were addressed, brainstormed, and discussed, participants were asked to share which strategies worked well together, and which strategies did not. Then the workshop concluded, and the designers were emailed anonymous feedback surveys that invited them to further elaborate on their experiences using the strategies, and provide written feedback on strengths, weaknesses, and combination of use.

Results

Data Analysis

As with the previous workshops, data analysis began by generating transcripts from the recorded sessions, followed by several reviews of the transcripts, brainstormed materials, and survey responses. Key portions were highlighted, and notes were taken. 92 relevant observations and ideas were used for analysis. To address the first aim of the workshops, the data was considered with regard to how clearly the designers understood and implemented the respective strategy. To address the second aim of the workshops, feedback for strategy refinement was considered with regard to clarity,

application to the design process, successful strategy combinations, and general considerations or suggestions for improvement.

Assessing Usefulness

Regarding usefulness, the designers were able to apply all strategies to the prompt, however, they noted that some strategies applied more successfully than others. For example, some participants thought the strategies in the “Utilize Convenience” category were difficult to apply to a lighting product because they viewed a lighting product to only have two potential options: to turn the light on or off. Therefore, positioning or streamlining the choices did not seem to apply, and seemed less useful in this context.

“It was a little difficult in this situation because I felt like the two options were opposites of each other. . . I feel like this strategy [Make the Most Desirable Option the Most Tangible] was more targeted towards if you had 10 different options and you were trying to choose the best out of those.”

However, other participants applied a dimmer switch to their lighting designs, creating more than two options for the user, which was considered more useful. Similarly, some participants struggled with applying the “Negative Indicators for Safety or Time Sensitivity” strategy to this prompt, because lighting products are rarely associated with safety or time-sensitivity. Participants noted that the qualifying phrase “for safety and time-sensitivity” may be too limiting, for negative violations

can be useful in other circumstances (though they will likely result in a negative emotional experience). Therefore, a negative violation may be appropriate in any scenario where this trade-off is considered worth it. Similarly, some participants noted the verbiage “Positive or Neutral Indicators for Attention” as limiting in scope as well.

“It [a lighting product] is not negative or positive, because “on” isn’t negative and “off” is positive. . . the knob [“The Aware Handle”, (Turner, 2009)], is pleasurable in that the opposite is uncomfortable. I think it works, but it’s always set in comparison to one another and just trying to find ways where “on” is not objectively displeasurable and the “off” is pleasurable, that is kind of a challenge.”

The juxtaposition of these two strategies was highlighted to be a strength, in that these strategies may be successfully used separately, but also together. Many designers considered the strategies in the “Violation for Interaction” category to be relatively easy to understand and implement because they involved an emotional component. Some designers felt the strategy “Create Incomplete Visuals and Provide the Ability to Complete Them” created an emotional response due to a desire to create order from chaos, while others attributed an emotional response to “Violation for Interest or Engagement” because it was associated with words such as “personality”, “playful”, or “curiosity”.

“I think it’s hard when you think about complex human behavior and interaction. But, when we talk about aesthetics [in the context of “Create

Incomplete Visuals and Provide the Ability to Complete Them”], I think there’s something to respond to. There’s a bigger emotional component to this feeling, of trying to move towards completeness or less chaos, more order.”

Refinement of the Design Strategies

In order to reflect participant feedback, specific refinements were made to the strategies. The strategy names and descriptions were modified for coherence and accurate representation of strategy goals. For example, the strategies in the “Utilizing Feedback Indicators” category were broadened due to the aforementioned participant feedback, but “Violation for Interest and Engagement” was narrowed to “Aesthetic Curiosity” to better focus the intentions of the strategy. It also became apparent that some strategies were worded at a “design level,” meaning describing specific aesthetic applications, whereas others were worded at an “interaction level,” meaning describing the way a user might interact with the violation. Therefore, the final strategies were adjusted so that all strategies were worded at the “design level,” with a note as to how this might impact the “interaction level.”

Additionally, the first set of strategies laid out “do’s and don’ts”, whereas the refined strategies more generally highlight best uses and considerations. This more accurately reflects the recommendations and potential concerns that may help a designer use the strategy, but it also indicates that these recommendations may not be true in all instances. These strategies are intended to offer ideas and guidelines to designers, rather than strict rules, and the revised phrasing more accurately communicates this intention. A more diverse set of examples were also provided to

better illustrate the potential breadth of the strategies. Additionally, partner strategies were identified based on participant feedback. Specific feedback was offered in accordance with each strategy; a summary of this feedback and key researcher observations can be found below in Table 2.

Table 2: Summary of Feedback on the initial Aesthetic Violation Strategies

Category	Strategy	Feedback & Observations
Violation for Interaction	Create Incomplete Visuals and Provide the Ability to Complete Them	<ul style="list-style-type: none"> • Most participants considered this to be a “fun” strategy. • This strategy was associated with bringing joy to users. • This strategy was associated with puzzle metaphors. • The resulting designs had both graphic and dimensional applications. • This strategy seemed to involve an emotional response. • This strategy was associated with applying order to chaos. • The designers connected this strategy with “Positive or Neutral Feedback Indicators” and “Violation for Interest or Engagement”.
	Violation for Interest or Engagement	<ul style="list-style-type: none"> • The designers understood the concept of the strategy, but the broadness made it difficult to apply. • Some observed overlap with the above strategy, but this was considered to have “more personality” • This strategy seemed to involve an emotional response. • Many of the resulting solutions were creative and fun. • The designers connected this strategy with “Positive or Neutral Feedback Indicators” and “Create Incomplete Visuals and Provide the Ability to Complete Them”
Utilizing Feedback Indicators	Negative Indicators for Safety or Time-Sensitivity	<ul style="list-style-type: none"> • It can be challenging to realistically frame a negative experience. • What is considered a “negative violation” will be subjective. • This strategy was conceptually easy to grasp. • The terms “safety and time-sensitivity” can be constraining. • Balancing a negative violation with positive reinforcement may connect this strategy to “Positive or Neutral Indicators for Attention”.
	Positive or Neutral Indicators for Attention	<ul style="list-style-type: none"> • What is considered a “positive or neutral” violation will be subjective. • This strategy was more difficult to understand because of this subjectivity. • This strategy may be more successful if it is framed like a reward system, rather than a punishment. • The designers connected this strategy with both strategies in the “Violation for Interaction” category.
Utilizing Convenience	Automatically Select the Most Desirable Option	<ul style="list-style-type: none"> • It can be difficult to apply this strategy to a product with binary (e.g. on/off) functions. • This strategy felt relatively intuitive because it tends to be a common goal in design practices
	Make the Most Desirable Option the Most Tangible	<ul style="list-style-type: none"> • Some designers found applying this strategy to be challenging because it seems to require a “trade-off”. • The alternate option(s) can’t be too inconvenient, or the design becomes unusable. • This may be difficult to apply to binary functions.

Refined Strategies

The finalized set of strategies with their corresponding categories are detailed below, in Table 3.

Table 3: A Refined Set of Design Strategies for Aesthetic Violation

Category	Strategy
User Interaction	S1. Aesthetic Chaos S2. Aesthetic Curiosity
Feedback Indicators	S3. Negative Violations for Necessary Behaviors S4. Positive Violations to Reward Behaviors
Perceived Convenience	S5. Aesthetic Simplification S6. Prime Positioning

S1: Aesthetic Chaos—Create a state of disarray but provide the opportunity for the user to restore order

Disarray primarily has visual implications (e.g., an incomplete pattern that the user then completes), but it would apply to other sensory experiences as well.

The action of restoring order should result in the user performing the desired behavior. This strategy invites the user to counteract a violation, and it should give them the means to do so. It may be most successful when a visual violation is appropriate. The state of disarray serves as a reminder to return the object to the ordered state without causing overt displeasure. This strategy may lead to feelings of frustration for users if they cannot restore order to the chaos, but this violation can bring joy or amusement when associated with puzzles, games, or novelty. Some examples include: (1) The Puzzle Switch (Turner,

2011); (2) A scrambled Rubik's Cube, where completing the cube results in a product performing the desired task; (3) the completion of a puzzle to reveal an image. This strategy may work well with S2 and S4.

S2: Aesthetic Curiosity—Aesthetically violate an object in an unexpected way, such that this violation draws user attention and creates a desire to better understand the violation

Break the aesthetic norm of a situation in a way that does not provide overt displeasure, but rather causes users to question their experience. This may encourage users to complete the desired behavior out of playfulness, amusement, or curiosity, created by an unexpected experience. This strategy may be most successful when feelings of fun and enjoyment are appropriate and/or when novelty is appropriate. This may be most beneficial in public spaces to attract attention, encourage conversation, and to encourage users to interact with a design. It is important that the violation looks intentional rather than accidental, and the impacts of this violation may be more susceptible to fade over time, therefore novelty is important. Some examples include: (1) The Leaning Tower of Pisa; (2) a fly etched inside a urinal to provide users with a mark to hit; (3) mismatched tiles leading up to a building facade to encourage users to enter. This strategy may work well with S1 and S4.

S3: Negative Violations for Necessary Behaviors— Use unpleasant or jarring violations in situations where it is crucial for users to counteract the violation

The use of this strategy should likely be limited to situations that are time-sensitive or that enforce safety measures, but may also be used to show a negative violation in contrast to a positive one. What qualifies as a negative violation may be subjective, so it is important to consider the target users. This strategy will likely conjure an unpleasant emotional response, so it is important to determine whether this “trade-off” is appropriate for the situation. Some examples include: (1) a fire alarm; (2) a seatbelt notification chime in a car; (3) the beeping notification on a microwave. This strategy may work well with S4 and S5.

S4: Positive Violations to Reward Behaviors—Use violations as a means of positive reinforcement to reward favorable user behaviors

This strategy intends to facilitate a positive aesthetic experience through the completion of the intended behavior. The user will perform the intended behavior out of the desire to increase the aesthetics of the object, or in response to the positive feedback they are receiving. This strategy may be most successful when a design is intended to draw attention to or reward a behavior without causing displeasure, or used to show a positive violation in contrast to a negative one. Depending on the solution, it may also be important to consider the effects of novelty. These violations may also be subjective, so it will be

important to tailor these violations to a specific audience. Some examples include: (1) turning off a lamp (or other electronic) results in a pleasant scent released by an air freshener; (2) reducing the temperature on the thermostat results in a musical chime indicating a positive temperature range; (3) lowering the temperature of the freezer results in a green backlit display, rather than a flashing red backlit display. This strategy may work well with S1, S2, S3, and S5.

S5: Aesthetic Simplification— Streamline the aesthetic experience and reduce visual clutter by automatically selecting the most favorable option for the user based on the desired behavior

This strategy assumes that users will most often keep the default setting, thereby most often executing the intended behavior. It may be most successful in an electronic object or other scenario where settings can be predetermined, especially if there are more than two potential options for the user. This strategy may be challenging if the default setting feels extreme to the user or if the manual override is complicated. Some examples include: (1) a thermostat that automatically presents the user with the most efficient temperature option and resets to this default every 12 hours; (2) a dimmable light switch that highlights the most efficient brightness and defaults to this value every time the light is turned on; (3) a car that starts in a gas-efficient mode with no

notification sign unless the driver manually turns off this feature. This strategy may work well with S3, S4, and S6.

S6: Prime Positioning— Position the most favorable option to be the most noticeable, the easiest to acquire, and/or the easiest to execute when compared with the other options

Making the most favorable option the easiest to act upon may reduce decision fatigue for users, encouraging them to perform the most favorable option more often. This strategy may be most successful in scenarios where there are more than two potential options for the user. Aesthetic principles such as scale and hierarchy may be helpful in implementing this strategy. This strategy may require a “trade-off,” because by making the most favorable option the easiest, the other options will become more inconvenient. The designer must balance this trade-off so the inconvenient options are not so unusable that they deter user interactions. Some examples include: (1) a refrigerator where healthy foods are visually prominent and easily accessible, and the unhealthy foods are hidden in the back; (2) an in-store point-of-purchase display that showcases the newest products, while positioning the clearance items in a different part of the store; (3) positioning the recycling bins in a more prominent and accessible location than the trash bins. This strategy may work well with S5.

Suggestions for Strategy Application

Throughout the workshops, some designers struggled with the application of aesthetic violation more than others. Some felt it was difficult because what characterizes an appropriate violation may be highly subjective, while others struggled in terms of choosing an aesthetic experience to prompt the desired behavior change. To better guide designers in this process, a flowchart was developed to help select the appropriate strategy based on the desired user interactions. Though this chart is not exhaustive, it may provide the designers with a starting point to begin introducing aesthetic violation into their design processes. Additionally, the resulting strategy will recommend partner strategies that may aid in the process. The flowchart can be viewed in Figure 11.

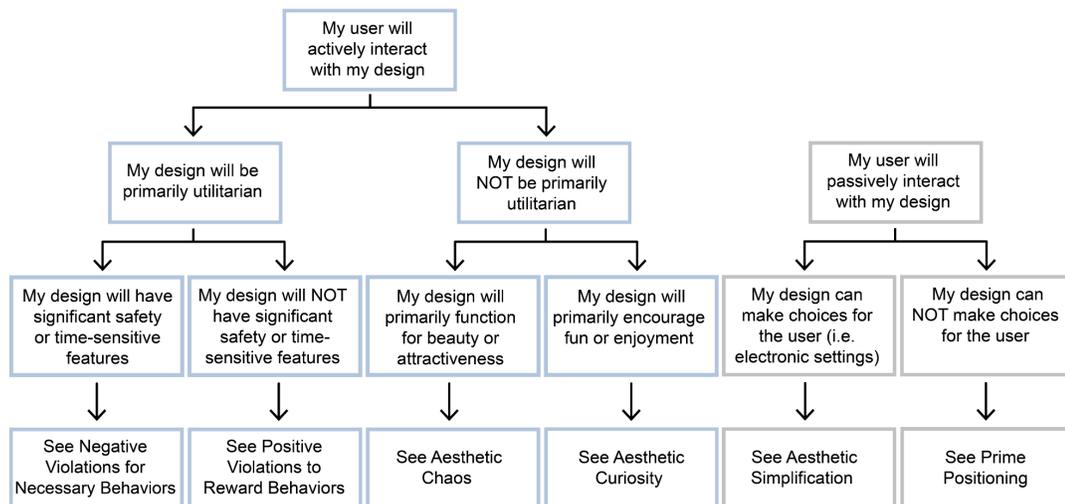


Figure 11. Strategy Flowchart

Discussion of the Workshops in Phases 1 and 2

This research used a two-step approach to gain insights into how designers can be supported to use aesthetic violation to influence users' behaviors in a favorable way.

We found the approach effective in both strategy formation and refinement. Strategy formation, explored in the first set of workshops, was implemented in a loosely structured brainstorming and discussion format, with the intention of promoting creativity and engagement between participants. Prior to conducting the workshops, a main concern was how to introduce aesthetic violation without biasing participants when generating design ideas. Ultimately, participants were provided with a definition and examples via email, but the examples were removed from the context of the workshop's brainstorming. Additionally, participants were asked to develop some of their own ideas prior to the workshop to prevent bias between participants. Regarding the brainstorming prompt, we provided a relatively unconstrained direction because we were interested in understanding the types of problems the designers would identify, along with the solutions to these problems. Further, when conducting the workshops, it was emphasized that the participants should not be overly concerned with whether or not their ideas constituted an aesthetic violation, but to simply explore as many ideas as possible. This was to both cultivate a positive atmosphere where participants felt comfortable being creative, and to encourage participants to make new connections based on the ideas of others. Occasionally, probes were needed to facilitate conversation, but overall the loosely structured time successfully prompted exploration and discussion. All of these considerations were useful for collecting a wide variety of unique ideas, contributing to a larger data set.

The second set of workshops introduced more structure than the first because we wanted more targeted feedback for the purposes of strategy refinement. In providing a more specific design prompt with shorter brainstorming periods, we hoped

the participants would offer ideas that specifically applied to each strategy. The results were mostly successful in this regard, though sometimes ideas would be applicable to more than one strategy. Overall, more usable data extracts were collected in the second set of workshops than the first.

A main benefit of using this two-step approach for strategy development is the ability to explore a wide range of possibilities, and to later refine this information down to the most relevant segments. This process could also benefit from a series of cyclical iterations to continue to develop design insights.

CHAPTER 5

GENERAL DISCUSSION AND CONCLUSION

Implications for Design Practice

The strategies were developed from the perspectives of designers, with the intention of applicability to the design practice. Aesthetic violation has clearly been used in the design and HCI fields, though to our knowledge, not systematically. Therefore, the development of strategies aimed to help designers systematically apply aesthetic violation to their own design processes. A key consideration of aesthetic violation is the subjectivity of the chosen violation, meaning the impacts of the violation and the resulting behaviors will vary from user to user. A participant noted: “What might annoy me may not have an effect on someone else, so I think it raises a lot of questions about subjectivity when it comes to “*what is a good experience for you and what is a good experience for me?*” Understanding the implications of a violation’s subjectivity will be crucial for successful implementation.

Similarly, we must also consider the cultural relevance of any set of aesthetic design strategies, for positive and negative aesthetic experiences may vary across cultures. Research has shown that individuals across cultures have different aesthetic preferences regarding attributes like color (Palmer & Schloss, 2010), polygon complexity (Soueif & Eysenck, 1971), and object orientation (Nittono et al., 2020), but similar preferences regarding attributes like proportion (Pittard et al., 2007) and contour shape (Gómez-Puerto et al., 2018). Because aesthetics is highly subjective,

both between and within cultures, the strategies may be most effective if the designer identifies and understands the characteristics of intended users before choosing a desired behavior and strategy. In-depth understanding of context and users' concerns (e.g., goals, values, and aspirations) may better equip the designer to pick violations that are appropriate for the users, creating higher chances of behavioral success. Additionally, understanding the relationships between emotional triggers and violations may play an important role in successful implementation. A strength of presenting a set of design strategies is that we are offering suggestions that guide solutions rather than solutions in themselves, thus allowing designers to tailor the strategies to be appropriate for various contexts and users. However, the guidelines surrounding each strategy may vary across cultural contexts and this is something that should be further investigated in the future.

Additionally, the workshops indicated that rarely were the strategies used in isolation; almost every design unintentionally involved a combination of strategies. The most common groupings involved Aesthetic Chaos, Aesthetic Curiosity, and Positive Violations to Reward Behaviors, because all of these strategies involved positive user experiences; however, all strategies were shown to effectively work with others. To use these strategies successfully, it is not recommended that a designer aspire to use only one, but perhaps to use one as a starting point to begin generating ideas. The Positive Effects of Temporal Negativity in Product Use. Throughout the workshops, it appeared that participants struggled more with violations they characterized negatively, because designers are typically trained to create positive user

experiences. Therefore, it may be beneficial to frame aesthetic violations in a broader context. If we consider that an aesthetic judgement can be formed based on the efficiency of a design or how well the object performs its function (da Silva Cardozo, 2016; da Silva et al., 2016), even a negative violation can result in a positive user experience if the violation improves the overall efficiency or functionality of the design. Similarly, our product interactions can be enriched when positive experiences are balanced with negative ones. As Fokkinga and Desmet (2012) theorized, positive and negative experiences can add richness to a product interaction, allowing designers to create experiences that are more “worthwhile” and “valuable” to the user. Benford et al., (2012) propose that purposely designing discomfort into an experience can increase the entertainment, enlightenment, or sociality of an experience. Aesthetic violation may provide another opportunity for designers to enhance positive experiences with negative ones. For example, S1 and S2 allowed workshop participants to experience positive emotions (e.g. playfulness or curiosity) as a result of violations that initially caused annoyance or discomfort. Similarly, when using S5 and S6, participants noted the potential benefits associated with positioning positive and negative violations in opposition to each other in order to encourage positive behaviors and/or discourage negative ones. Importantly, a violation does not necessarily denote a negative user experience, provided the violation is used appropriately to increase the function of the design or add richness to the experience.

However, ethical considerations must be made when introducing discomfort or other experiences that may hinder inclusive design. Similar to the problem of

subjectivity, ethical considerations also highlight the need for an empathic and participatory design approach (McDonagh, 2004; Oulasvirta et al., 2003) when using aesthetic violation in order to safeguard users. It is critical to understand the users of the product not only to determine what constitutes an effective violation, but what will be considered safe, usable, and appropriate for the necessary audience.

Sustainable Applications

While the goals of this research were to help designers use aesthetic violation to encourage user behaviors (as exemplified in the workshops), this research has significant applications with regard to sustainable usage behaviors. More specifically, aesthetic violations have the potential to promote more conscious product use and the development of sustainable behaviors. The first category of strategies, “Violation for Interaction”, incorporates user participation in a way that provokes curiosity or interest. These strategies may have large impacts in scenarios that are deemed novel rather than mundane, as the effects of curiosity may diminish over time. However, when we consider the use of these strategies in a public space or at a public event, they may significantly impact the environmental choices of a large group. This type of approach not only draws attention to positive behaviors, but it also associates sustainability with fun and interesting experiences. The second category of strategies, “Feedback Indicators”, allows the aesthetics of a product interaction to provide feedback, thereby encouraging the user to act more consciously. Whether this uses a positive or negative violation, the act of experiencing the violation has the potential to

lead to a higher level of situational awareness and more conscious decision making in regard to sustainable choices. The last category of strategies, “Perceived Convenience”, may best lend itself to the development of unconscious sustainable behaviors. With the perception of convenience providing the main motivation for the user, the sustainable behavior in this case could function as a secondary benefit. For example, having a light that defaults to a low or intermediate brightness still allows the user to perform the desired function, but in a way that has better environmental consequences. These small types of changes, when functioning on a large scale, could significantly reduce resource consumption in a way that may not be overly troubling to the user. Furthermore, if the user does choose to override these settings, it becomes a conscious and intentional choice rather than a mindless one.

Limitations and Future Research

Due to the exploratory nature of these studies, there are limitations to be considered. First, the strategies presented are in the early stages of development, and this may not be a comprehensive list. In the future, new strategies may emerge and be added, while others may be removed or altered. Additionally, these strategies were developed from the perspective of designers rather than users. Ultimately, the users of these products will largely be nondesigners, so the next steps toward strategy validation must include non-designers as participants. To our knowledge, many of these strategies have not been consciously implemented in a wide variety of designs, therefore it was sometimes challenging to develop realistic examples for each strategy. As future

research continues to expand upon these ideas, better examples will likely emerge to illustrate the goals of each strategy.

Future research should empirically test these strategies with a larger group of participants in order to validate their effectiveness and propose improvements as necessary. Due to the subjective nature of aesthetic violations, future research is needed to better establish boundaries and guidelines for applying these violations, especially across cultures. Since the method of development involved both the application and evaluation of these strategies by designers, these strategies have the potential to be used as heuristic tools. Therefore, future research could further explore the applicability of these strategies to design heuristics. Overall, the concept of aesthetic violation is still in need of systematic validation and of more detailed guidelines. However, these strategies provide a rich foundation for the continuation of this research.

Conclusion

This thesis explores aesthetic violation as a means of inciting usage behaviors through design. Two sets of workshops were conducted in order to understand what aesthetic conditions may constitute an aesthetic violation, and how these conditions might be incorporated into design to influence user behavior. As a result of the first set of workshops, six design strategies were developed, and as a result of the second set of workshops, the strategies were refined and improved. The resulting strategies can

serve as guidelines for designers to use aesthetic violation both effectively and systematically.

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