

Representing Sight and Sound in Design Media:

A Cyclical Time-based Model

by

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ABSTRACT

As digital technology promises immediacy and interactivity in communication, sight and sound in motion graphics has expanded the range of design possibilities in advertising, social networking, and telecommunication beyond the visual realm. The experience of seeing has been greatly enriched by sound as visual solutions become dynamic and multi-dimensional.

The ability to record and transfer sight and sound with new media has granted the designer more control in manipulating a viewer's experience of time and space. This control allows time-based form to become the foundation that establishes many interactive, multisensory and interdisciplinary applications. Is conventional design theory for print media adequate to effectively approach time-based form? If not, what is the core element that is required to balance the static and dynamic aspects of time in new media? Should time-related theories and methodologies from other disciplines be adopted into our design principles? If so, how would this knowledge be integrated? How can this experience in time be effectively transferred to paper? Unless the role of the time dimension in sight is operationally deconstructed and retained with sound, it is very challenging to control the design in this fugitive form.

Time activation refers to how time and the perception of time can be manipulated for design and communication purposes. Sound, as a shortcut to the active time design element, not only encapsulates the structure of its "invisible" time-based form, but also makes changes in time conspicuously measurable and comparable. Two experiments reflect the influence of sound on imagery, a slideshow and video, as well as how the dynamics in time are represented across all design media.

A cyclical time-based model is established to reconnect the conventional design principles learned in print media with time-based media. This knowledge helps expand static images to motion and encapsulate motion in stasis. The findings provide creative methods for approaching visualization, interactivity, and design education.

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CHAPTER 1

INTRODUCTION

OVERVIEW

The increasing use of motion and sound in digital media challenges the traditional values of print design, and expands the possibilities of visual communication. Visual form is more than just an initial representation of appearance. For example, a clickable web icon can trigger a series of physical and psychological interactions. Form represents both the static and dynamic aspects of function. Exploring the state of equilibrium and opposition between stasis and dynamics in visual communication facilitates our understanding of interactivity and the multi-sensory dynamics in the digital era.

Dynamic form underlies a life force that can be internalized as “movement” and externally represented as “change.” In this research, the general definition of “dynamic” and “change” is interchangeable except “dynamic” is conceptual and “change” is physical. In order to operate “dynamic” in this research, sound is used to decompose the visual “change” in time. This decomposition not only exposes the potential sequencing behind the visible form; it also identifies the most representational “change” in time that shifts the design platforms from motion to print. Although the concept of “dynamic” has been long discussed in both traditional and digital media, the connection linking “dynamic” concepts from both areas has never been clearly established. In other words, does the dynamic in poster design bare the same dynamic quality in web or in movie format? What conclusions can we draw from their similarities and differences in terms of the “aesthetic” and “function”? What is the key to unlock the dimensional shift between traditional and digital media?

STATEMENT OF PROBLEM

In order to understand how new technology empowers a dimensional shift in design by isolating time, space, and our senses, let us compare the typing experience among

traditional typewriters, computer keyboards, and touch-screen displays. When typing with an antique typewriter, we hear two distinct sounds: one from each time we hit the key and another each time the key strikes the paper. Consequently, the harder we hit, the louder the sound is, and the text on the paper is darker from the increased pressure (assuming the ink on the ribbon is not dry). This direct mechanism embraces all seeing, hearing, and touching in real time and space.

The separation of direct feedback in real time makes time designable. When typing on a computer keyboard we no longer hear the striking sound of the key hitting the paper. Instead, the sound of our fingers hitting the keyboard is all we hear. Imagine if the computer is unplugged, no visual feedback will be shown no matter how hard we hit the keyboard. The input of typing text and the output text displayed on the screen exist in two isolated time-space locations: the real time in reality and the designable time in time-based form. Our ability to separate sequential experience from direct feedback makes time a designable medium.

The touch screen display (i.e., cellphone or ipad) further segregates our senses into modules. For instance, sound can be completely muted and volume can be disassociated from typing. The three dimensional button is merely a projection of a two-dimensional icon on a touch screen display with drop shadows and perspectives. The mechanism of typing with our sense of touch has been digitally modified by the new form (the ipad keyboard), time (the feedback of sounds and images displayed on screen), and dimension (the substitution of the third dimension using two-dimensional design). Time-based form not only dominates the design of stimulating new interaction in reality, it also reinforces the power of sight in affecting other senses (sound, touch, taste, smell) in perception. McLuhan ranked sight as the highest specialized sense that constructs this reality in time and space.

According to him, technologies both extend and amputate our senses.¹ As technology makes

1 Marshall McLuhan, "Sight comes first, because the eye is such a specialized organ. Then come hearing, touch, smell, and taste progressively less specialized senses. By contrast with the enormous power of the eye and the distances from which it can receive a stimulus, the tongue is thought capable of distinguishing only sweet, sour, bitter and salt and only in direct contact with the substance providing the stimulus." *Understanding Media*, (New York: McGraw Hill, 1964), xix.

both seeing and hearing recordable and transferable in time and space, time-based form is the extension of seeing. Psychologists have estimated that when the brain is receiving visual and aural impressions simultaneously, about 70 per cent of the intelligence comes through the eyes and about 30 per cent through the ears.² Integrating the creative processes of both sight and sound can certainly increase the impact and experience of a message.

OBJECTIVES

The goal of this study is not to re-define the principles of motion graphics or to reissue the historical aspects of film editing; numerous books have provided both. To the contrary, it emphasizes the role time plays in all design applications. There should be no gap between print design and motion graphic design. It is essential to consolidate a model that offers the skills of expanding static visualization into motion as well as executing motion in static media. The knowledge and methods that allow us to juggle visual representation across mediums differentiates our profession from other types of design. Different visual representations are studied meticulously through change in time-based form. Change, as a tangible entry point to the unified experience of the seen (sight) and unseen (sound), is scrutinized and decomposed in the literature review.

BACKGROUND

Digital technology expands the range of design applications. Sight and sound in motion graphics are widely used for advertising, social networking, and telecommunication. The advancement in camera and mobile phone technology makes recording and editing accessible; high-speed video streaming emancipates the visual constraints of time and space in video sharing (youtube, vimeo) and video conferencing (ichat). The immediacy and interactivity of using sight and sound in social media (Facebook, Myspace) catalyzes a dynamic shift between static presentation and motion graphics. Whether video and sound are employed casually or professionally; they demand a new role in visual communication design. What are the new expectations and standards from this shift? In the process of

2 David Epstein, *Shaping Time*. (New York: Shirmer Books), 56.

animating a logo design, what is the added value of expanding this static logo to a 24 frames per second rate? Do we just animate it for the sake of animation? If anyone has access to video production, how can graphic designers contribute additional skill sets in typography and visual language to enhance the video and differentiate our role from professional film editors? The answer re-defines our role and discipline in this new media era.

New media is both forgiving and forgetting. Digitized information spreads out fast in this time-sensitive world. Older information in a blog can quickly be buried with new updates. The digital revolution shortens our tolerance of waiting. Our sensitivity in time has changed. Director Steven Spielberg has mentioned in an interview³ that fast editing in film is popular nowadays and this new generation is prepared for this pace. Director Martin Scorsese echoed Spielberg's observation by adding his concern on how we may consume things too fast before taking the time to appreciate the value of an experience. Regardless of searching for the ideal pace in life, their observations demonstrate the inseparable interplay between the sensitivity of pace and the experience of time. Our tolerance of time is truly related to our experience. Maister's research focuses on methods that either increase the tolerance for waiting time or reduce the perceived waiting time. Visually informing the "progression" and "occupation" in time as a strategic solution alter the degrees of tolerance in participants.⁴ Our experience of story time in design context lives in parallel with reality. A three-hour movie occupies three hours of real time to progress. It is necessary for designers to gain sensitivity in time for organizing the time-based form qualitatively and quantitatively.

The quality (content of interest) and the quantity (the amount of content) are two aspects that relate to the subjectivity and objectivity in experience. Objectively we can count how many events are sequentially arranged in a given time frame; the counting may lead the audience to think the story takes a long period of time to play. Assuming the audience is very engaged in the content and has lost track of time, we then shift the experience to

3 The Cutting Edge. DVD. Directed by Wendy Apple. CO: Starz! Encore Entertainment. 2004

4 David H. Maister, "The Psychology of Waiting Lines," *The Service Encounter: Managing Employee/Customer Interaction in Service Business*, (Massachusetts: Lexington Books, 1985), 113-123.

its qualitative aspect. The qualitative aspect of motion refers to the feeling that connects the units and the dynamics of our emotional experience.⁵ With these two aspects in mind, a designer can emphasize one aspect or the other to partially control the viewer's interpretation. For example, applying rhythmic music with video footage may enhance the mood, flow, and quality of storytelling. Alternatively, multiple quick cuts/inter cuts of unrelated events intensify the quantitative aspect because we intentionally invite the audience to feel the abrupt units. The understanding of these two aspects rationalizes the use of change(s) in storytelling.

THE FUSION OF SENSES

Our overall experience of time is also affected by the fusion of senses. Sight and sound are the two sensory channels that we are focusing in this research. According to "Avant Garde" musician John Cage, anyone can be entertained by sound/music in the airport. There is always sound around us, but typically we are not as aware of it as the things we see. Cage performed his signature piece Silence "4:33" to further prove that both sound and sight are closely linked. The performance was controversial because he was sitting in front of the piano for 4 minutes 33 seconds without playing the piano at all. In fact, people's expectation, anxiety and reaction to the real "silence" became part of the content of "4:33". To him, this music is not just created for the rhythm or beat, it is about the four minutes thirty-three seconds experience of time with its surroundings. "4:33" identifies that seeing dominates our expectation of hearing. When the piano sound is not there and the light is dim, people start to anticipate the "music". If our senses are not connected, the reaction of silence in "4:33" would not be nearly as amplified.⁶ As a fundamental phenomenon in visual-aural perception, the McGurk effect⁷ substantiates the interwoven relationship between seeing and hearing. It ascertains that the perception of a single event is unified by both senses. Even though each channel offers a unique perspective of reality,

5 David Epstein, *Shaping time*, 9.

6 Merce Cunningham - *Dance in lifetime*. DVD. Directed by Charles Atlas. NY: WinStar Home Entertainment. 2000.

7 Harry McGurk & John M. Hearing Lips and Seeing Voices. *Nature* Vol. 264 (1976), 746-748.

the involuntary joining of sight and sound still modifies the overall experience. If an image makes us feel sad, synchronizing a sound to this image can skew the degree of sadness. As an emotional signifier, sound is a powerful channel to support visualization. Sight and sound are complementary in perceiving the abstraction in meaning. In the design context, they can be manipulated either complementarily or contradictorily for re-arranging logic, amplifying meaning, and signifying changes. When both the sound and image are holistically reinforcing one message, the interpretation of this expression can be emotionally impactful. Synesthesia⁸ in psychological research further reflects this cross-sensory influence in the human mind. For example, one might use the statement “the song is dark” to describe a song with a haunting beat or dismal melody. We subconsciously borrow the word “dark” from our visual vocabulary to describe the invisible tune.

The juxtaposition of seeing and hearing provides a shortcut to explore time. We learn the time-based structure from comparing its functionality and constraints with other time-related disciplines. For example, exploring how musicians and dancers document sound and perform in time provides an alternative perspective to study time-based experience. This cross-disciplinary approach highlights the strengths and weaknesses of seeing by realizing the counterpoint of seen/unseen, conscious/subconscious, and station/flow in time-based form. Dynamics can be explicitly delineated or implicitly transferred with the fusion of sight and sound. Steven Heller once mentioned that the digital revolution has cost graphic design its tradition.⁹ It is time to adapt new perspective to our conventional creative process through the discovery of the hidden value in visible language underneath sound. “Moving images and sound were not part of the traditional graphic designer’s tool kit – but it has moreover created an entirely new communications environment.”¹⁰ Similar to how musicians often visualize soundscapes to further investigate the mood of a melody, the rhythm in an

8 L. Robertson & Sagiv N. *Synesthesia: Perspectives from Cognitive Neuroscience*. (New York: Oxford University Press, 2005)

9 Steven Heller and Teresa Fernandes. *Becoming a digital designer*. (New York: John Wiley & Sons, 2002), 17.

10 Gert Staal, “Introduction,” *In Copy Proof: A New Method for Design and Education*, (Rotterdam: 010 Publishers, 2000), 8.

image can be analyzed with sound to expand in time-based form. Because sound always exists in time and space, discovering the “sound” in an image helps develop a time-based experience from its original form. After reviewing course syllabi, curricula, and projects on teaching motion graphics from nearly 50 schools and design programs,¹¹ the process of how we design motion graphics has been overpowered by how we design print deliverables. There is certainly a need to elaborate a cyclical thread to connect the basic design principles from print to motion and from motion to print in design practice and design education.

11 Steven Heller and Michael Dooley. *Teaching motion design*, (New York: Allworth Press, 2008)

CHAPTER 2
LITERATURE REVIEW

FORMING

Time is a comprehensive linearity that we experience throughout life. The unification of events and senses in time selectively changes the hierarchy of meanings. “A city is not just seen, it certainly also heard and smelled, and for the persistent, perhaps even tasted and felt. There are sounds and smells.”¹² Whether we are walking through this city in a story or reality, there is always more than one sense and one dimension. The key is that the comprehensive change in the linearity of stories time is manipulative and operational for design purposes. “Different time contains different event and each thing contains its own time and space. All senses coexist in an unified pattern.”¹³ Time embraces the complexity of changes in one unique self-contained form – time-based form. Flatland¹⁴ by Edwin Abbott identifies how different dimensions are connected in time. The physical constraint of the two-dimensional “flatlander” limits the seeing of a three-dimensional object to one flat slice. In order to perceive the entire three-dimensional form, “flatlander” needs to mentally construct all the perceived flat segments into a three-dimensional form as the three-dimensional object moves in time. Similarly, human beings require 15 seconds to absorb the completion of a 15-second television commercial. Humans, as three-dimensional creatures, are only able to experience a slice of time during their life. Form is presented differently in each dimension. The experience of seeing the third dimension in a two-dimensional flatlander’s view of point highlights one unique characteristic of the change in time-based form: invisibility.

12 Hugues C Boekraad, “Principles for Design Education,” *In Copy Proof: A New Method for Design and Education*, (Rotterdam: 010 Publishers, 2000), 20.

13 Edward T. Hall. *Silent Language*, (New York: Anchor, 1973), 202.

14 Edwin Abbott. *Flatland: A Romance in Many Dimensions*, (London: Seeley and Co. 1884).

If we want to see the back of a chair when we are facing the front, we have to walk around it. Our view starts to change as soon as we walk. And every visible change marks a new reference of reality in forming our perception of the whole. The whole of the chair is forming as we walk around it. Our attention is normally conditioned to see what is currently presented to us instead of seeing the passage of all visual content in time. Attention is very selective to our visual reference. The visible element offers a reference to detect foreground element such as figure, while time is the “shapeless” background element that we live through but are often unaware of. This forming experience reveals the hidden dimension of the chair and its invisible revealing time required for viewing the whole. This chair example reflects our experience in film. “Film does not simply present a reproduction of reality, but instead is means of forming in time.”¹⁵ The fragmented story and its distorted time scale is not a direct reproduction of our experience in real time. It amplifies a selection of reality by filtering out the unnecessary and overwhelming “noises.” From a creative standpoint, designers should be aware of both the visible and the invisible elements in time, similar to how we manipulate the “figure and ground” relationship in designing print composition. Forming unfolds the invisible pace, rhythm, and duration of a visible story.

The recognition of wholeness in time relies on the sequence of each slice to be remembered along with its duration. It is more difficult to recognize the wholeness without framing the beginning and the end. In the chair example, as the audience walks around the chair, the front view disappears as soon as the side view appears. Stitching these mental “slices” of form completes the three dimensional chair in the mind, not in our eyes. In order to learn the message, the audience must dig into their memory. If the duration of this observation is shortened, the cumulative details in seeing could be weakened. “Film and video are ephemeral media; the experience is fleeting. Nothing is left when it is over except an impression. Their usefulness is therefore primarily to create an impression and to create emotional attachment.”¹⁶ Therefore, in order to project a rich experience, other senses could

15 Peter Von Arx. *Film and Design*, (New York: Van Nostrand 1983), 83.

16 Kenneth J. Hiebert. *Graphic Design Processes*. (New York: Van Nostrand Reinhold, 1992), 189.

be incorporated. In advertising, “a song is the short cut to one’s emotion,”¹⁷ synchronization frames our focus. The ephemeral quality of time can be enhanced with a higher level of engagement from multiple sensory inputs in forming.

According to Paul Rand, “Design is the fusion of form and content, the realization and unique expression of an idea.”¹⁸ As both realization (experience-based) and expression (emotion-based) consume time, design should always associate time, specifically, the degree of change in time that stimulates the dynamics of form. These dynamics, also referred to as “forming” dominate experience and emotion, while the recognition of a beginning and end differentiate “forming” from form. One slice of visualization in form (e.g., what the flatlander sees) can expand to endless possibilities in forming. If the progression in motion captures dynamics, what is the most stimulating moment in dynamics that can be represented in a frozen frame? Forming extends the expressiveness in form. It is important to scrutinize the connection from one dimension to the others before we can fully understand forming from form.

DIMENSIONS

A dot is an example in the first dimension. It is the very basic visible element that floats in an undefined space. It is a reference point in space (Figure 1). In order to transform this dot into a two dimensional plane, four dots are connected into a square (Figure 2). The square offers an enclosed frame that divides the inner and outer spaces. When a dot is placed in the center of the inner space (Figure 3), it becomes the entry point to the composition as the frame activates the space around the dot. Every element inside this frame carries a relative relationship to other elements in terms of scale, weight, shape, etc. In the three-dimensional world, the square/plane becomes the workable format for design (Figure 4). Imagine we increase the dot size and move it to the edge of this square in the third dimension. The dot can only go so far until we crop it off the page. If it is a three-dimensional cube, the dot will be wrapped around in the adjacent panel. (Figure 5)

17 Brooke Capps, “Sonic branding,” *Advertising Age*, July 2007.

18 Paul Rand. *Design Form and Chaos*, (New Haven and London: Yale University Press, 1993). 3.

The viewer may either perceive it as a half or a full dot running off the back of the page. The answer can be revealed in the fourth dimension – time. By turning the page over, we are unfolding the story with action, pace, and rhythm (Figure 6). Form is giving depth in the third dimension with perspective and volume (Z) in space. The paper has two-sides in the third dimension, and the one-sided frame is two-dimensional. Similar to the chair scenario, a viewer would have to walk around the entire object to mentally perceive all the perspectives in time. If we record the page-turning experience on video for an audience, we capture exactly what we want them to see in time-based form. Forming incorporates the seeing of a reference point, while framing this reference discovers the depth in space and the sequential order in duration. All elements are arrested in this self-contained time capsule that both expresses emotion and changes the form.

Recognizing a single moment in time-based presentation, an audience might expect the reoccurrence of a similar pattern or variation to be presented in the future. Form starts to evolve as both the visual and aural structures communicate new meaning and value in this continuity. “Form grew from the need to communicate meaning.”¹⁹ The forming from one dimension to the next reveals the constraints within form and the transformation of dynamics and expressiveness in forming.

THE REPRESENTATION OF TIME

The representation of time-based form can be theoretically analyzed using visual-aural synchronization. Sound and sight are complementary to each other. By default, if someone loses their sight, their hearing immediately becomes the primary perceptual channel for survival. Many visual attributes can be cross-referenced with auditory attributes. For example, loudness can be visualized as scale, rhythm can be represented by different visual orientations of elements, musical contour can be defined as shape, pitch can be associated with luminance, and the color of music refers to the quality of tone (timbre). It would be unnatural to use the term “color” with olfactory, tactile, and taste, because these sensory

19 Lucienne Robert and Julia Thrift, *The designer and the grid*. (New York: Rotoision, 2002), 20.

channels have less perceptual resonance in common. The only difference is that sound originates in time-based form and a melodic song is a rendition of time-based design.

The wholeness of sound can only be heard in the fourth dimension. As a result, sound can condition this time-based relationship to the visual form with forming. “It takes two to know one... By crossing one identity with another, we multiple the variety of the total system, and at the same time each identity serves as both a check on the other and a spur to the development of the total system.”²⁰ Through the synchronization of sight and sound, the constraints and strengths in visual language can be re-discovered. When a CD cover is designed, the cover only represents the music, not the presentation of the song. Visual form can be presented in all dimensions. The duration of perceiving the visual content depends on the given platform, whereas the duration of perceiving music is more controlled by the time-based form. For instance, we can stare at a poster for hours, yet when limited to listening to a three-minute song, time becomes more ephemeral. Studying music notation is the initial step to outline the essence of time representation in form and forming.

Western music notation offers a unique representation of music composition. The fleeting phenomenon of rhythm and melody are delineated in lines of the stave and notes. In showing two measures of Schumann’s notation of Joyous Farmer (Figure 7), we can clearly visualize the rise and fall in melody, pitch goes up as the melody progresses in “d”. If we connect all the music notes in a line, the rise and fall of the melody can be visualized by a contour line or shape. Comparing “a” and “b,” we see the repeated pattern (with variations) of a chord progression. This short musical motif can be referred to as a theme. Furthermore, by comparing “d” to “e,” silence, as the counter of sound, offers contrast and harmony in time-based form. The phrase labeled “c” indicates the beginning of a song, and “f” shows how the system of representational elements are “off-and-on” in time. This two-dimensional time map precisely represents the musical changes in duration, and also articulates the comprehensive time-based form with rhythmic, emotional, and kinetic characteristics.

20 Stephen Nachmanovitch, *Free Play: Improvisation in Life and Art*. (New York: Tarcher/Putnum, 1990), 94.

There are two terms that delineate the comprehensive time-based form: “duality”²¹ and “Pluralism.”²² Duality refers to the two modes forming time. One imposes structural measurement in duration like the mechanical clock time, while the other offers event-based experience that dominates the duration in mind. Pluralism emphasizes that many events co-exist simultaneously in one experience. As a result, time and experience are intertwined (Figure 8). The internal mind time of a human mind and external clock time both affect the forming of experience, while any dissimilar events can be pluralistically unified in time. Music is more than hitting a note of an instrument it is the audience’s response that completes the experience. In analyzing John Cage’s 4’33”, he mentioned, “the performance clock time of the piano suddenly became the experience.”²³ The clock time and mind time are integral in that forming experience. It is the concentration of this complexity in duration that challenges our awareness of time. “Pluralism” can be seen in Schuman’s notation, even though many notes are played simultaneously we still hear them in unison. According to the gestalt grouping principles, the sum of the parts is more impactful than the parts themselves. Most of the gestalt grouping principles (proximity, similarity, good continuation and closure) are applicable to explore the sum of visual and sonic parts. However, the principle of common fate is the only exception. It explains that movement units are grouped in the same direction they are moving towards. This motion grouping in time further supports the definition of “pluralism” in forming. The gestalt principle offers another perspective to reinforce the complementary relationship between sight and sound in time.

Communication in the digital world relies on sensory channels to deliver an embodied experience. Sound subconsciously affects emotion and feeling against a sense of realism. In film, seeing someone walking down a staircase with no audio seems unreal and unusual. It is obvious that the audio track is missing from this experience. If we only hear the stepping sound without any visuals, the realism of the experience might be preserved.

21 David Epstein, *Shaping Time*, 7.

22 Edward T. Hall, *Silent Language*.

23 Michael Nyman. *Experimental Music: Cage and Beyond (Music in the Twentieth Century)*, (Cambridge: Cambridge University Press, 1999), 60.

Sound allows abstraction by default. It does not always need the visual element to support realism, while video often requires synchronized sound to engage the audience. “Sound is mental, cannot be touched. With film we can also say that the image is projected and the sound is a projector, in the sense that the latter projects meanings and values onto the image.”²⁴ There is more freedom for mapping reality with different visual-aural imaginations. In film, “diegetic music” is the music in the plot that the characters in the story can hear and respond to. The source may or may not be visible. A scene that depicts a driver listening to a car radio which is not included in the shot would be an example of this “off-screen” realism. Furthermore, scoring the film “against the drama,” is to compose music that is opposite to what the scene seems to call for emotionally. An example of this is in a scene where someone is murdered by violent strangulation, while the accompanying music is the calm and restful Bach’s moonlight sonata. This conflict creates cognitive dissonance between sound and sight which generate an unforgettable realism for the audience to experience. Our ears must be trained as well as our sight to gain more sensitivity to the time-based design element. That is, we should observe things beyond what normal people see. Because of the “pluralism” and “duality” aspects, sound can be viewed as a collective groundwork for designers to push visual grammar and provide emotion in design. Discovering the element of time (story time, clock time and mind time) invites the play of imagination from the unseen and unheard in forming.

EXPANDING VISUAL PRESENTATION FOR TIME-BASED GRID

From the creative standpoint of seeing, a photograph of a bird not only presents a specific moment of that living bird, but it should also open a doorway to decompose that one moment into multiple frames that construct the past, present, and future in time-based form. It is the process of how we expand the presence, rhythm, and story in forming. “Duration begins with the division of time, and especially with those subdivisions by which

24 Michel Chion. *Audio-Vision: Sound on Screen*, (New York: Columbia University Press, 1994), 144.

mechanical clock impose uniform succession on the time sense.”²⁵ The passage from one moment to the next incites some degree of change in its original form. It is critical to recognize these changes in forming because each sequential unit dominates the value of the overall communication in time. Decomposition is about the presentation of a single unit and its transition among other units in forming. What unit(s) do we see in a given duration? How do we want to experience these physical changes in time? The stage of “decomposition” and its relative stage “re-composition” are often used in time-based form such as film editing and even music analysis. Therefore, it is beneficial to implement the methods of decomposing through narrative and rhythm to structure a sequence that pushes one single moment forward (to its sequential future) or backward (the past) in time.

When the photograph of a bird is taken (Figure 9), it captures a moment of the bird in the form of a two-dimensional frame. Neither the sound nor the past is recorded in this dimension. In order to expand the duration in forming from this particular moment, the bird in the form of a photograph requires a narrative or musical extension to structure its past and future, i.e., the before and after. First and foremost, we have to believe the possibility of co-existence among the past, present, and future in stillness in order to decompose the form for forming. Adapting T.S. Eliot’s description of time in Brunt Norton V, “Words move; music moves only in time... words, after speech, reach into the silence. Only by the form, the pattern can words or music reach the stillness... the end precedes the beginning, and the end and the beginning were always there before the beginning and after the end...”²⁶ When looking at the bird photo, do we imagine the wings flapping in the unseen? Or do we imagine the sound of wings flapping?

NARRATIVE

The unseen and seen elements spark a series of visual narrative logic in actions, transformations, and conflicts that offer a purpose of understanding the value within each fragmentation in duration.

25 Marshall McLuhan, *Understanding Media*, 199.

26 T.S. Eliot. “Burnt Norton,” *Collected Poems 1909-1962*, (Faber & Faber, London, 4th ed. 1963), 194.

The minimum narrative can be simply executed as the difference between “before” and “after” from the original composition. For example, two photographs of a glass of water are presented simultaneously (Figure 10). One has the full glass of water and the other is half full. The contrast between the two glasses bears a minimum causal relationship in narrative. The assumption that something has happened to change the water level implies a connection in time. Time visually expands when change is detected. If two photos are identical (Figure 11), time is not nearly as important as it is for the two glasses with different water levels. The change in content visualizes the passage of time. The simplicity in “before” and “after” allows narrative to be interpreted in two directions, while the sense of “forward” and “backward” is not as clearly defined because they can be reversed and still be functional. Either presenting the full glass or half glass first will work because the focus of this decomposition is the change.

If the simplest narrative is between the “before” and “after” in time, the next fundamental narrative structure would be Plato’s plot that consists of a beginning, middle, and end. This three-step structure establishes a chronological relationship to sequence. A plot puts more emphasis on the linear direction. The “middle” reflects the rise of conflicts that differentiate the opening and ending. The end can either be a variation or repetition of the beginning. Because of the close resemblance in beginning and end, the middle affords more dramatic contrast in changes. Using the glasses of water as an example, we can insert a photo of a straw (which visually and physically has no connection to the glasses of water photo) as the middle to elaborate more details in change (Figure 12). The visual consistency in the beginning and the end increases more contrast in the middle; this contrast enriches the sequential relationship and possibly makes the turning point of the story more memorable. Time is ephemeral and the past sequence can be easily forgotten. Music, as a time-based design, faces the same ephemeral challenge as information that is presented using duration. “We cannot categorize, we cannot remember and what we cannot remember, we cannot articulate in language. Hence, there is a large amount of musical experience that we basically

forget and cannot talk about.”²⁷ The logic is that the narrative required can invest meaning in time-based forming. Frank Lloyd Wright summarizes the essence of decomposition as, “the part is to the whole as the whole is to the part, and which is all devoted to a purpose.”²⁸ Therefore, there is no value to “expand” a static image unless we can offer additional meaning and value to each successive fragment. Decomposing the original form theoretically provides each fragment a portion of the original form, which preserves a sequential logic between what we see and what we imagine (possible seeing). When the decomposed parts are distributed through out forming, any additional “outside” elements can thereafter be integrated without breaking the flow of recognizing wholeness.

A plot expands the content in chronology, the first thing (beginning) and the last thing (end) affect how we perceive and remember the sequence. The primacy and recency effects in serial position effects²⁹ prove that people tend to remember the very first thing and the last thing they have seen. The primacy effect is weakened when the opening is presented in short duration. Most of the James Bond movies have longer opening title sequences with kinetic typography, stylish imagery, and theme songs to support a memorable “first impression.” In *Forrest Gump* (1994), the falling white feather offers a visual cue that assists the flow of the opening credits by introducing the protagonist as the feather lands on his shoe. The ending echoes the beginning with the use of a white feather flying away from the main character. This feather as a visual cue indicates the in and out points of the narrative structure. In stage performance, prologue and epilogue are used to stress the understanding of a full cycle in narrative for a similar purpose.

In addition to the plot structure, Kenneth Burke also approaches the “sequence of meaning” in narrative as a process of four stages: pollution, guilt, purification, and redemption. “A story begins with actions that violate the rules or values of system... The dramatic process continues with actions that establish guilt by assigning blame to

27 Niall Griffith. “Music and Language: Metaphor and Causation,” *Language, Vision and Music*. (Philadelphia: John Benjamins Publishing Company, 2002), 195.

28 Timonhy Samara. *Making and Breaking the Grid*, (Massachusetts: Rockport, 2002), 14.

29 William Lidwell, Kritina Holden and Jill Butler. *Universal Principles of Design*, (Massachusetts: Rockport, 2003), 178.

the person... In the third, a search is undertaken to get rid of the problem... and in the final or redemption stage, a resolution occurs as the system is put back in order.”³⁰ This model emphasizes the “point of no return” in directional linearity. Changes become more irreversible in this analogy. When decomposition is involved in this approach, we intentionally want to differentiate the redemption from the pollution. As an example, inserting a photo of dentures in the glass into the same series of photos (Figure 13), forces a new interpretation in “redemption” and this impact forever changes our initial impression of the “pollution.” “Point of no return” reinforces the ephemeral value in time. In the opening title sequence of *Memento* (2000) we see a Polaroid photo of a blood-spattered wall. Gradually the Polaroid fades out of focus, and reminds us that the scene is being shown in reverse and the story is being told backwards. This opening scene is also repeated as the last episode in the chain of events.³¹ Unlike the reverse sequences presented in the French movie *Irreversible* (2002), *Memento* contains a comprehensive reverse narrative that decomposes the forwards, backwards and flashbacks into a “hairpin” (according to the director Nolan) chronology³² (Figure 14). Visual narrative can go forward and backward; on the contrary, sound is often limited to one direction. For example, in Coldplay’s music video “The Scientist,” the reverse sequence expresses the lyrics “back to the start” as its main theme. In order for the lead singer to appear to be mouthing the lyrics in this reverse presentation, the singer has to be trained to sing backwards. The reverse narrative in “the Scientist” unfolds the “beginning” as the “ending” where a fatal car accident is used to achieve the no-point-of-return. According to director Christopher Nolan, “We can’t hear backwards sound, I wanted people to watch the reverse sequence as a physical realistic sequence. If you reverse the sound, the physicality is gone.”³³ Different narrative structures

30 Gretchen Barbatsis, “Narrative Theory,” *Handbook of Visual Communication: Theory, Methods, and Media*, (New Jersey: Lawrence Erlbaum Associates, Inc., 2005), 335.

31 Noël Carroll, “Memento and the Phenomenology of Comprehending Motion Picture Narration,” *Memento (Philosophers on Film)*, (New York: Routledge, 2009), 135.

32 Andrew Kania, “Introduction,” *Memento (Philosophers on Film)*, (New York: Routledge, 2009), 4.

33 Andrew Kania, “Introduction,” *Memento (Philosophers on Film)*, 5.

approach the decomposition of a moment in time differently. The six categories in transition by Scott McCloud³⁴ allow us to apply narrative decomposition to influence the degree of changes in transitions or actions. The “before and after” is the basic unit in change for decomposition in moment-to-moment (blinking eyes) or action-to-action (hitting a baseball). Similarly, the plot and Kenneth Burke’s narrative structure reflects the expansion in a larger scale from subject-to-subject (two people talking), scene-to-scene (walking from the park to the bed room), or aspect-to-aspect (two concurrent events).

STRUCTURE

Any structure can be modified for delivering content more creatively and effectively. For example, in Cibo Matto’s “Sugar Water” video, Michel Gondry uses a single stream of video that plays in opposite directions on a split screen. In this video both forward and backward sequences are presented at the same time and then both of them are reversed at the halfway point (i.e. the forward becomes backward). Other creative narratives can be conceptualized as the Russian doll structure and Split narrative (Figure 14). The different levels of dreaming in *Inception* (2010) by Christopher Nolan can be analyzed as the non-linear Russian doll structure. The movie *Sliding Doors* (1998) contains a split narrative to portray how the life of the main character changes when she misses or catches the train. Two mini-stories are playing in parallel in the same movie. Again, the narrative structure refines the story telling, but should never restrain our creativity. Usually, due to time constraints on television, TV commercials skip the beginning by starting the story immediately from the middle. Cliffhangers, which are an inconclusive narrative in television dramas always eliminate part of the “redemption” to maximize the climax between the middle and the end. As a general principle, the modification in narrative structure is no different from breaking a grid structure in print or imposing a “musical time signature” to print. Breaking the grid is just as essential as constructing the grid. “Structure without life

34 Scott McCloud, *Understanding Comics: The Invisible Art*, (New York: Harper Perennial, 1993), 74.

is dead. But life without structure is unseen.”³⁵ Structure has to be used intuitively and intellectually.

The structure in a grid always provides a systematic method to access and decompose hierarchy. Time unifies the randomness, chaos, and disorder in linearity.³⁶ Since music has this linear quality, the decomposition in time is closely related to music demarcation. “A story line encompasses a set of events much like a melodic line in music.”³⁷ When sound is attached to an image, the rhythmic regularity in time-based form naturally imposes duration in stasis. Synchronization makes a moment of stillness decomposable. Specifically, the sound element stretches the moment of stillness into a controllable duration. “Demarcation” in music refers to the segmentation of continuous time with the rhythmic composition. For example, a music theme can be demarcated into six parts: Introduction, Exposition, Transition, Development, Recapitulation, and Coda. The three key transitions for Sonata are Exposition, Development and Recapitulation of which are very similar to a plot. With music, the decomposition process not only determines the ordering of logic, meaning, and hierarchy in sequence, it also suggests an up-and-down rhythmic flow in experiencing emotional patterns. Sound in movies intensifies the contrast in tension/release. Because we are framed in duration, tension can build from the first frame in a narrative structure and release it at the very end. When the protagonist is under attack or in danger, hearing the panting sound of him can affect the audience’s regularity in breathing as if we are suffering shortness of breath in reality. As a result, the sound layer offers a guidance to internalize the story. Whether we are synchronizing “before and after” with sound or the plot, sound offers proportional precision in decomposing the stasis. “Sequence is part of all the essential rhythms of nature - the measured passing of time, the beating of the pulse, and the act of breathing.”³⁸ It is the sound that gives breathing the visible rhythm; it is the point

35 John Cage. *Silence: Lectures and Writings*, (Connecticut: Wesleyan University Press, 1961), 113.

36 David Epstein, *Shaping Time*, 7.

37 Marshall McLuhan, *Understanding Media - the Extension of Man*, 11.

38 Edward A. Hamilton, *Graphic Design for the Computer Age: Visual Communication for All Media*, (New York; Van Nostrand Company, 1970), 48.

of synchronization that rewards the structure with more contrast. “Hear it” is one of the twenty ways to expand a Plot idea. Music can be used as a shortcut to our heart. We can use a piece of music to put us in the mood for story writing.³⁹

Using the ABA “statement-departure-return” music analogy we can compare the decomposition and demarcation that bridges the gap between time-based form and non time-based form. Because the concept of ABA requires a variation or repetition in the “return,” it cross-examines the re-occurrence of design elements on both horizontal and vertical paths. The system creates a sense of rhythm with flowing content containing repetitions and variations. The consistency in columnar print layouts (vertical content) and rows (horizontal content) are reinforced by the ABA variations.⁴⁰ (Figure 15) The “A” in “ABA” can be subdivided with a secondary “aba.” The proportion of the first “ABA” in the time-based form is longer than the second “aba.” Similarly, the proportion of the first “ABA” in print media appears larger in size than the second “aba.” Visually and sonically, the weight of a larger unit becomes the “dominance of majority” and the highlight of the smaller unit becomes the “emphasis of minority.”⁴¹ The decomposed form with “statement-departure-return” serves as an alternative grid for regulating contrast and rhythm.

Similar to a Modular grid, the ABA analogy mechanically breaks down the units in modules, where each module carries a rhythmic repetition and variation that the “A” or “a” has reinforced. “Grid can be seen as metaphors for the human need to make sense of the world and to position ourselves in control of it.”⁴² Both narrative and grid structures prepare us conceptually and physically by decomposing form. Decomposition may not be applicable or suitable for all visual forms, but it certainly pushes our creativity beyond what we actually see. To apply time and sound in decomposition offers new possibilities of establishing and breaking the conventional use of grid and structure.

39 James Scott Bell. *Write Great Fiction: Plot and Structure*, (Ohio: Writers Digest Books, 2004), 41.

40 Rob Carter, Ben Day and Philip Meggs, “Syntax and Communication,” in *Typographic Design*, (Canada: John Wiley & Sons), 43-84.

41 Wucius Wong. *Principles of Form and Design*, (New York: John Wiley & Sons, 1993), 109.

42 Lucienne Roberts and Julia Thrift, *The designer and the grid*, 19.

Time is both absolute (Newton) and relative (Einstein) in the creative context. Isaac Newton believes in absolute time as a mechanical divider that precisely breaks down duration into year, month, week, day, hour, minute, and second. This definition of time-based form not only quantifies time in decomposition, it also offers a fundamental pace as if a modular time-grid supports the content. This absolute breakdown reflects the relativity in narrative structure. For example, we experience proportion in story development, because the ending does not need to be as lengthy as the opening. M. Night Shyamalan's "The sixth sense" and "the unbreakable" turn our expectation in the story world upside down during the last 5 to 10 minutes. This absolute decomposition gives a reference to our system to feel both fast and slow elements in duration. We stop dividing seconds because it is impossible to detect the changes among 1/4 of a second, 1/16 of a second or 1/30 of a second. In reality, our normal heart rate and breathing frequency affect our perceptual reference of time. The objective time reference in a clock provides a reference to our subjective mind. "Bees are not as busy as we think they are. They just can't buzz any slower."⁴³ In "Inception," the pace and time of the five levels of dreaming are executed in slow motion. In order to differentiate the longer duration in our deeper dream, a scene of falling van from the bridge in slow motion makes a strong reference to further decompose time beyond seconds in the narrative. Although most of us cannot perceive changes faster than a second in reality, story time makes this possible. In real time, if an action happens in less than a second, it will play so fast that our eyes cannot study the details. Instead of realistically presenting the action within a real second, we expand the perception of real a second in a movie to fit a longer experience. The decomposition of speed and sound in digital technology expands design capacity in time-based form.

In conclusion, narrative structures provide a platform to expand meaning and logic in communication, while sound in synchronization regulates this complexity with rhythm. Philosophically, one image or moment in time can be treated as the core of forming. A simple form can be decomposed and expanded into motion only if we can visualize the time-based form in stillness. Film director Claire Denis always creates narrative with just one

43 Paul Davis. *About Time*, (New York: TouchStone, 1995), 272.

sentence, like “I am in love,” or “I am desperate,” or “I don’t want to die.” “It is very simple, very strong, and this one sentence has to survive all those boring moments you have to go through in making a film. If I lose my orientation, I just remember it’s a film about this one idea. The rest are just details.”⁴⁴ Similarly, a time-based structure can plan its successive seeds in just one single image/frame and let the decomposed unit carry the details in the forming sequence.

ENCAPSULATING MOTION IN NON-TIME-BASED DESIGN

Visual language is embedded in many platforms in both advertising and branding. What makes a graphic designer unique is the communicative power in controlling type and image. Digital technology has raised the standard and expectation in visual communication design. Branding is not just about print or the web. Sonic branding is another strategy for a company to portray its personality without words. “We all have ears, but most brands don’t have voices,”⁴⁵ thus, a sound signature can tattoo a permanent resonance in our brain. Harley-Davidson has designed a signature exhaust “chug” sound for motorcycles, and we can hear the engine rumble before seeing the motorcycle. Additionally, Coca cola has synchronized a catchy motif on its animated logo at the end of each TV commercial. As an informal experiment, the coke commercial is played with only audio in my lecture. About one third of the students immediately recall the brand as soon as the tune is heard. Applying sound to branding and presentation in the video format can lead to memorable communication that follows with new standard that might be expected in multi-sensory design.⁴⁶ If digital technology has already shaped our conventional way of interacting with visual content, perhaps it is time to discover what new design elements can be adapted into traditional media for this digital revolution.

44 Doug Aitken and Noel Daniel. Broken screen, (New York: D.A.P./Distributed Art Publishers, 2005), 96.

45 Brooke Capps, *Sonic Branding*, 2007.

46 Brooke Capps, 2007.

The long history of print in visual representation cannot present sounds and movies with its two-dimensional platform, time-based form is required. Since sound is naturally a time-based design with no physical form, the projection of sound, movement, and sonic rhythm has to be strategically selected, transferred, and represented through the juxtaposition of meaning and the strategic use of space in print media. Non-time-based form allows viewers to control time when perceiving content, but leaves the sound, rhythm, and pace of the content to our subjective imagination. It is about feeling the forming in our mind. The actual tune in music is not presented; instead the audio is only a visual representation.

SPACE

Different dimensions have different constraints, e.g., the first, second, and third dimensions can co-exist in the time dimension. If we agree that time and space are relative to each other across all dimensions, then this inseparable relationship makes space the key element to unlock the representation of sound, rhythm, and pace in non-time-based dimensions. If the viewer subjectively controls the perception of time, space can skew their experience of time to some degree.

Sound in space can be theoretically defined in design as the visual noise that offers tension and distraction for viewer to perceive the content. On sheet music, we document sound directly by representing the form and function in the second or third dimensions. When more space is occupied with design elements, the more noise it introduces. Any image can be categorized as an icon, index, or symbol when used as a sonic representational element. When these images are placed in space (layout), each image signifies a sonic reference. The arrangement of space around the images affects the “loudness.” For example, an image of a piano represents the instrument or piano sound (Figure 16). The amount of space we are given to focus on the image can affect the level of noise within the image. For example, rotating the image 15 degrees might create more tension, while reducing the white space of the page by duplicating the piano image amplifies its representational sound (Figure 17). Under the umbrella of Peirce’s semiotics (the study

of sign), music shares similar icon, index and symbol in semiotics as imagery. We can compare visual and sonic information using a correlated taxonomy to experiment with the representational power of sound in images and sound in the space between images.

SIGNIFIER

As a visual signifier, iconic images bare the most resemblance to the object, and differentiate one object from another. Indexical images indicate the existence of something. They link our imagination from one thing to another. For example, smoke reminds you of fire, and symptoms remind you of the disease. Symbolic images stand for something that is based on convention. A flag of a country is an example of a symbol. It requires a learning curve on the cultural and social background in order to comprehend the meaning of the symbol. In mapping visual semiotics to sound, we focus on the meaning that music can generate. For example, an iconic type of sound would be the nature sound of objects. It has a distinguishing trait, property, or quality of sound. The sound of rain reminds us of raining. The indexical sound is similar to the indexical sign that indicates an extension of the existence. For example, the siren sound leads us to believe that there is an accident. The symbolic sound is an artificial sound that we attach to a purpose based on cultural, social, or personal experience. Playing a national anthem in the Olympics symbolizes the honor of the winning country. The three types of sounds and signs are closely interweaved. The abstract and invisible quality of sound can be represented through different visual semiotics. Analyzing and comparing them in the same categories help us approach representational meaning with control. If we want to engage the viewer by not showing things too literally, index will be a good choice. The image and sound of a coo-coo clock can further explore the representational connection between seeing and hearing.

One can easily see the color, style, and craftsmanship of a photographed coo-coo clock as iconic. The indexical type of a coo-coo clock image is akin to its symbolic meaning in this example. A coo-coo clock is both an indication of time and a symbol of time. On the other hand, the sound of a coo-coo clock, as an icon, can represents a clock, or the coo-

coo clock beats. The audience has to imagine its color, shape, and scale. In addition, if we map sound with a movie clip, it signifies the duration as a “time’s up” concept that makes us feel rushed. The audience may expect something to happen when the coo-coo sound goes off. In visually representing the coo-coo clock sound, we need to construct the physical body of the clock as an icon. Sound is both invisible and abstract. The sense of rush will be conceptually displayed through symbolic shapes, colors and the use of space. Additional images can conceive more meaning. Generally speaking, the juxtaposition of index, icon, and symbol in sight and sound provide a system to “visualize” the real and the abstract. In applying this system to emphasize duration, multiple images of interwoven index, icon, and symbol can spread out in succession to unfold the complexity in sound. In three-dimensional CD packaging, the images can be sequentially designed on the cover, back cover, and the inside booklet to support a particular kind of sound, musical theme, or rhythm. Sound is actually not heard but imagined because of the visual association⁴⁷.

The spacing between image compartments in design signifies the passage of time. For example, comparing two presentations of identical content, the photo that is divided into three compartments offers more time-related interpretations (Figure 18). Therefore, the space in CD packaging design allows the designer to represent motion in stillness, sound in silence, and fast in slow. As sound lives in space and time, being conscious of the juxtaposition in sound and image connects the implementation of time in static platform with rhythm and pace. In CD design, the meaning we perceive on the cover sets our expectation to the music. As a comparison, the same Beethoven’s moonlight sonata song can have three different visual representations on the cover – wedding, baby sleeping, and dining (Figure 19). Wedding and dinner will lead our interpretation to romance; the baby-sleeping cover will make us think of a lullaby. As a result, many CD covers tend to represent the tone and mood of music through “familiar stories and acceptable faces,”⁴⁸ it offers an index to the heart of music. Most likely, the listener will not expect heavy metal music from seeing

47 Don Fairservice. *Film Editing: History, Theory and Practice*, (New York: Manchester University Press, 2001), 122.

48 Jeremy Hall. “Envisaging Soundscapes: Art Direction and Classic Music,” *Eye Magazine*: No. 39, Vol 10. 2001): 56-65.

a classical renaissance painting on the cover. According to the designer Stefan Sagmeister, “with the introduction of a new artist, the sleeve design is extremely important. If a person is being asked to take a chance on a new album where they have maybe heard one track or read some press review, then the artwork plays a crucial role in giving a wider impression of what they can expect to hear. If the sleeve fits with the impression I have of the album then that can be the final persuading point for me”.⁴⁹ This impression can either be a direct reference to the music or an additional story that we impose on the music.

Music is flexible for different visual representations. Seeing music in its new context invites less musically literate audiences to find new meaning or stories behind the music and its cover. “The effect of these images is to remove the music from its cultural context and force a more active interaction between sound from the disc and the attempt to visualize it on the cover”.⁵⁰ When a CD cover approaches the music only with type treatments; the representation becomes very abstract and subtle. The stereotype in different display typefaces might still frame our interpretations, but it might affect us subconsciously. Typography reflects the structure in basic geometric elements in design, within its form and counter form; there is room to creatively control the pace and rhythm in time with space.

RHYTHM AND PACE

The representation of pace and rhythm can change our perception of time. Similarly, letter spacing and the use of typographic arrangement affect our reading time in print form. The word “tYPogRAphY” reads much slower than “typography.” The exaggerated spacing in “s l o w m o t i o n” also slows down the reading speed. Therefore, space and time are interrelated. When information is presented in book form instead of time-based form, space becomes a critical separation tool to differentiate and to group visual elements in reading. The consistency in the separation dominates the pace and the rhythm. “Space is not emptiness,” it activates the figure and

49 Charlotte Rivers. *Innovation in CD Packaging Design*, (Switzerland: RotoVision, 2003)

50 Jeremy Hall, *Envisaging Soundscapes: Art Direction and Classic Music*, 56-65.

ground relationship. When letters are set far apart from each other, the isolation makes them look more independent according to the gestalt principle of proximity. When more space is given to the form, the figure gains more attention as an individual interval. Repeating or varying this interval consistently throughout the given space creates a sense of pace and rhythm. This changes our time perception. For example, “++++” as four intervals seem faster than “+ + + +”.

In line with such thinking, putting more spacing among the plus signs allows the letterform to be revealed at a slower pace as if more silence surrounds the content. A sense of motionless is naturally oriented in print form; the sense of motion is naturally embedded in time-based form. The shift from one to the other requires comprehensive understanding of meaning to manage the representation of motion and presentation of being motionless with control and balance. Slow motion in a fight scene intensifies the action and the inner emotional status. If all “cuts” are determined by the action⁵¹, the print platform should attempt to arrest the most representational action and inner emotion with the arrangement of type and image in space. Lines and visual blur can accelerate the speed and pace in comics as “motion line.”⁵² Again, line by default has the indexical quality to direct seeing. The “incompleteness” in fuzziness and out of focus content often projects a sense of motion. Painter John Singer and Rembrandt Van Rijn intentionally created this incomplete movement in time for viewers to fill in and to investigate the details (even though the nuances are non-existent or hidden under their brush strokes). This incompleteness is not different from the division in painting invented by Georges Seurat where color is mixed optically in the mind to engage time dimension to interact with the art. In comics or film, different angles and zooming are used to alter the audience’s orientation in the story. For example, applying the panning technique in a coffee shop brings the viewer into the space by showing all the walls, floors, and ceilings. It exposes the third dimension within a two-dimensional frame in time-based form. Zooming can be executed as a long shot, medium shot, close-up shot, and extreme close-up shot in presenting the distance between the viewer

51 Don Fairservice, *Film Editing: History, Theory and Practice*, 160.

52 Scotts McCloud, *Understanding Comics: the Invisible Art*, 114.

and the object in the movie. The closer we zoom into the object; the more intimate we are with the object in space (Figure 20). The zooming from one frame to the next conveys a sense of change in duration. Space helps communicate pace and the rhythmic flow of time. The zooming effect can also be executed within one frame to imply motion with a sense of depth (Figure 21).

Historically, time and spatial constraints have always been a challenge and inspiration for designers and artists. For instance, cubists flattened many levels of three-dimensional viewpoints onto a two-dimensional canvas. The viewpoints separate the spatial connection in time. As a result, the assembling of multiple perspectives in one picture forces different times/durations to be represented in a homogenous space. If one painting freezes a moment, cubism “flattens” many moments in a collage. The juxtaposition of these collective moments makes the representation active and vivid. Theoretically, the use of “discontinuity” in texture signifies the discontinued space and time. Adhering to the existing materials on a painting montage interrupts the flow in time and space. Dada challenges our normal perception of time and space in a non-sense arrangement with randomness and disjointed graphic treatments, while futurism represented time with speed and rhythm. The glory of the machine age and new technology are reflected in two-dimensional and three-dimensional Futuristic design and art. Particularly, the use of successive lines indicates the speed of technology, and successive images are also used to symbolize motion. “Forming” is metaphorically implied in this non-time-based platform. In print, the perception of time is controlled in the audience’s mind. It is important to stimulate this mental connection of time, motion, and rhythm for this naturally motionless platform. Therefore, a dynamic design requires the user to sense some degree of changes within the composition.

Type and image can be used as an index, icon, or symbol to amplify the degree of change. Motionless does not mean lifeless. The internal dynamics need to be explicitly visualized in order to overcome invisible time constraints. A poem has its own “reading time.”⁵³ We, as designers, should be sensitive to the translation of this “time” element. Futurism and Dada approached typography as expressive images that provide a sense of

53 Bruno Munari. *Design as Art*, (Hawthorn: Penguin Global, 2009), 68.

rhythm and speed. Letterform is recharged with kinetic value in this representation. The slant form in Italics was often used to increase the reading flow as well as the speed in futurism.

THAUMATROPE AND STROBOSCOPE

The Thaumatrope (Figure 22) is the first and simplest “film machine.” Drawings are placed on the front and back of a disc in such a way that when the disk is quickly spun, the images optically blend to form a third image. This third image is the combination of two intermittently viewed separate images and it is the smallest unit of film.⁵⁴ This foundational concept of “1 + 1 = 3” invites us to internalize the meaning, and understand the “incompleteness” in change. If McLuhan believes that media is an extension of man, the image-blending process extends our seeing both physically and mentally. Deleuze Gills has categorized movement image as the action image that cuts the most representational moment in time. We can find the Thaumatrope experience in CD packaging design or in book design. When the front and back covers afford the space for two individual images, showing an apple in the front, and an eaten apple in the back represents the narrative time structure of “before” and “after”. Even though both panels may not belong to the same space because each photo might have been taken in a different location hundreds of years apart from the other, cognitively we blend the time and spatial relations in our perception of time. If the inside spreads of the booklet present more steps of how the apple was eaten, we then enter the elementary level of the imagery montage – “stroboscopic phenomenon.” It achieves a sense of animation through associating two similar forms in differing locations, of differing size, or of gradually differing formulation, thus, linking two isolated images through an effect of motion.⁵⁵

Similar to the Thaumatrope, stroboscopic effects can be seen and understood through Eadweard Muybridge’s photography. “Movement was not seen, but imagined in the gaps between instances of stillness.” Locomotion is studied through the successive

54 Peter von Arx, *Film Design*. 83

55 Peter von Arx, 84

moments of a continuous movement. Some of the successions of gestures are imitated rather than enacting movements, therefore, Muybridge was labeled as an illusionist of movement not a scientist.⁵⁶ He selected the best representational thumbnails to communicate the flow of movements and actions. The elimination of some of the thumbnails makes his study less scientific. However the accuracy of displaying all thumbnails is not critical for this study, it is the presentation and representation of motion that matters.

With careful analysis, print can represent pace, rhythm, and time into quantifiable frames. The number of frames dominate the perception of time, pace, and rhythm. Unlike the spinning in Thaumatrope toy optically merges the two space and time images, stroboscope is the thumbnail approach of representing the entire passage of time in relation to another from the beginning to the end. The Thaumatrope superimposes the meaning of two independent images in unified duration by spinning the disk, while the stroboscope stretches and compresses time in quantitative frames to visualize the transformational progression. That is, while the Thaumatrope delivers a simple message in one frame, the stroboscope delivers the message through many frames in one composition. The perception of time is dramatically different in both cases. The speed in the Thaumatrope is fast, simple, and repetitive, while the speed of reading in the Stroboscope depends on the quantity, scale, and arrangement of the thumbnails. Cropping the thumbnails differently can alter our reading speed. Each thumbnail becomes a creative variable to manipulate time in a non-time-based format. In summary, the Traumatrope and Stroboscope are the two basic modes of representing time and space during the Futurism movement.

In the three-dimensional sculpture, Boccioni's Unique Forms of Continuity (Figure 23) in Space not only captured the velocity of movement in sculpture, but also froze that one moment in all viewpoints. It reminds us of how cubism captures all viewpoints from three dimensions and collapses them into two-dimensional paintings. The seeing experience of the viewer in time is flattened and superimposed similar to the Thaumatrope effect. The key action of this flow mechanism in Boccioni's form was extracted and compressed in three-dimensions (Not sure what actions and mechanisms you are talking about in

56 Sam Rohdie, *Montage*, (Manchester: Manchester University Press, 2006), 3.

this sentence). In fact, we are flattening the moment of “forming” in the presentational “form.” In photography, Anton Giulio Bragaglia superimposed successive movement in his “Photodynamism.”⁵⁷ All successive changes were overlapped, and the viewer can see the “before”, “after”, and “everything in-between” through this transparent overlapping comparison. This transparency flattens duration in one moment as opposed to Eadweard Muybridge’s method of stretching time into numerous consecutive stop-action pictures in chronological thumbnails. One interpretation of these two major time-representational methods is to define them as “Thaumotropic overlap” and “stroboscopic progression”. A poster is designed based on the concept of “Thaumotropic overlap” and “stroboscopic progression” (Figure 24).

These descriptions define their representational characteristics and methodology. We can apply them to explore conventional design elements with movement in form and temporal changes. For instance, comparing a dotted line with a straight line, the straight line carries our eyes from one point to the other much faster than the dotted line, which can be interpreted as a stroboscopic progression. The term “leaders” in print design carries eye movement from the title to the page number. Rules (lines) in print design separate elements with less directional movement (Figure 25). Fast or slow motion can be represented by the use of space in between dots and/or by the width and weight of the dots. Heavier units with more space in between them increase individuality and decrease speed.

Progression is more directional in the visual flow. In the two-dimensional print format, it can move left to right, or top and down in the same panel. The composition of a book involves forward and backward movements in forming. The use of gradient can be seen as Thaumotropic overlap as the shifting of color (the change in time) is flattened into one color spectrum. It is also directional. These two modes help balance the contraction and expansion of time in representation. The contraction and expansion refer to pace, rhythm, weight, flow, proportion and the counter of seen and unseen. This opposite tension generates more dynamic changes in form. This flow of movement energizes the basis of

57 Caroline Tisdall and Angelo Bozzolla, *Futurism*, (New York: Thames & Hudson, 2003), 136.

dynamics in design. We do not perceive this flow of energy with our eyes; we see it in our mind. This internalization brings life (a life that encapsulate time) in forming. It is the closure of “the incompleteness in change” creates an illusion of dynamic forming.

$$1+1=3$$

Dynamic is about how we feel about changes in what we see. The Lev Kuleshov effect can explain how closure bridges the gap in Thaumatrope progression and connects the successions in stroboscopic overlaps. This famous effect is called the “effect of desire” in filmmaking. Three pairs of two clips are played one after the other. Their sequential order changes the way we internalize the meaning. The second clip is always the man and the first clip is different each time. “First the soup, then the hungry man. First the revolver, then the frightened man. First the baby, then the tender man. First the object of desire, then the desire. Kuleshov’s montage experiments demonstrated the fictive nature not of the image but in any succession of them, the joins. A bowl of soup and the face of a man linked together created a scene of hunger.”⁵⁸ The joint as the desire is similar to our “1+1=3” analogy and “closure”. “1+1=3” emphasizes the meaning, “closure” (as one of the gestalt principles) shows the cognitive aspect of grouping, and the “Kuleshov effect” implies the emotional status of the viewer. They all promise “internalization.”

Another incarnation of the “Kuleshov effect” can be seen in comic books. Every frame in a comic strip requires mental reconstruction to close the narrative gap. McCloud identifies how closure contributes to the transitions between comic panels. Comic books are an art of intervals that rely on closure to connect the change from moment-to-moment, action-to-action, subject-to-subject, scene-to-scene, aspect-to-aspect, and the non sequitur montage.⁵⁹ Closure, allows “incompleteness” in a composition to be concluded in the audience’s mind. “The notion of closure as equilibrium, as displacement of perception,

58 Sam Rohdie, *Montage*, 26.

59 Rick Poyner. *Design without Boundaries: Visual Communication in Transition*, (London: Booth-Clibborn Editions, 1998), 242.

as completion of image.”⁶⁰ In visual composition, we are able to perceive a complete letterform A even if one third of it is missing (Figure 26). The cropping prolongs the time that information is perceived, while closure affects our interaction (both physically and psychologically) in perceiving the missing content. The same theory applies to sound as long as the interruption is not too long. Film takes advantage of closure in storytelling to create suspense. Watching a movie character walking towards a door, hearing only the sound of the door opening and closing without seeing, we are convinced the character has entered a different room. “Star Wars” uses this door effect to simplify the visualization of a scene. Fight scenes use this same technique to convince us of a painful punch without any real physical interaction. It has also been widely used in love/romance scenes, where the audience does not see everything, but they know.

In the blink of an eye seeing a series of still images, closure transforms them into motion at 24 frames per second. The omitted details with editing not only increase the speed of the storytelling aspect, but also invites our imagination to fill in the missing details. The closure for simple and familiar forms happens automatically in our daily life; the complex forms invite the audience as a conscious collaborator to decipher the incompleteness in a longer time.⁶¹ Closure controls the length of time we need to perceive the composition from element to element, frame to frame, action to action, scene to scene and dimension to dimension. Closing the differences between two segments in any non-time based composition involves time, therefore, time is designable. Theoretically, as we are shifting away from the time-based dimension in print form, we actually internalize our experience of the story time in real time by engaging to the changes from Thaumotropic overlaps and stroboscopic progressions. Time dominates the life force between the seen/unseen, the conscious/subconscious, and the intuitive/intellectual.

60 Marshall McLuhan, *Understanding Media - the Extensions of Man*, xiii.

61 Scott McCloud, *Understanding Comics: The Invisible Art*, 65.

CHAPTER 3

METHODOLOGY

The increasing use of sight and sound in digital media challenges the traditional values and possibilities of visual communication design. Visual form is more than just a representation of appearance; it triggers a series of physical and psychological interactions. Sound as a time-based design tool expands static visualization into motion as well as executing motion in static media. Two experiments are conducted in this research. The first experiment focuses on the influence of sound in perceiving visual content, while the second experiment offers an alternative comparison of representing time across five print applications poster, contact sheet, brochure, flipbook and CD packaging design. Both experiments use time as a design element to explore the connections between print and motion graphics.

The research protocol has been approved and considered exempt after review by the Arizona State University (ASU) Human Subjects Institutional Review Board (IRB). Copies of the IRB's approval form and the consent form are provided in the Appendix section. A total of sixty participants are recruited for both experiments. Four are used for the pilot test.

EXPERIMENT ONE

OBJECTIVE

Sound lives in the time-based form and image is free from this time-based form unless it is synchronized with sound. With visual-aural synchronization, the real-time perception of imagery, slideshows, or video can be manipulated by adding sound. Theoretically, video with sound not only activates the use of silence, it should also command more attention and emotion from the content. Therefore, the time spent perceiving content can be affected by the incorporation of sound.

HYPOTHESIS:

H_0 : The time an audience spends viewing media with sound is not different from the time spent viewing media without sound.

H_1 : The time an audience spends viewing media with sound is different from the time spent viewing media without sound.

DESIGN AND PROCEDURE:

Seven stories were developed for this experiment (A-G), and each story has seven interventions (I – VII). Within the interventions, stories are categorized as a single montage of nine images, a slideshow (with nine slides), or a 75 second video. The on-screen dimension of all videos is 640 x 480 pixels. Below are the list of seven stories and seven interventions:

The seven stories are:

- A. Train
- B. Storm
- C. Water
- D. Mantis
- E. Ice
- F. Foot Soldier
- G. Promise

The seven interventions are:

- I. Image (no sound)
- II. Image (with sound)
- III. Slide (no sound)
- IV. Slide (with sound)
- V. Video (no sound)
- VI. Video (with sound)
- VII. Sound only

Detailed descriptions of all seven stories can be found in Figure 27. All visual and sound elements were created to exercise different synchronization techniques, and to apply the principles mentioned in the literature review section.

Each subject was designed to experience one of the seven interventions per each of the seven stories, therefore a crossover design was used in this experiment. The order of the stories and interventions were constructed by the Williams Squares' design, which controlled the carry-over effect by eliminating similar visual content from the same story being experienced more than once from a different intervention. An algorithm for devising Williams squares for any number of interventions was given by Sheehe & Brosse (Biometrics 1961, 17, 405-411). The ordering of stories and interventions was set-up in 14 combinations as a complete cycle (Table 1). The first subject was set to watch using the combination 1 (stories and interventions) in the following order:

- A - I: Train - Image (no sound)
- B - VII: Storm - Sound only
- C - II: Water - Image (with sound)
- D - VI: Mantis - Video (with sound)
- E - III: Ice - Slide (no sound)
- F - V: Foot soldier - Video (no sound)
- G - IV: Promise - Slide (with sound)

The 15th subject followed the same sequence as combination 1, and subject 16 followed the same sequence as combination 2, etc. With this design, amongst every 14 combinations, every intervention (I - VII) occurred twice in each story (A - G) to counterbalance the ordering effect. As a cycle needed 14 subjects to complete 14 combinations, the sample size would be limited to the multiples of 14.

Since this experiment explored the impact of sound on sight in real time, a screen-recording tool was used to record each subject's screen activities, including cursor movements and time spent on each story/intervention. The subjects were allowed to skip

and to re-play each story at their own pace by clicking the replay and next buttons (Figure 27). Instructions were given before they began the experiment. Once a subject proceeds to the next story, they cannot return to the previous one. An exit button was presented at the last intervention to indicate the end of watching content. Recording the computer cursor movement on the screen accurately captured amount of time spent on each intervention for data analysis. No identifying information of the subjects was recorded. A semi-structured interview took place after each subject completed the experiment. A typical session for experiment ONE took approximately 15-20 minutes per subject.

Questions:

1. Among all the stories, which ones are your favorite and least favorite? Why?
2. Among all the videos, is there one that seems particularly long? Why?
3. Do you think video helps you understand music more efficiently?
4. How important do you think an album cover design is to the songs (music) on a CD?

SAMPLINGS:

A total of 56 subjects were randomly sampled. There were 28 males and 28 females. Within each gender, there were 14 graphic designers and 14 non-graphic designers. Because the time-based model of this study will benefit design educators, both students and practitioners, subjects in the experiment should represent the general population. The screening before the experiment provides background information about each subject. The screening form is provided in the Appendix. All subjects were required to be 18 years or older. Subjects were recruited via email through relevant ASU list serves, the internet, and through verbal announcements where appropriate. Snowball sampling⁶² was also used in the process. Four subjects were used for a Pilot test.

⁶² “Snowball sampling helps identify one or more individuals from the population of interest.” Colin Robson. *Real World Research*, (Massachusetts: Blackwell, 1993), 142.

LIMITATION/CHALLENGE:

In order to test for creativity and emotion in visual communication, the visual and sonic elements of the test media cannot be over-simplified. Otherwise, this experiment cannot truly reflect the nature of visual communication design that engages people. It is a challenge to make all seven stories distinctively different from each other and keep them equally exciting. Therefore, it is important not to present the same exact video or even a variation twice. In order to condense sound and movement on a single frame for the still image intervention, nine images are composed in a montage to increase visual complexity for balancing the comparison with the video format. Setting up all seven stories with 49 interventions that potentially have no significant difference in statistic is the biggest challenge.

INSTRUMENTS:

Computer – 14 combinations of two sets of 49 interventions (of images, slides, and videos) and the Snapz Pro X screen recording software.

LOCATION: ASU Centerpoint 660, Suite 312-26

DATA COLLECTION:

The recorded viewing time is the outcome variable. The subjects, stories, and interventions are covariates. The goal is to estimate the contrast of viewing time among the interventions when the subject effect, theme effect, and order effect are removed.

The Generalized Linear Model was used to approach the data. The presentation with sound was compared to the presentation without sound, (i.e. I Image vs II Image with sound; III Slide vs IV Slide with sound; V Video vs VI Video with sound). In addition, all video presentations (I, III, V) will be comparing to video-audio presentations (II, IV, VI) with sound only presentation (VII).

EXPERIMENT TWO

OBJECTIVE:

Five print applications (i to v) are created to represent one video. Subjects review five print applications that represent a video (i. 6 x 80 poster/ ii. 20 x 36 contact sheet/ iii. book/ iv. flipbook/ v. cd packaging design) before they get to watch the video. The goal is to evaluate the closest representation of the video among all possible print representations in order to find out how dynamics can be experienced and executed differently. The user interaction and the time spent with the print applications were observed. Both Thaumotropic overlap and stroboscopic progression are executed in the representations. The length of time for this experiment was about 15-20 minutes.

HYPOTHESIS:

H_0 : There is no difference in the average (or total) score between the five print applications.

H_1 : There is a difference in the average (or total) score between the five print applications.

DESIGN AND PROCEDURE:

1. Brief participants about the procedure, and inform the participants that a total of five treatments will be shown before the video
2. Present all five treatments
3. Present video
4. Subjects will rank the five applications (with first being the best) based on the following criteria:
 - Creative representation of time (five is the most creative method of representing time and one is the least)
 - Interactive representation of time (five is the the most interactive/engaging piece and one is the least)

- Best representation of video (five is the piece that most resembles the video format and one is the least video representation)
- Loudest representation of sound (five is the most effective representation that connects you to sound the most and one is the least)
- Motionless representation of motion graphics (five is the most static and one is the least static)
- Most representational storytelling in comparison to video (five is the piece with the most story telling qualities that has an apparent plot structure: beginning, middle, and end)
- Longest duration in reviewing the content (five the longest time required to perceive the information within its format and one is the shortest)

5. Ask one question

Which print piece is more dynamic? How would you define the word “dynamics”?

SAMPLINGS: Same as experiment ONE

DATA COLLECTION:

Two-tailed test was used to assess the average (or total) score between the five print applications. Wilcoxon’s signed-rank test is used to assess the medians among the ranked print applications. A P value less than 0.05 is set as statistically significant for this experiment. Designers often work on different applications where dimension restricts the presentation of content and the use of senses. These restrictions challenge the representation of sound and motion in maximizing the control of dynamics. In this experiment, experience and impact are compared between the presentation in time-based form (original video) and the representation of the time-based form (print deliverables).

A detailed description of all five print applications can be found in Figure 29, and the video can be found in Figure 30. All visual and sound elements are created to experiment with Thaumotropic overlap and Stroboscopic progression.

CHAPTER 4

FINDINGS

EXPERIMENT ONE

Experiment one explored the impact of sound, as a time-based form, on visual presentations (image, slide show, and motion graphics) during a real-time experience. Twenty-eight male and twenty-eight female are sampled; there are 14 non-designers and 14 designers within each gender. If anyone who have worked with sound editing, video extensively or trained/majored in design, he or she will be considered as a designer. In this experiment, two subjects are majoring in journalism and since they have been doing editing with sight and sound, both are categorized as designer. The screening questions further confirm subject's experience in sight and sound in design context.

From the Generalized Linear Model with viewing time being the dependent variable and the 5 independent factors, i.e. subject, gender, profession, story, and intervention, it shows that there is no subject effect ($P = 0.407$) after adjusting for the other 4 factors, this suggests the recruited subjects, on average, behaved similarly after accounting for the differences observed from the other factors.

However we have observed a gender difference regarding the average viewing time, with the male subjects spent longer time than the females in viewing the given contents (after adjusting for the other 4 factors), and this is statistically significant ($P = 0.001$).

The model also indicates that there is a statistically significant difference between the designer and non-designer participants ($P = 0.027$), with the longer average viewing time by the non-designers (after adjusting for the other 4 factors).

Amongst the seven stories used in this experiment, taking into account of all other factors, there still shows no statistical significant differences in the average time spent on viewing the stories ($P = 0.233$).

Having adjusted for the differences seen in the 4 factors mentioned above, there is a

highly statistically significant difference among the seven interventions used ($p < 0.001$). We have performed further analyses to locate these differences. Bonferroni correction was used to adjust the Type I error rate (False positive result rate) for these multiple testing results.

Table 2 summarizes the observation of the participants ($n=56$) and the overall mean duration they spent watching the presentations among all seven interventions in each theme. The Storm video (theme B) on average has the longest duration of viewing in seconds (Mean = 68.77), while Train (theme A) has the shortest (Mean = 56.23). However, the difference among these themes did not show any statistical significance (A value of $P > 0.05$ with Bonferroni correction between two videos means there was no statistical significance between the viewing durations). Even though the content in each theme tells a different story, the actual content of the presentations seemed to have little effect on the participants' viewing time.

Within each theme, seven interventions were compared to test the power of using sound in visual communication. Based on the sample of all participants ($n = 56$), there are statistically significant differences among the interventions as shown in Table 3 ($P < 0.05$). The mean viewing time of the image (no sound) in Intervention I was significantly lower than that of the image with sound (Mean difference = 26.02, 95% CI = 8.81 to 43.21). Video without sound is also a time-based form, and the data also show a longer viewing time in Intervention V when compared to Intervention I (Mean difference = 39.18). When both visuals and audio were used, a large difference in mean viewing time between Intervention VI and the image without sound in Intervention I was observed (Mean difference = 42.63). We might therefore conclude that sound can extend the time spent experiencing visual content. Participants spent more time exploring/experiencing the content with the accompaniment of sound. When only sound with no visual content (Intervention VII) is compared to the standalone image without sound (Intervention I), sound stretched the visual experience ($P = 0.002$). Sound increased the overall viewing time in the corresponding interventions compared to those without. Even though there are no statistical differences when comparing the slide and video with sound to the slide and video without sound, we still observe a higher mean in both the slide ($M = 69.88$) and video ($M = 79.98$) with sound.

Table 3 further reveals the breaks down each of the seven interventions within each theme. Most of the interventions with sound had longer viewing times than those without sound, as participants tended to spend a longer time experiencing the visual and sonic content. Two exceptions are revealed in the slide presentation. The slide with sound in Storm (B) and Promise (G) are both slightly shorter than the slide without sound.

OBSERVATION AND INTERPRETATION

In order to understand how each participant experienced the seven interventions/stories, four questions were asked during the interview. The purpose was to discover how each participant subjectively experiences the passage of time. The first question asks the participant to choose their favorite and least favorite stories. The answer provides an understanding of whether the participant perceives sound, visual presentations, and stories quantitatively or qualitatively. It is an open discussion that allows for investigation as to whether there is any correlation between what they prefer to see and the time spent viewing it. In addition, we can possibly infer what presentations work more effectively with sound from the users' perspective. During the interview, a sheet that contains seven images, one from each of the seven stories, is presented as a reminder of their video experience. Since the viewing time of each video has been captured, the in and out points of all stories are captured precisely from when participants clicked the on screen buttons. Since the duration of each video has been documented, the second question asks the participants if any particular video felt longer than the rest. This question attempts to compare mind time (what we think) with the clock time (how we behave). The third question asks for opinions on whether the visual content helps increase understanding of the music, or vice-versa. Along the same line, the fourth question investigates the value of CD album cover design as a visualization tool for the abstract sonic content in a consumer's mind.

In summarizing the answers from the semi-structured interview, the following conclusions separate the findings of Experiment One into four categories. In order to accommodate the wide range of answers from all participants, their opinions on different

interventions have been calculated as vote(s), and converted to percentages as shown below. Additionally, some participants had more than one favorite story. If the participants chose their favorite story based on how much they liked the subject matter (e.g. nature, sunset, praying mantis) rather than the visual representations (image montage, slideshow, or video) and sound, their vote was excluded from this sight and sound analysis.

1. The favorite intervention among stories: (Total votes: 25)

Question: Among all the stories, which is your favorite(s)? Why?

I – Image (no sound)	0	0%
III – Slide (no sound)	2	8%
V – Video (no sound)	1	4%
II – Image (with sound)	3	12%
IV – Slide (with sound)	4	16%
VI – Video (with sound)	13	52%
VII – Sound only	2	8%

As shown above, about 52% (13/25) of the votes are in favor of the video with sound intervention (VI). Participants not only specifically pointed out the motion and sound aspects of the storytelling, but they also recognized the story content immediately from the reminder sheet. In terms of the editing, the unexpected reverse sequences in Storm (B) seem to have aroused viewer curiosity. One participant actually interpreted the disjointed scenes as a metaphor for the four seasons. Also, while no votes were received for the image only intervention (I), there were two votes for the sound only intervention (VII). By nature, sound is invisible and time-based; thus, even without visual synchronization some participants still found the music attractive. This result could be slightly different if the images were not presented along with the other time-based items. Clearly, when an image is put in motion and synchronized with sound, people become more engaged. The slide presentations contain some changes in time that makes it more than just an image, but less

than a video. As a result, the slide with sound was the second most popular intervention.

Recommendation: Applying motion, even implied motion like slides and sounds in a presentation helps to engross viewers. Additionally, sound is more forgiving without visual content. For example, participant 8 said, “Music is more fleshed out without image.” Therefore, placing a static image into a time-based form requires some degree of changes to that form. Furthermore, there is some degree of connection between the viewing duration and the favorite intervention. Video (with sound) has the longest mean viewing duration ($M = 76.98$ sec.) while the image without sound has the shortest mean viewing duration ($M = 34.36$ sec.).

2. The longest mind time: (Total votes: 65)

Question: Among all the presentations, is there one that seems particularly long?

I – Image (no sound)	10	15 %
III – Slide (no sound)	15	23%
V – Video (no sound)	8	12%
II – Image (with sound)	13	20%
IV – Slide (with sound)	6	9%
VI – Video (with sound)	5	7.5%
VII – Sound only	8	12%

The results from question two show that about 23% (15/65) of votes indicate that the slide without sound felt the longest in the mind of the participant. According to the mean viewing duration ($M = 59.61$ sec.) of the slide with no sound, many participants did not watch the complete slide show presentation, since all 49 interventions are 75 seconds long. The slide with sound ($M = 69.88$ sec.) had a longer average viewing time than the slide without sound, because the audio holds attention until the next slide proceeds. Three participants reported feeling annoyed by the sound in the slideshow interventions. Additionally, the slide with no sound might seem longest because participants knew there was more information, but they had no control on revealing the information at their preferred speed. With no sound accompaniment, the participants could not foresee the ending, and felt there was “nothing to

wait for”. Participant 13 said, “Intervention V seems long without music, but III seems the longest because it has no sound and no control on the slideshow. Come on!”

Recommendation: When a slideshow presentation is used without music, the interval and pace of the each slide should be carefully considered. Without music, the viewer cannot anticipate the ending. Visual cues should be applied to signify the total number of slides as well as the number of the current slide in order to fully activate the narrative structure and expectation of an ending. Then a designer can manipulate the “tension and release” for projecting a dramatic climax. A sequential format such as a slideshow has to be visually guided in order to engage the audience. On the other hand, when music is added, the time interval of switching slides should be adjusted based on visual-aural synchronization. For example, a slide can be changed at the first measure of a music beat. Sound can prolong a painful experience if the visual content is not fully integrated. Adding a sound layer can definitely affect our mind time interpretation, and presenting the same content in nine slides might put more emphasis on the quantitative aspect of time more than the qualitative aspect. The visual-aural synchronization in a video does not always guarantee a shorter mind time perception in an audience. Similarly, some participants even perceive the videos with sound (5%) or without sound (8%) as the longest when compared to the other interventions.

3. Visual and sound content (Total: 32)

Questions: Do you think the music video helps you understand the music better?

Video increases the understanding in sound	23	71.875%
Video and sound are equal	7	21.875%
Sound increases the understanding of video	2	6.25%

Twenty-three participants (about 72%) think that visual presentation can enhance our understanding of music as shown by their answers to question three. Participant 9 said, “The visual element contextualizes and motivates the listener’s experience. Visual content is not about understanding the music; it is about supplementing the experience.” Those participants who answered this question ambiguously (i.e. “maybe”, “could be”, “can be”, “don’t know”, etc.) are not included in this summary. Two participants (6.25%) think it is

the music that helps to interpret the visual content, while seven participants (21.875%) believe video and sound are equally important and influential. In the story entitled Train (A), participant thinks the visual content immediately situated them in a subway train station. Participants who did not get to hear the sound in Water (C) and Foot Soldier (F) think they have missed a critical portion of the presentation.

First, the semiotic aspect of imagery as an index and icon signifies the existence of sound of which is desired to be heard. Unlike seeing a single image or hearing music alone, the motion in a slideshow or video without sound urges the audience to fill in the missing sonic elements. Theoretically, the visual presentation of the Flamenco dance tapping in Foot soldier (F) is strongly associated to the concept of “diegetic sound” in film. It refers to the source music and actual sound in the story space. Without them, the “completeness” of realism is missing. For that reason, cartoon animation relies on “Mickey-Mousing” (i.e., hitting the action) and “Foley artists” to create sound effects that accompany animated drawings.

Second, Water (C) only contains instrumental music. No sound effects applied to the water bubbles clip. Without hearing the sound in this video, participants actually imagined a bubble sound. As participant 41 said, “The music helps describe the picture.” It is necessary to see the whole message with sight and sound. On the contrary, participant 43 states, “Visual put more focus on the perception.” It is also echoed by participant 42, “Visual helps to manipulate!”

Recommendation: Sight and sound are complementary to each other. In the time-based video format, they need each other to re-construct the reality of the story. A slide presentation in time-based form may not make sound as desirable as the same content in video, but familiarization with different synchronizations can help create alternate experiences of the visual world. Therefore, a cyclical time-based model should be implemented for learning the sight and sound in both video and print representations. Personally, I think the impact of television (particularly MTV, VH1) originated the expectation of visualizing music in the video format. This assumption leads to our analysis in the next category.

4. The value of music album cover: (Total: 33)

Question: How important do you think an album cover is to the songs in CD design?

Important	20	60%
Not Important	8	24%
Maybe	5	15%

The answers to Question four show that about 60% (20/33) of participants think CD design is still important. The ultimate goal for this question is to detect the value of visual representation in invisible music. Instead of simply gathering the above answers, it is more intriguing to hear how participants evaluate this visual wrapping differently. The rationale behind each answer offers constructive thoughts on connecting sight and sound. Below is a summary of how participants define the visual representation of the songs:

a. Visual cover as the transition from sight to sound

Participant 9, "Artwork is related to the transition of the purchase. It is like buying the newspaper for the news."

b. Visual cover as the first impression, impulse, assumption and expectation

Participant 10, "CD cover is the first impression, expectation, like a TV commercial."

Participant 13, "Cover design drives the first impulse in buying. It is not necessarily correlated to the CD's music."

Participant 14, "One of the first thing you use to make assumptions."

Participant 29, "A CD cover is like a book cover or DVD movie cover."

c. Visual cover as an immediate connection for decision-making

Participant 21, "CD design provided an immediate connection for the thing you first see and it might affect the decision making process."

Participant 24, “CD design communicates the music for someone who doesn’t know the band.”

d. Visual cover as an identity

Participant 51, “It is harder to identify the music when no image is attached. It is an introduction like a logo.”

Participant 27, “You will miss the CD design from buying it online. It is the personality of the person who makes the music.”

Participant 20, “If I know the artist, the cover doesn’t affect me. Otherwise yes.”

Participant 36, “It’s your final image; it’s your face.”

Participant 53, “CD art is not as important, when I burn the music I bought online onto a CD, it’s a blank disk.”

e. Visual cover as a story

Participant 34, “CD cover tells the story.”

Participant 46, “If I don’t know the singer or the song, yes! It should be the summary of the album.”

Recommendation: The digital media revolution has no doubt changed the way we experience an album cover and its overall value to the content. Since an album cover design shares the vocabulary of sight and sound on so many representational levels, it is still worthwhile to explore the key element that connects the visible and invisible. The five items listed above perhaps offer insightful parameters on what visual elements can possibly reinforce sound as well as the ephemeral time-based form through the transition, the initial impression, the immediacy in decision-making, the identity, and the story development.

EXPERIMENT TWO

Experiment two ranked five possible executions of time-based form in print media. Each application uses thaumatropic overlap and stroboscopic progression in some degree. Wilcoxon signed-rank test⁶³ is used to assess the medians among the ranked print applications. A P value less than 0.05 is set as statistically significant for this experiment. Participants were asked to rank according to seven categories (five being the highest score and one being the lowest). All 56 participants (N = 56) ranked the five print design applications.

1. Creative representation of time

In Table 4 criteria 1, the poster-book (P = 1), and book-CD (P = 629) comparisons show no statistical significant difference. We can compare 50% of the observations in the inter-quartile range (under LQ, UQ). Flipbook is highly significant (Medium = 5) in representing the video creatively, has the highest upper percentile (Medium = 5), and highest lower percentile (Medium = 4). The CD has the second highest score, and the book is the third since it has a higher upper percentile than the poster. The box-and-whisker plot summarizes the score for each medium (Figure 31). The comparison between the book and poster is not significant (P = 1) just as listed in Table 4. The contact sheet is the least creative in representing the video as demonstrated by its low scores. During the experiment it was observed that participants spent more time experiencing the flipbook. After a few trials, they were able to operate the animation in both forward and backward sequences. Even though many participants think the CD design is creative, two participants did not unpack all the layers because they think it is too complex. The ranking of creative presentation from the highest to the lowest: Flipbook > CD > Book > Poster > Contact sheet.

2. Interactive representation of time

The comparison between the CD and flipbook is not considered statistically

63 The Wilcoxon signed-rank is a nonparametric equivalent of the paired two-group t-test. Colin Robson, *Real World Research*, 355.

significant ($P = 0.852$) as shown in Table 4. This is expected because both the CD and flipbook are highly interactive. The book is ranked third, and the upper and lower percentiles are equal to the median (Median = 3) as shown in Table 4. That is, 50% of the participants ranked the book exactly the same way. For this question both extreme values and outliers were observed, but they are far from the core part of the data. It can also be seen from Figure 32 that participants ranked the poster fourth most interactive and contact as the least interactive representation. The ranking of the most interactive presentation: Flipbook > CD > Book > Poster > Contact sheet.

3. Most representational piece for the video

The comparison among poster, contact sheet, and book in this question does not show statistical significance ($P > 0.05$) as shown in Table 4. We observe that the flipbook was rated highest, and carries the most resemblance of the video format, while the CD was rated the least representational under criteria 2 in Table 4. Most participants find the unpacking process distracting. They can easily see the movement and transition of the movie in flipbook. The flipbook shows statistical significance against all the other representations with the poster being rated third highest on average as shown in Figure 33 and Table 1. The ranking of the most representational piece for the video: Flipbook > Contact sheet > Poster > Book > CD.

4. Loudest representation of sound

In representing time-based sound in print media, the flipbook was rated as the most representational form. The highest ranking is reflected in the central box which contains 50% of the observations in Figure 34. Participants seemed to have the most difficulty ranking the sound in print because of its abstract form, and several comparisons are not statistically shown (Table 4 criteria 4) to be statistically significant (P value > 0.05): poster-book, poster-flipbook, poster-CD, book-flipbook, book-CD, and flipbook-CD.

Furthermore, the poster and book are almost equally ranked on average. The ranking of sound representation from the loudest to the quietest: Flipbook > CD > Book/Poster > Contact sheet.

5. Motionless representation of motion graphics

The dynamics in print design are often limited by the format. Participants ranked the flipbook overwhelmingly as the least motionless presentation. It has equal upper and lower percentiles with a few outliers observed. The book, poster, and contact sheet proved to have no significant statistical difference ($P > 0.05$) as shown in Table 4 criteria 5. All three of them have the same rating in the upper and lower percentiles for the sense of motion/movement they conveyed. The contact sheet was rated more static than either the book or the poster as shown by the lower whisker in Figure 35. In practice, book, posters, and contact sheets are all traditional formats we use, while both the flipbook and CD packaging involve the sense of touch. This physicality might skew our perception of what is in motion and what is static. The ranking of the most motionless representation: Contact sheet > Book/Poster > CD > Flipbook.

6. Most representational storytelling in comparison to video

If storytelling structure is defined as having a beginning, middle and end, participants ranked the flipbook as possessing the most story qualities. In Table 4, it has the highest rating in both the lower and upper percentiles, along with the highest median (Median = 4). The comparisons among the CD, book, contact, and poster are not significantly different, but the poster is rated a bit higher than the book as shown in Table 4 and Figure 36. In a qualitative observation related to this question, one participant explained that a poster allows for multiple entry points, and that he can read the content up or down from this entry point repeatedly until he figures out the message. Conversely, a book only affords seeing the content per spread, and the visual flow of the story might affect this rating. In terms of flow, the flipbook flows the content smoothly. The ranking of the most representational storytelling: Flipbook > CD > Book > Contact sheet > Poster.

7. Longest duration in reviewing the content

The comparison between the flipbook, poster, contact and book are do not show statistically significant difference ($P > 0.05$) as shown in Table 4 criteria 7. The unfolding process of the CD packaging took the longest to review the content. According to the box plot (Figure 37) the book is rated the second longest. Both the poster and the flipbook are on average ranked the shortest in time spent perceiving the content. The flipbook animates all frames/pages at a high speed, while the poster highlights the key frames in one linear flow that only requires up and down eye movement. The ranking of the longest duration in reviewing the content: CD > Book > Contact sheet > Flipbook > Poster.

OBSERVATION AND INTERPRETATION

The five design applications represent the same content as the video, but in five separate ways each with its own physical limitations and dimensionality constraints. The following analysis is generated based on statistical data, design theory, and qualitative observations made during the study participant interviews.

Poster and contact sheet: Asymmetry in dynamic

Both the poster and contact sheet shared a similar level of representational value, but the poster was more intuitive while the contact sheet was more systematic. They are both rated by the participants of this study as the most motionless representations. However, the contact sheet is relatively more static as it took participants longer to perceive all the frames that were mechanically extracted from the video. A few participants suggested a bigger contact sheet to improve the readability of details in each thumbnail. It literally transferred the time-based form into a two-dimensional surface with the least amount of modifications. Unlike the contact sheet, the poster highlights more representational frames that reflect the key transitions from “motion-to-motion” and “action-to-action” in a vertical strip. In terms of composition, the contact sheet is more symmetrical, while the poster has more contrast

in its asymmetrical layout. The longer reviewing time and the homogeneity (lack of contrast) in its layout make the contact sheet the most motionless and static in expression. It is the second closest representation of the video format.

Contact sheet and flipbook: Sense of touch in interactivity

As the top rated video representation and the least motionless design, the flipbook transformed the mechanical frames of the contact sheet into a three-dimensional book form. Unlike the poster, where all details are presented on the surface; the flipbook has two hundred pages of content bound in book form. The sense of touch is incorporated in the revealing process. It is the closest representation to time-based video, and requires a short amount of time to flip through the content. The physicality of flipping makes it the most interactive, the most video-like, and the most creative representation of time-based form. When the content is perceived as the close to motion graphics, sound and dynamics are implied. Physically, people can hear the flipping sound; seeing the successive movement also signifies the “diegetic” sound that lives in the story. While the contact sheet spreads out time in stroboscopic progression, the flipbook limits time in volume. Successive content requires time to review like playing a Thaumatrope (Figure 22). The third dimension is truly the bridge between the second and fourth dimension. In order to systematically express dynamics in a design like the flipbook, the projection of volume (as loudness), interactivity, and other senses should all be considered.

Flipbook and book: Visual cues in continuity

Both the book and flipbook have the same dimensionality. The difference is that the pages in the flipbook contain a massive amount of visual cues to establish an absolute continuity in the visual flow. The entire flipbook belongs to one unified time and space. On the other hand, the book layout has many time and space compartments. Each spread is relatively independent, and the photo compartment in each page has its own time and space. Therefore, the book requires a longer duration to perceive the content. It requires physical

interaction like the flipbook, however, the feedback from this tactile interaction is very different. Motion is the direct feedback from the flipbook, while a new compositional panel/surface is the feedback you get from a regular book. If we were to operate any book form in the way we operate a flipbook, all we would see is the filmic collage (disjointed imagery) rather than the montage. Overall, the book is rated towards the middle in most categories. It may not be the most effective print form to represent video, but the physical format conveys the conventional storytelling experience. The use of transitions, visual cues and continuity can be revisited to explore the book form with the use of time and sound.

Book and CD packaging: Connecting sequence

The packaging design plays with the control in manipulating both sequence and experience. Unlike the non-linear reading experience in the book form, the Russian doll style CD packaging design unfolds all selected frames in nine jackets. Participants have to physically remove one jacket at a time to experience the “successive” story. The core unit (an envelope with flower seeds) extends to the original story in the video. This packaging was rated the most interactive and creative representation of time by the study participants. Interestingly, participants reacted to the unfolding process in several different ways. Two participants got tired of the unfolding process and refused to open the entire package. For future study, it might be beneficial to capture the unfolding experience on video to further analyze the relationship between “mind–time” and “clock–time” in interacting with three-dimensional objects. Participants rated the CD package as the least related to the video representation, because most of them found the unfolding process too distracting to make a visual connection to the story. The images in each unit are very disconnected because of the unpacking interaction. It is the opposite of the book form, where the action of turning a page or flipping the book connects the visual content. Conversely, unpacking the units only breaks the content in pieces. The number of unit and the complex assembling process make the pieces very difficult to piece together at the end. It took the longest time to reveal because time and the sequential process are predetermined and controlled just like in the movie format.

CHAPTER 5

CONCLUSIONS

ESTABLISHING A CYCLICAL MODEL FOR VISUAL DYNAMICS

Time connects a static moment with its dynamic progression in a full-spectrum of design applications (print, web, packaging, motion etc). The knowledge of how to control the dynamics in different dimensional platforms is a tool for developing engaging experiences and memorable emotions in visual communication design. Sound makes time structure more visible. As a counter to sight, sound revisits our visual capacity in time-based form. Communication is no longer one-dimensional and interactivity is becoming multi-sensory. The initial step is to explore our visual language in the seeing, hearing, and feeling of each moment we observe as a part of motion as a whole. This mentality translates our visual presentation and representation into a cyclical model to facilitate dynamics and creativity in both time-based and non-time-based design.

A cyclical model of integrating time can be illustrated with a design context analysis of the Möbius band⁶⁴ (Figure 38). Time in the Möbius band encompasses all four dimensions at once. This band interweaves the first, second, and third dimensions into one infinite time cycle. The first dimension is a point on the outside surface of the band. The second dimension is the plane of the outside surface where the edges of the band frame the communication. The third dimension incorporates both sides of the band. We cannot see the opposite side of the band unless we travel along the band to experience the backside. This analogy is similar to our three-dimensional chair example. The user has to walk around the chair to see what is hidden in the depth dimension. Similarly, we cannot see some of the “shaded/covered” area in the band unless we travel through it. Traveling through the surface of the band generates a complete cycle that involves the fourth dimension – time.

64 “An one-sided surface that is constructed from a rectangle by holding one end fixed, rotating the opposite end through 180 degrees, and joining it to the first end.” Merriam-Webster Dictionary. <http://M-W.com>

As a result, time can encompass all dimensions, and the activation of time in form reflects a developmental change in forming. With the awareness of this cyclical connection, we not only separate the design application, we also isolate the senses and the experience. A cyclical model is a process.

SIX CYCLICAL STEPS

A cyclical model highlights the dynamic changes both from stasis to motion and from motion to stasis into six essential steps (Figure 39):

1. Identification
2. Transition
3. Differentiation
4. Time
5. Story
6. Re-identification

Identification: This step provides an anchor point to approach the unknown, the unseen, and the unheard. It creates the entry point for us to focus on the exploration, as well as to compare its evolution. Dimensional constraints and affordances should be detected in launching “a concept.” This initial step is not an instrument for creating dynamics, but for exploring its visual possibilities beyond what we see and hear. After all steps in the cyclical form are completed, this anchor point creates a complete reference for controlling the constraints/affordances and the range of “recessiveness” and “expansiveness” in form.

Transition: To provide emphasis on how things are interrelated requires transition. Unlike any linear model, five transitions in cyclical forming exist between all steps (Figure 39). All transitions should carry some degree of resemblance for consistency. In this comprehensive cyclical continuum, the consistency helps structure forming with unity, rhythm, and

connection. In order to extend the form, a minimum of two steps is required. Because transition is set between all other steps, it is always required. The knowledge of dimensional constraints and affordances explores different transitions. Metaphorically, the “edge” of a frame is the transition from the second dimension to the third dimension; the “end” of a line is the transitional connection to the extended contour; the “visual cue” of one scene is the transition to the next scene. As a connection from one step to the next, it implies the direction in this cyclical shifting. One direction expands the stasis into motion and the other direction represses motion into stasis. It determines the concealing and revealing of the next possible step. The frequency of using transition can reflect the complexity of forming.

Differentiation: reflects the physical change(s) in forming from the smallest to the most dramatic. The differences make the forming process visible. In perception, JND (just noticeable differences) measure the very limits of human abilities to detect the faintest of differences between two adjacent colors in a continuous spectrum of 100,000 colors.⁶⁵ Hierarchy is established as soon as we differentiate the primary, secondary, and tertiary information. The change from a dot to a plane carries dramatic change in space and counter space, as well as change in form and counter form. The smaller the changes, the easier it is for us to notice how these changes alter the critical use in transitions (step 2). The degrees of difference affect our perception of time qualitatively and quantitatively. Difference can be the smallest division in time to convey the polarity in expectation, assumption, meaning, and expression.

Time: this step engages time both actively and passively in structuring/framing the content. Because of the dimensional constraints and ephemeral nature of time, different sensory channels should be incorporated. Seeing and hearing are complementary in time-based form; both senses can be manipulated in the third dimension. While Sonic elements control the temporal dynamic in time, visual elements control the spatial dynamic. The third

65 Edward Tufte, “The Smallest Effective Difference.” *Visual Explanations*. Connecticut: Graphic Press, 1997, 73.

dimension enters the “comparable time-scale”⁶⁶ for projecting sight and sound in sequence. The perception of time (clock time and mind time) can be conditioned actively and passively through the dynamic tension built in visual-aural synchronizations. The degree of control from both the user and the designer perspective should be analyzed. Since many elements are changing in time (as a montage or collage), the responsiveness of each change in time dominates the overall aliveness and activeness in interaction and sequential development.

Story: this step is required for time-based design. In any actual time-based presentation, motion and the passage of time can only become meaningful if new value is added. The immediate added value in motion refers to the expressiveness, information, and meaning.⁶⁷ The successive change in time should introduce a narrative relationship between the denoted form in what we observe and the connoted forming experience of how it affects our mind. Story pushes the limits of using dynamic tensions and changes. The passage of time and movement alone do not promise vitality in time-based form, story does.

Re-identification: this step recombines all developmental parts between the identified in-point and the re-identified out-point into a unified whole. Re-identifying the root amplifies the primacy and recency effects in this full cycle of change(s). It showcases the dynamics within both stasis and change by demonstrating the full spectrum between the static initial entry point in contrast to the final resolution (expansion of development). “Too much stasis is boring; too much change results in confusion.”⁶⁸ The re-identification help find the harmony in stasis and change. Each full cycle reaches the internal dynamics within its process from the communication standpoint because of “the recombination of elements from the past into a new present in turn becomes the past that influence tomorrow’s present.”⁶⁹ The

66 Michel Chion, *Audio-Vision: Sound on Screen*, 19.

67 This definition is adapted from Michel Chion’s definition of added value. *Audio-Vision: Sound on Screen*, 5.

68 Wendy Leeds-Hurwitz. “Introduction” *Communication and Semiotics in Semiotics and Communication: Sign, Codes, Cultures*. (New Jersey: Lawrence Erlbaum Associates, 1993), xxiv.

69 Leeds-Hurwitz, Wendy. xxi.

re-identification step reminds us to incorporate the following into designs we originate: (1) the past and the future, (2) the small and the big, and (3) the internal and the external.

THE CYCLICAL MODEL IN PRACTICE

The two-tailed test in experiment one validates that sound has significant impact on a viewer's perception of time. It overwhelmingly ascertains that the synchronization of sound with a visual element extends the time spent experiencing the media, while also providing greater control to the designer.

Sound influences the motion, progression, and successive change(s) in time-based form which retain the attention of the viewer longer. In order to successfully incorporate the time-based dimension in visual language, sound should be used to reflect rudimentary dynamic elements in time-based form and non-time-based form. On one hand, the invisible sound facilitates the visualization of motion in stillness with the pace, the rhythm, and the contrast of silence. On the other hand, the successiveness in motion demands the physical sound to complement the real time experience in motion. For example, a video or slideshow of a dancer demands the presentation of a tapping sound, while the image of a dancer only suggests the tapping sound as a representation.

As an overall guideline, a single frame poster has the least association with sound because of the fact that both motion and sound cannot be represented directly or they can only be implied. We are conditioned to detach the sound when fewer frame(s) in time and successiveness are perceived due to dimensional constraints. Both experiments have compared the level of detachment in sound among different applications and the number of frames used. The connectivity of frames and the physical experience of successiveness dominate the representation of sound and the viewing time. These findings further support the idea of using a cyclical model to conceive dynamics in design. The cyclical model provides a mental image of how frame(s) are developed in time. As an example, let us review how this model is used to expand a static logo design into its time-based form (Figure 40).

The ASU LightWorks organization researches light-inspired research for renewable energy. In applying the cyclical model to a single-frame logo design, we identified the key word “light” as a theme to develop the implied motion and sound. A narrow projection of a light beam inspires extended frames of motion and a split second of abstract sound. Attaching these implications of sound and motion allows pace, rhythm, and contrast to visually differentiate the change of frames in time for this logo. As the light beam expands outward, more letterforms are revealed to support the “light-inspired” theme. Hierarchy is emphasized with successive order, and it is this order that encapsulates the viewing time in reality. As the motion is forming in time, a sound effect is synchronized to reinforce the theme of the logo animation. The point of visual-aural synchronization is used when the light is shooting out from the letterform “I.”

For branding, the pace and motion in this logo animation is further expanded for a longer video introduction. The “sunrise in the globe” visual at the beginning echoes the same pace and motion as the LightWorks logo at the end, while rhythmic beats are expanded to pace the cuts between scenes and typographic treatments. Unlike simple logo animation, a full-length soundtrack is required for this extension. Synchronization is executed strategically to enhance the dynamics in the visual content.

As a creative process, the physical implementation of sound synchronization originates and evolves from the initial analysis of implied sound and motion in the static logo. Sound is therefore not an add-on or secondary element in production. Instead, it dominates the dynamics in time-based form when the six steps in the cyclical model are used as a creative process.

1. Identification (explore the anchor point in relation to the range of “recessiveness” and “expansiveness”)
2. Transition (implied motion or sound that can be repeatedly used)
3. Difference (visualization of change)
4. Time (presenting pace, rhythm, contrast)
5. Story (narrative structure, flow, tension, and release)
6. Re-identification (synchronization)

In reverse order, the six steps provide a structure to convert motion into static form:

1. Identification (explore pace, rhythm, and synchronization)
2. Story (deconstructs the narrative or the causality in the story)
3. Time (representing the density/contrast in sound and visualizing the rhythmic flow)
4. Difference (representing change in frame(s) or visual compartments)
5. Transition (thaumatropic overlap and stroboscopic progression)
6. Re-identification (examine the focal point in relation to the implied time-based dimension)

This reverse cyclical model has been used in creating the five print applications for representing the video in experiment two. The thought process and production notes are documented in Figure 29. It extensively explored the decomposition of time and content in relation to dimensional constraints.

The major contribution of this model is to access statics and motion in all dimensions as time is a continuum that connects all forms (Figure 39). Even though the cyclical model has six steps, designers can enter the model from any step. For example, if they are expanding a three-dimensional object without any narrative content, they can start analyzing the form from steps three or four instead of one and six according to Figure 39. It is a nonlinear model that facilitates creativity in two directions. In this case, we can either expand the three-dimensional object into time-based form or re-project/decompose the complexity of the third dimension in the second dimension.

In addition, the cyclical model allows designers to recognize the full range of visual language and its inseparable relation to sound and experience. The creative process becomes more analytical and structural when the constraint and affordance in each dimension are identified. The creative process for print, web, and motion are connected. In fact, the same design principle is applied differently in each dimension. For example, “tension” in two-dimensional design seems to be more dominant and controllable in comparison to the application of “release” until the form is expanded to forming in the time-based dimension. The linearity in forming makes “release” more manipulative. Designers sometimes worry about “the end of print” because of the digital revolution, the findings of the research and

the cyclical model confirms that knowledge of print (in both two- or three-dimensional applications) will never become obsolete simply because all dimensions are linked in a cyclical evolution of form. We might not execute the message on two-dimensional paper, but most of the skills and knowledge are required to see the full creative cycle. Therefore, when applying this model in design education, each step becomes a learning stage. In order to present this model in the context of design learning, the following list generalizes the most critical concepts within each stage:

1. Identification: Introduction / Tension
2. Transition: Dimensional Constraints and Form Affordance –
Typography and Image
3. Differentiation: Difference and Interactivity
4. Time: Motion and Stasis (with Noise and Senses)
5. Story: Narrative and Structure
6. Re-identification: Conclusion / Communication

Similar to the original cyclical model, there are five transitions set-up between each stage as students explore different aspects of typography and image with dimensional constraints and form affordances each year. Each reoccurrence of transition revisits the focus of type and image in designing the other critical stages “difference and interactivity,” “Motion and Stasis,” and “Narrative and Structure.” The form in type and the presentation in image are forced to expand for forming and represented within new sets of limitations in each stage. The model simplifies a basic framework of learning design. New knowledge or techniques can be added in stages three, four, and five as they represent the three major categories from print to packaging design, from interactive web design to motion. They can be seen as new extensions for visual communication design (in terms of execution), while stages one and six connect the micro and macro aspects of design theory with communication theory. Below is the cyclical model breakdown for a four year program:

Year 1: Identification and Transition (1 & 2)

Year 2: Differentiation and Transition (3 & 2)

Year 3: Time and Transition (4 & 2)

Year 4: Story and Transition. Re-identification (5 & 2, 6)

This will help students gain sensitivity of how different dimensions frame the message and prepare them to manipulate the visual language beyond sight. The concepts of icon, index, and symbol will be studied under the juxtaposition of sight and sound in time-based form and under narrative theory. Visualization will become more dynamic, multi-sensory, interactive and experience-based. Forming becomes more complex in the narrative layer with visceral behavior and reflective layers from emotion design. The above cyclical curriculum should be used along with the cyclical creative process to reinforce the idea of exploring a full cycle/range. Students will be challenged to re-visit and re-evaluate the old self after they have experienced stages three through five.

FUTURE IMPLICATIONS

In order to visualize sight and sound individually in this model, cut the Möbius band along the middle of the strip to form new interlocking strips. The new strips are identical and parallel to the original one, except they are connected (Figure 38). This model allows a potential cross-disciplinary comparison with time-scale to explore the visual element in its rhythmic forming. “Rhythm is certainly also a visual term. Yet when we look at visual qualities from another standpoint—the vantage point of music—we gain a fresh insight for applying rhythm to design.”⁷⁰ This cyclical model inspires new orientation to articulate and execute form and forming beyond our conventional routine.

70 Kenneth Hiebert, *Graphic Design Processes*, 95.

Time, as the core of this cyclical model, unifies all dimensions and senses. This research focuses on the sight and sound in time-based form. We can also conceptualize this time traveling experience with other senses in any particular dimension.

In exploring sight and sound in time-based form, the experiments indicate some associations among creativity, interactivity, and duration. The book and flipbook both require participants to physically interact with their hands. If sight and sound can be studied in the linearity of time, perhaps it is not unreasonable to extend the study to sight and touch, or sound and touch for interaction design. The cyclical model contributes a framework that makes the study of change in time-based form and experience more designable and controllable. The proposed steps lay the groundwork for studying other senses in juxtaposition with time. If time and space are closely interrelated, this model may provide some insights for architects and interior designers to conduct further experiments on the change in physical space and void in relation to the perception of time. Besides, the findings of applying sight and sound in time can be beneficial for any research study on users' feedback in designing instruction.

Experiment two allows the exploration of time and sound representation in print. The majority of subjects felt the CD packaging took the longest to review. However from my observation, both the flipbook and brochure took about the same duration or longer in total viewing time. The difference is that people tend to experience the flipbook repeatedly and read the book inconsecutively during the interview. The long unfolding process in one continuum of the CD packaging offers more "sequential viewing" control to the designer. On the other hand, viewers have more "sequential viewing" and pace controls with the brochure and flipbook. Different levels of control seem to fluctuate the perception of time in our mind. When the control of seeing is mapped to the sense of touching, the physicality might skew the perception of clock time in viewers. The nuances of this interaction and the physicality in the third dimension should be further explored in studying user experience in time. Can the level of control dominate our perception of time in experience beyond the qualitative and quantitative aspects? Is there a positive relationship between giving more

control to the user and shortening the passage of their mind time? The answers can offer tangible improvements for occupying waiting time and constructing interaction in experience design. In addition, it will be worthwhile to conduct an alternative version of experiment two by comparing a web-based contact sheet that allows user to zoom in and out, an iPad version of the flipbook and brochure, an online store or blog for the CD packaging with digital booklet and a web-based gallery for the poster design. Instead of representing the sight and sound of video in print media, this alternative ranking experiment can focus on different video presentations in various digital platforms.

The cyclical model proposed for design education and the creative process can be further developed and evaluated according to any technological revolution in the future. The proposed model/framework embraces an adaptive skeleton as an experimental starting point. For non-designers and collaborators, the steps in the model can be used as an index to find the common ground in different disciplines. The non-linear, dyadic, two-directional cyclical model offers a flexible creative process to encourage cross-disciplinary collaboration.

The ranking of the loudest representation of sound is completely opposite to the ranking of the motionless representation of video. By reversing one of the categories, we find two identical rankings from the loudest to the quietest and from the motion to motionless:

Flipbook > CD > Book/Poster > Contact sheet

It should be useful to further scrutinize the relationship in the future to see if there is a strong relationship among dimension, sound and the number of senses that influence visualization and representation.

The outside and inside of the band offers an insightful perspective to see figure and ground in time. The outside surface reflects the visible figure; the inside surface represents the invisible ground underneath. They are coexisting in this time cycle. Therefore, figure and ground are interchangeable in this dynamic experience. In a story time, traveling on the band can happen in both the forward and backward directions. Thus, our creative thinking should not be one direction as well. Expanding statics to motion, we have to present physical

changes; extracting motion to static, we need to represent the changes conceptually. A slice of the strip can be cut out from the Mobius band to reflect the moment in time as if it is one frame out of a movie strip. Likewise, a section of this strip reflects the duration. As we are traveling through the band, the outside and inside exchange their dominance and emphasis in communication. This model equalizes and counter balances the weight of the seen and unseen, sound and silence, figure and ground. The harmony, contrast, and tension of the dynamics are built upon this evenhanded scale.

Only when we are able to understand how dimensions are interlocked – that print is part of motion graphics and motion graphics are embedded in print – can we approach print design with motion and design motion in print.

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APPENDIX A

TABLES

Table 1. The combinations of interventions and stories in experiment one.

	Train	Storm	Water	Mantis	Ice	Foot Soldier	Promise
	A	B	C	D	E	F	G
Combination 01	I	VII	II	VI	III	V	IV
Combination 02	II	I	III	VII	IV	VI	V
Combination 03	III	II	IV	I	V	VII	VI
Combination 04	IV	III	V	II	VI	I	VII
Combination 05	V	IV	VI	III	VII	II	I
Combination 06	VI	V	VII	IV	I	III	II
Combination 07	VII	VI	I	V	II	IV	III
Combination 08	IV	V	III	VI	II	VII	I
Combination 09	V	VI	IV	VII	III	I	II
Combination 10	VI	VII	V	I	IV	II	III
Combination 11	VII	I	VI	II	V	III	IV
Combination 12	I	II	VII	III	VI	IV	V
Combination 13	II	III	I	IV	VII	V	VI
Combination 14	III	IV	II	V	I	VI	VII

The seven interventions are:

- I. Image (no sound)
- II. Image (with sound)
- III. Slide (no sound)
- IV. Slide (with sound)
- V. Video (no sound)
- VI. Video (with sound)
- VII. Sound only

Table 2. The mean and mean difference in viewing time (second) amongst four variables: gender, professions, stories and intervention.

Variable	Category	N	Mean	Difference	Mean Difference (95% CI)	P value*
Gender	Male	28	67.09	Male – Female	10.86 (4.91, 16.81)	<0.001
	Female	28	56.23			
Profession	Designer	28	58.04	Designer – Non-designer	-7.23 (-13.50, -0.96)	0.024
	Non-designer	28	65.27			
Story	A. Train	56	56.23	Train – Storm	-12.54 (-29.72, 4.65)	0.561
	B. Storm	56	68.77	Train – Water	-7.30 (-24.49, 9.89)	1.000
	C. Water	56	63.54	Train – Mantis	-6.82 (-24.01, 10.37)	1.000
	D. Mantis	56	63.05	Train – Ice	-0.48 (-17.67, 16.71)	1.000
	E. Ice	56	56.71	Train – Foot Solider	-1.86 (-19.05, 15.33)	1.000
	F. Foot Solider	56	58.09	Train – Promise	-8.98 (-26.17, 8.21)	1.000
	G. Promise	56	65.21	Storm – Water	5.23 (-11.96, 22.42)	1.000
				Storm – Mantis	5.71 (-11.47, 22.90)	1.000
				Storm – Ice	12.05 (-5.14, 29.24)	0.696
				Storm – Foot Solider	10.68 (-6.51, 27.87)	1.000
				Storm – Promise	3.55 (-13.64, 20.74)	1.000
				Water – Mantis	0.48 (-16.71, 17.67)	1.000
				Water – Ice	6.82 (-10.37, 24.01)	1.000
				Water – Foot Solider	5.45 (-11.74, 22.64)	1.000
				Water – Promise	-1.68 (-18.87, 15.51)	1.000
				Mantis – Ice	6.34 (-10.85, 23.53)	1.000
	Mantis – Foot Solider	4.96 (-12.22, 22.15)	1.000			
	Mantis – Promise	-2.16 (-19.35, 15.03)	1.000			
	Ice – Foot Solider	-1.38 (-18.56, 15.81)	1.000			
Ice – Promise	-8.50 (-25.69, 8.69)	1.000				
Foot Solider – Promise	-7.12 (-24.31, 10.06)	1.000				
Intervention	I. Image (no sound)	56	34.36	Image (no sound) – Image (with sound)	-26.02 (-43.21, -8.83)	<0.001
	II. Image (with sound)	56	60.37	Image (no sound) – Slide (no sound)	-25.25 (-42.44, -8.06)	<0.001
	III. Slide (no sound)	56	59.61	Image (no sound) – Slide (with sound)	-35.52 (-52.71, -18.33)	<0.001
	IV. Slide (with sound)	56	69.88	Image (no sound) – Video (no sound)	-39.18 (-56.37, -21.99)	<0.001
	V. Video (no sound)	56	73.54	Image (no sound) – Video (with sound)	-42.63 (-59.81, -25.44)	<0.001
	VI. Video (with sound)	56	76.98	Image (no sound) – Sound only	-22.52 (-39.71, -5.33)	0.001
	VII. Sound only	56	56.87	Image (with sound) – Slide (no sound)	0.77 (-16.42, 17.96)	1.000
				Image (with sound) – Slide (with sound)	-9.50 (-26.69, 7.69)	1.000
				Image (with sound) – Video (no sound)	-13.16 (-30.35, 4.03)	0.420
				Image (with sound) – Video (with sound)	-16.61 (-33.80, 0.58)	0.070
				Image (with sound) – Sound only	3.50 (-13.69, 20.69)	1.000
				Slide (no sound) – Slide (with sound)	-10.27 (-27.46, 6.92)	1.000
				Slide (no sound) – Video (no sound)	-13.93 (-31.12, 3.26)	0.290
				Slide (no sound) – Video (with sound)	-17.38 (-34.56, -0.19)	0.045
				Slide (no sound) – Sound only	2.73 (-14.46, 19.92)	1.000
				Slide (with sound) – Video (no sound)	-3.66 (-20.85, 13.53)	1.000
	Slide (with sound) – Video (with sound)	-7.11 (-24.30, 10.08)	1.000			
Slide (with sound) – Sound only	13.00 (-4.19, 30.19)	0.453				
Video (no sound) – Video (with sound)	-3.45 (-20.64, 13.74)	1.000				
Video (no sound) – Sound only	16.66 (-0.53, 33.85)	0.068				
Video (with sound) – Sound only	20.11 (2.92, 37.30)	0.008				

* Bonferroni correction was applied for multiple comparison tests.

Table 3. The interventions within each story.

Stories	Interventions	Mean	Std. Deviation	N
A. Train	I. Image (no sound)	20.38	12.305	8
	II. Image (with sound)	61.62	19.871	8
	III. Slide (no sound)	37.88	39.011	8
	IV. Slide (with sound)	51.88	33.198	8
	V. Video (no sound)	68.88	40.069	8
	VI. Video (with sound)	96.75	27.249	8
	VII. Sound only	56.25	29.927	8
	Total	56.23	36.351	56
B. Storm	I. Image (no sound)	23.00	13.670	8
	II. Image (with sound)	68.75	45.301	8
	III. Slide (no sound)	83.75	43.859	8
	IV. Slide (with sound)	74.88	14.427	8
	V. Video (no sound)	95.50	32.107	8
	VI. Video (with sound)	72.50	13.680	8
	VII. Sound only	63.00	21.119	8
	Total	68.77	34.952	56
C. Water	I. Image (no sound)	31.13	22.216	8
	II. Image (with sound)	53.13	26.557	8
	III. Slide (no sound)	58.25	44.657	8
	IV. Slide (with sound)	87.13	34.626	8
	V. Video (no sound)	96.37	38.034	8
	VI. Video (with sound)	77.25	5.548	8
	VII. Sound only	41.50	26.753	8
	Total	63.54	36.695	56
D. Mantis	I. Image (no sound)	62.00	63.552	8
	II. Image (with sound)	52.13	24.151	8
	III. Slide (no sound)	48.88	33.947	8
	IV. Slide (with sound)	76.88	3.758	8
	V. Video (no sound)	65.50	22.431	8
	VI. Video (with sound)	70.63	13.627	8
	VII. Sound only	65.38	27.918	8
	Total	63.05	31.752	56
E. Ice	I. Image (no sound)	33.50	25.529	8
	II. Image (with sound)	42.00	22.590	8
	III. Slide (no sound)	66.13	32.743	8
	IV. Slide (with sound)	69.88	34.345	8
	V. Video (no sound)	60.25	24.881	8
	VI. Video (with sound)	66.75	21.933	8
	VII. Sound only	58.50	30.280	8
	Total	56.71	29.259	56
F. Foot Solider	I. Image (no sound)	41.63	20.798	8
	II. Image (with sound)	66.00	33.437	8
	III. Slide (no sound)	45.88	34.799	8
	IV. Slide (with sound)	57.38	22.481	8
	V. Video (no sound)	65.88	23.308	8
	VI. Video (with sound)	72.00	18.951	8
	VII. Sound only	57.88	18.380	8
	Total	58.09	26.094	56
G. Promise	I. Image (no sound)	28.88	23.805	8
	II. Image (with sound)	79.00	45.450	8
	III. Slide (no sound)	76.50	39.265	8
	IV. Slide (with sound)	71.13	45.952	8
	V. Video (no sound)	62.38	24.553	8
	VI. Video (with sound)	83.00	36.249	8
	VII. Sound only	55.63	35.713	8
	Total	65.21	38.861	56
Total	I. Image (no sound)	34.36	31.655	56
	II. Image (with sound)	60.38	32.829	56
	III. Slide (no sound)	59.61	39.641	56
	IV. Slide (with sound)	69.88	30.471	56
	V. Video (no sound)	73.54	31.926	56
	VI. Video (with sound)	76.98	22.579	56
	VII. Sound only	56.88	27.097	56
	Total	61.66	33.718	392

Table 4. The difference ranking scores among five applications based on seven criteria.

Variable	Application	N	Median	(LQ, UQ)†	Difference	Difference in Medians	P value*
Criteria 1	i. Poster	56	3.0	(2.0, 3.0)	Poster – Contact sheet	1.5	0.418
	ii. Contact sheet	56	1.5	(1.0, 4.0)	Poster – Book	0.0	1.000
	iii. Book	56	3.0	(2.0, 3.5)	Poster – Flipbook	-2.0	<0.001
	iv. Flipbook	56	5.0	(4.0, 5.0)	Poster – CD	-1.0	0.129
	v. CD	56	4.0	(2.0, 5.0)	Contact sheet – Book	-1.5	0.274
					Contact sheet – Flipbook	-3.5	<0.001
					Contact sheet – CD	-2.5	0.016
					Book – Flipbook	-2.0	0.001
					Book – CD	-1.0	0.629
					Flipbook – CD	1.0	0.098
Criteria 2	i. Poster	56	2.0	(1.0, 2.0)	Poster – Contact sheet	1.0	0.446
	ii. Contact sheet	56	1.0	(1.0, 2.0)	Poster – Book	-1.0	0.004
	iii. Book	56	3.0	(3.0, 3.0)	Poster – Flipbook	-2.5	<0.001
	iv. Flipbook	56	4.5	(4.0, 5.0)	Poster – CD	-2.0	<0.001
	v. CD	56	4.0	(4.0, 5.0)	Contact sheet – Book	-2.0	<0.001
					Contact sheet – Flipbook	-3.5	<0.001
					Contact sheet – CD	-3.0	<0.001
					Book – Flipbook	-1.5	<0.001
					Book – CD	-1.0	<0.001
					Flipbook – CD	0.5	1.000
Criteria 3	i. Poster	56	3.0	(2.0, 4.0)	Poster – Contact sheet	-0.5	1.000
	ii. Contact sheet	56	3.5	(2.0, 4.0)	Poster – Book	1.0	0.981
	iii. Book	56	2.0	(2.0, 3.0)	Poster – Flipbook	-2.0	<0.001
	iv. Flipbook	56	5.0	(4.0, 5.0)	Poster – CD	2.0	0.023
	v. CD	56	1.0	(1.0, 3.0)	Contact sheet – Book	1.5	0.374
					Contact sheet – Flipbook	-1.5	<0.001
					Contact sheet – CD	2.5	0.006
					Book – Flipbook	-3.0	<0.001
					Book – CD	1.0	0.160
					Flipbook – CD	4.0	<0.001
Criteria 4	i. Poster	56	3.0	(2.0, 4.0)	Poster – Contact sheet	2.0	<0.001
	ii. Contact sheet	56	1.0	(1.0, 2.0)	Poster – Book	0.0	1.000
	iii. Book	56	3.0	(2.0, 4.0)	Poster – Flipbook	-1.0	0.457
	iv. Flipbook	56	4.0	(3.0, 5.0)	Poster – CD	-1.0	1.000
	v. CD	56	4.0	(2.0, 4.5)	Contact sheet – Book	-2.0	<0.001
					Contact sheet – Flipbook	-3.0	<0.001
					Contact sheet – CD	-3.0	<0.001
					Book – Flipbook	-1.0	0.336
					Book – CD	-1.0	1.000
					Flipbook – CD	0.0	1.000
Criteria 5	i. Poster	56	4.0	(3.0, 5.0)	Poster – Contact sheet	0.0	1.000
	ii. Contact sheet	56	4.0	(3.0, 5.0)	Poster – Book	0.0	1.000
	iii. Book	56	4.0	(3.0, 5.0)	Poster – Flipbook	3.0	<0.001
	iv. Flipbook	56	1.0	(1.0, 1.0)	Poster – CD	2.0	0.003
	v. CD	56	2.0	(2.0, 4.0)	Contact sheet – Book	0.0	1.000
					Contact sheet – Flipbook	3.0	<0.001
					Contact sheet – CD	2.0	0.021
					Book – Flipbook	3.0	<0.001
					Book – CD	2.0	<0.001
					Flipbook – CD	-1.0	<0.001
Criteria 6	i. Poster	56	3.0	(2.0, 3.0)	Poster – Contact sheet	1.0	1.000
	ii. Contact sheet	56	2.0	(1.0, 4.0)	Poster – Book	0.0	0.806
	iii. Book	56	3.0	(2.0, 4.0)	Poster – Flipbook	-1.0	<0.001
	iv. Flipbook	56	4.0	(3.0, 5.0)	Poster – CD	0.0	1.000
	v. CD	56	3.0	(1.0, 4.5)	Contact sheet – Book	-1.0	1.000
					Contact sheet – Flipbook	-2.0	<0.001
					Contact sheet – CD	-1.0	1.000
					Book – Flipbook	-1.0	0.037
					Book – CD	0.0	1.000
					Flipbook – CD	1.0	0.013
Criteria 7	i. Poster	56	2.0	(1.0, 3.0)	Poster – Contact sheet	-0.5	0.002
	ii. Contact sheet	56	2.5	(2.0, 4.0)	Poster – Book	-1.0	<0.001
	iii. Book	56	3.0	(3.0, 4.0)	Poster – Flipbook	0.0	0.871
	iv. Flipbook	56	2.0	(1.0, 3.5)	Poster – CD	-3.0	<0.001
	v. CD	56	5.0	(4.0, 5.0)	Contact sheet – Book	-0.5	1.000
					Contact sheet – Flipbook	0.5	1.000
					Contact sheet – CD	-2.5	<0.001
					Book – Flipbook	1.0	0.032
					Book – CD	-2.0	<0.001
					Flipbook – CD	-3.0	<0.001

† LQ = Lower quartile; UQ = Upper quartile.

* Bonferroni correction was applied for multiple comparison tests.

APPENDIX B

FIGURES



Figure 1. A reference point in space.

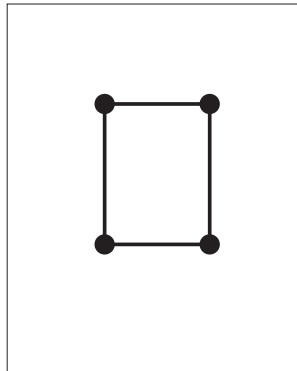


Figure 2. Four dots are connected into a two-dimensional plane.

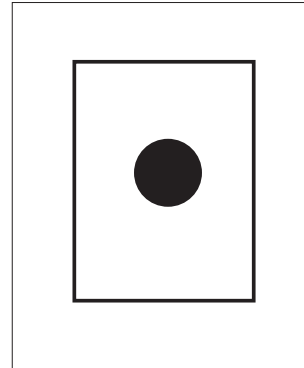


Figure 3. The square offers an enclosed frame that divides the inner and outer spaces. The dot becomes the entry point to the composition as the frame activates the space around the dot.

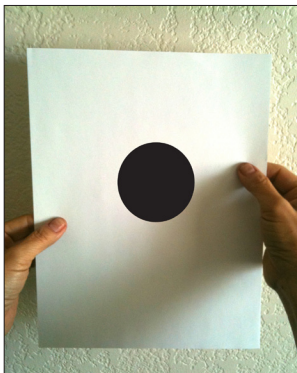


Figure 4. The square/plane becomes the workable format for design in the third dimension.

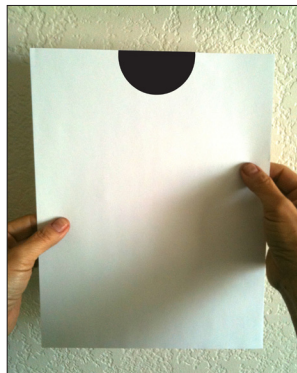


Figure 5. The frame limits our viewing and creativity.

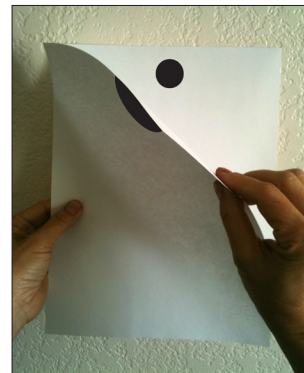


Figure 6. By turning the page over, we are unfolding the story with action, pace and rhythm in time-based form.

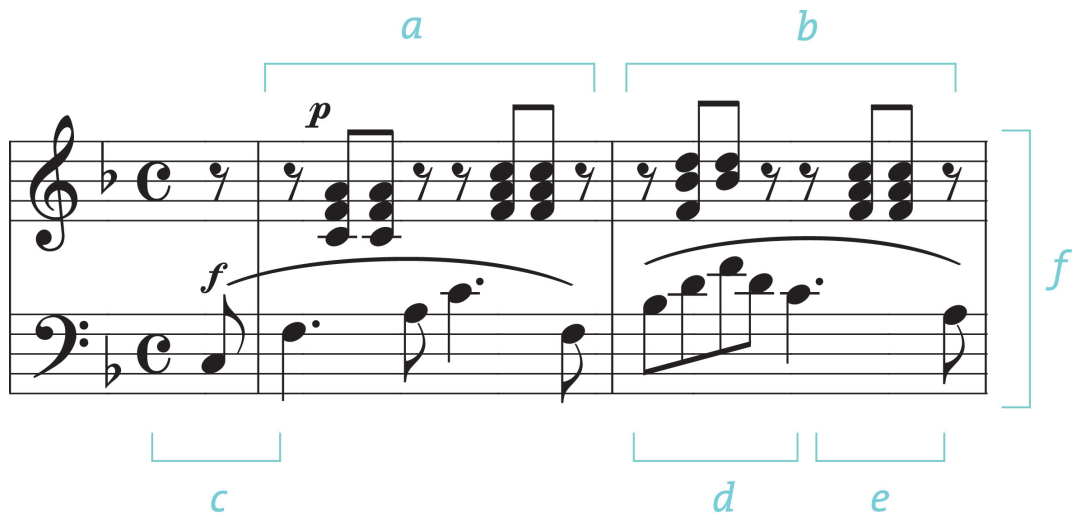


Figure 7. Joyous Farmer by Robert Schuman (1810-1856).

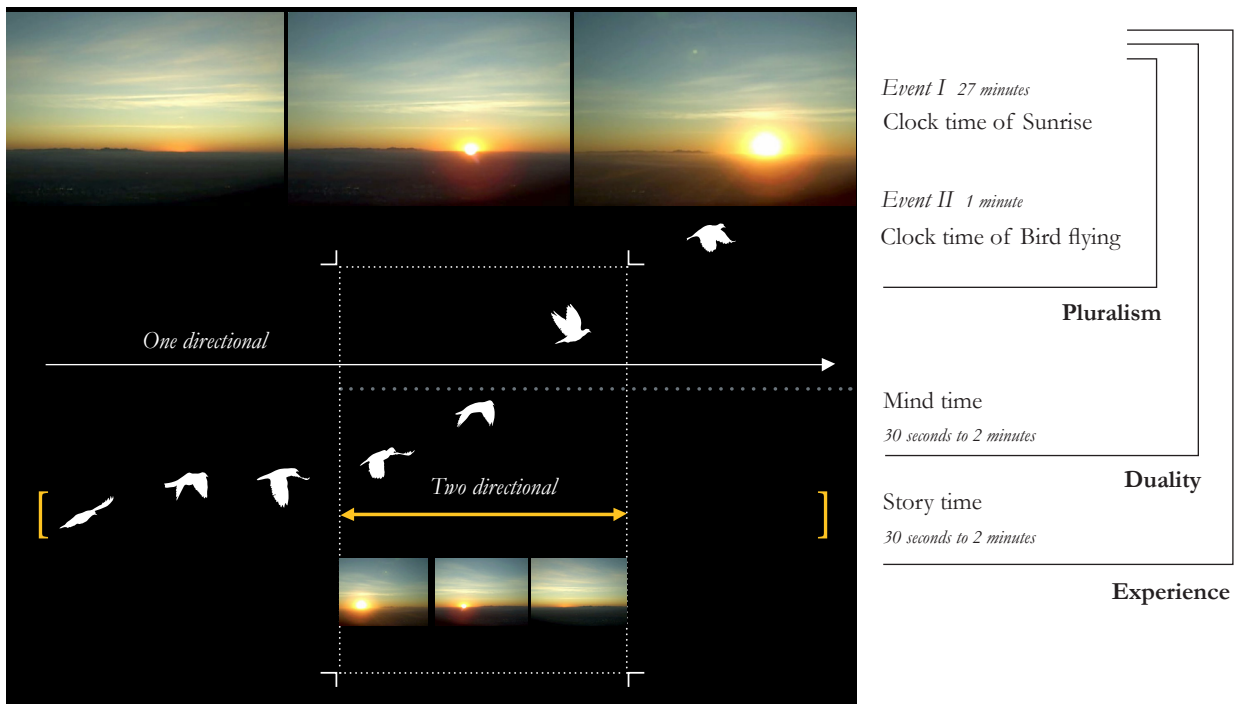


Figure 8. Duality, pluralism and experience in time.



Figure 9. A photo captures a moment of the bird in the form of a two-dimensional frame.

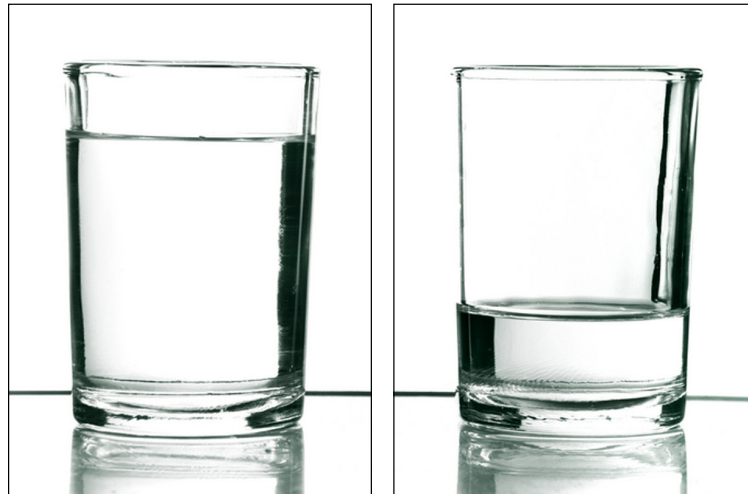


Figure 10. The contrast between the two glasses bears a minimum causal relationship in narrative.



Figure 11. The two identical photos do not reflect the passage of time.

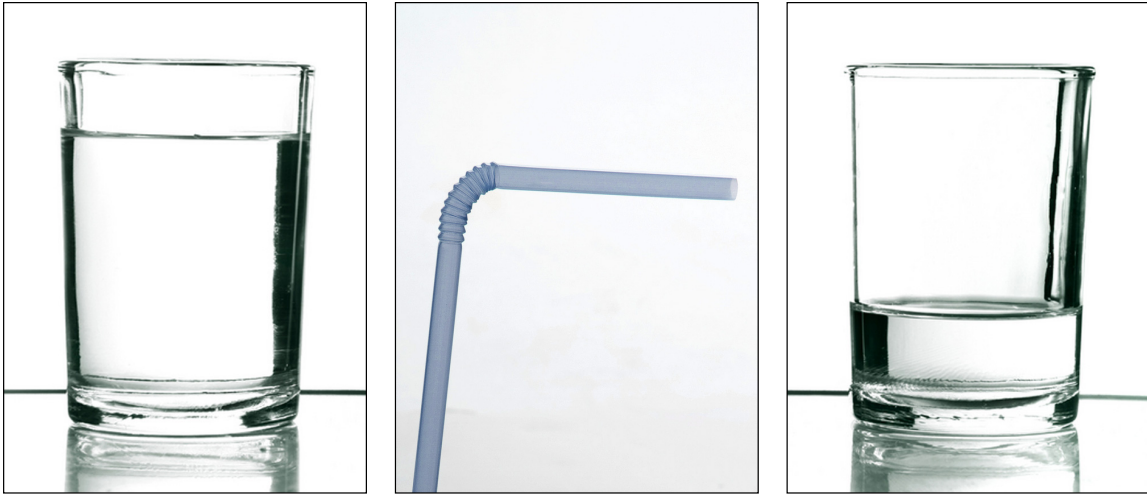


Figure 12. A photo of a straw is inserted as the middle to elaborate more details in change.

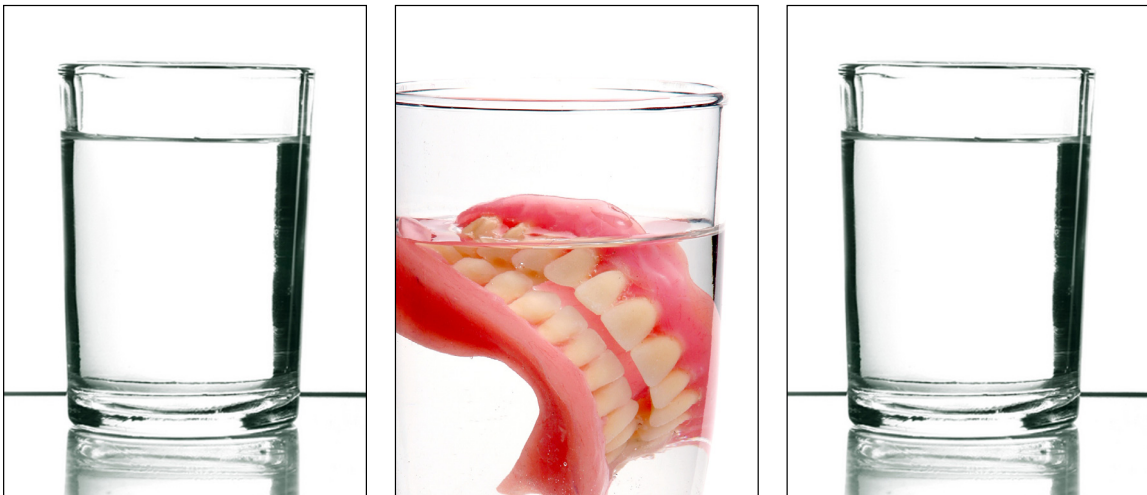


Figure 13. A photo of dentures in the glass forces a new interpretation in “redemption” and this impact forever changes our initial impression of the “pollution” in a story structure.

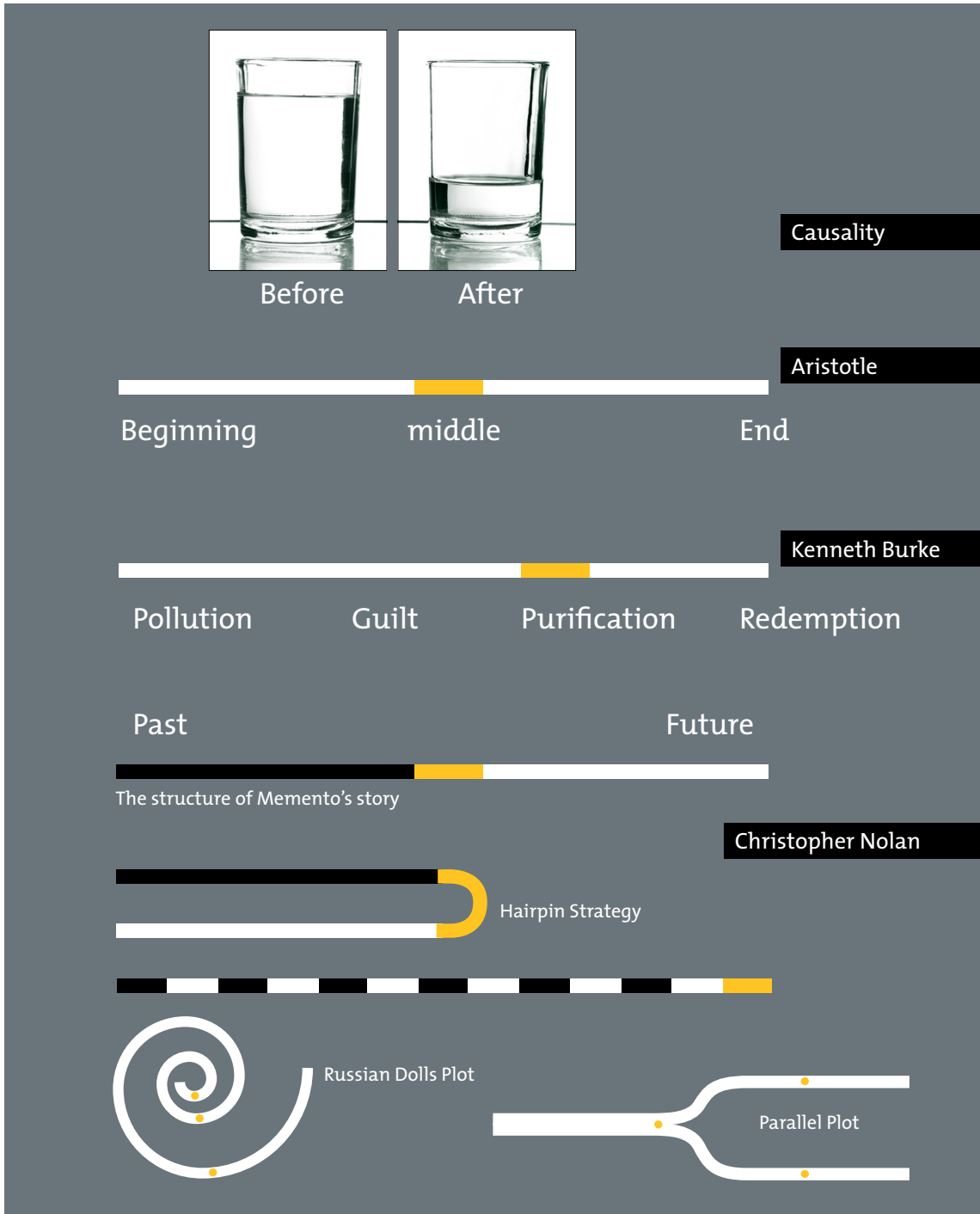


Figure 14. Narrative structure visualization.

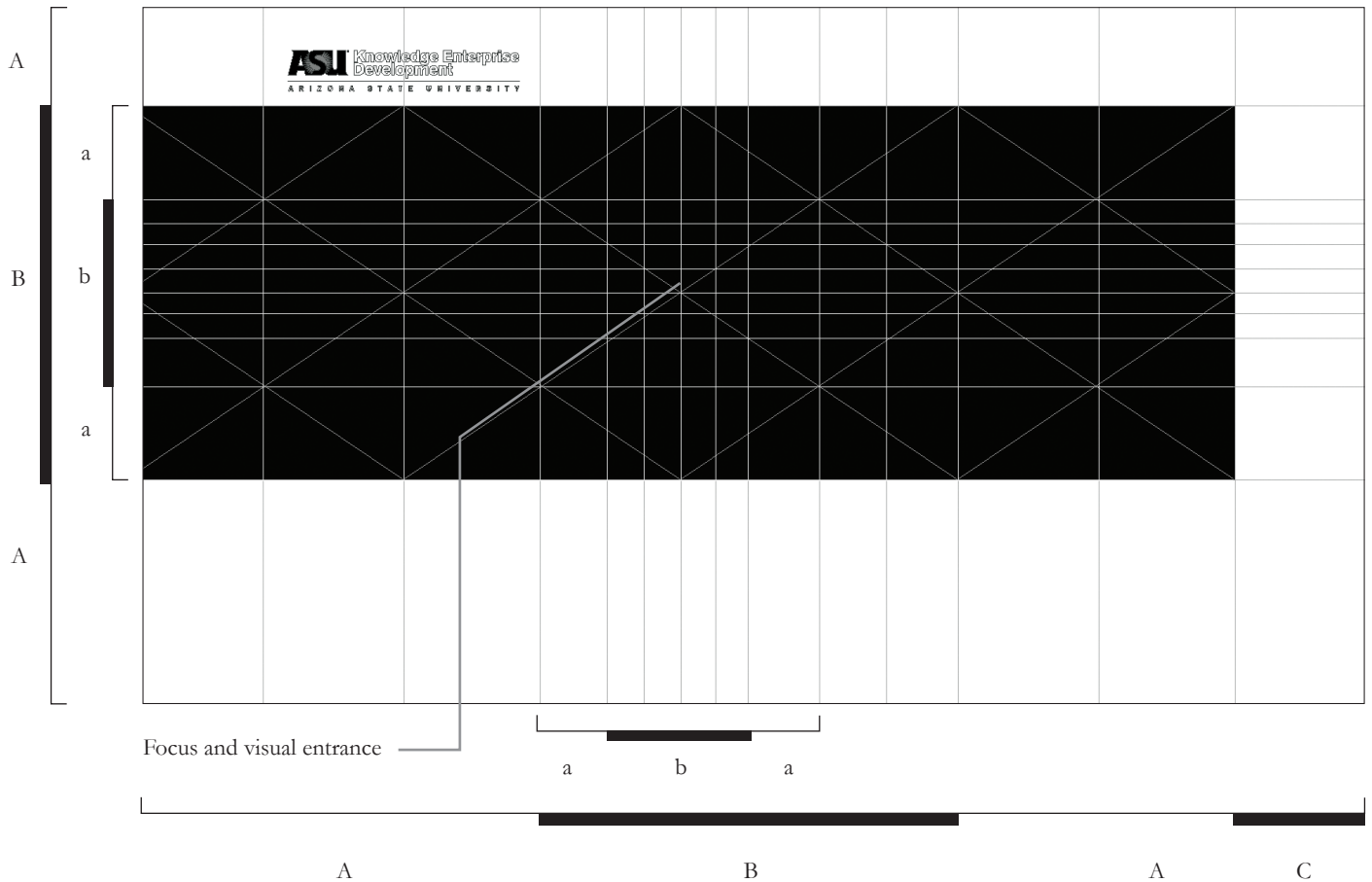


Figure 15. The consistency in columnar print layout (vertical content) and rows (horizontal content) are reinforced by the ABA music structure. The “A” in “ABA” can be subdivided with a secondary “aba.”

The weight of a larger unit becomes the “dominance of majority” and the highlight of the smaller unit becomes the “emphasis of minority.”

Top: Grid system with ABA structure

Middle: Design elements in grid structure

Bottom: Design elements with the grid turned off



Figure 16. The piano image.

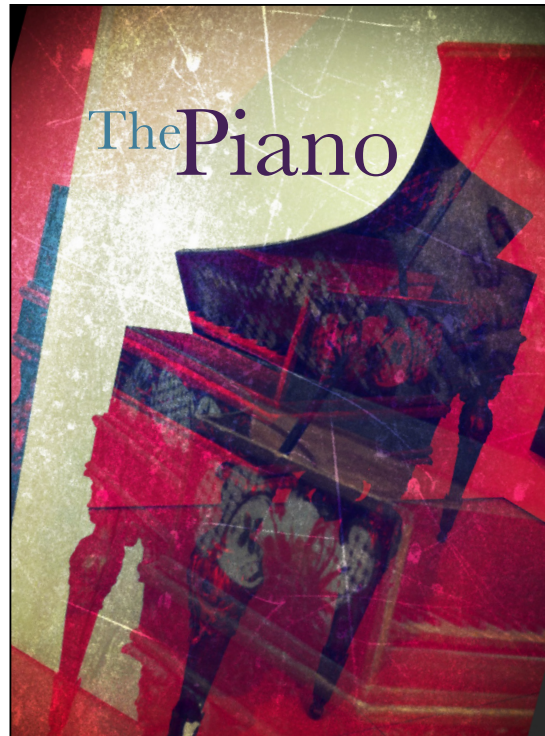


Figure 17. The piano with rotation and layering effect.



Figure 18. A comparison of images with and without compartments. The image on the right projects more movement than the one on left.



Figure 19. Three different CD cover design with the same content.



Figure 20. The hotel images with and without the zooming effect.

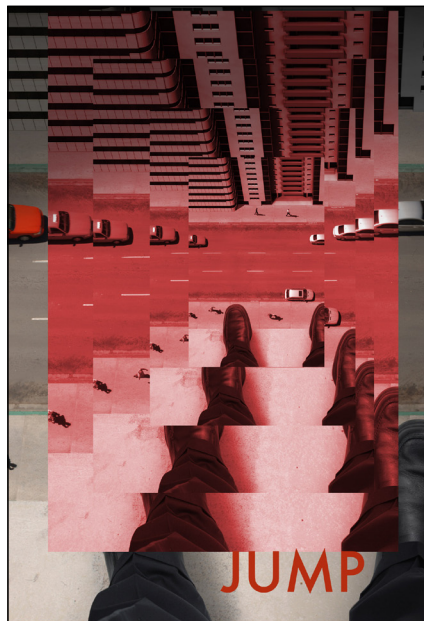


Figure 21. Book cover design with the zooming effect within a single compartment.



Figure 22. The Thaumatrope.



Figure 22. Unique Forms of Continuity in Space
by Umberto Boccioni (Rear view).

Tate modern



Figure 24. Poster design with “Thaumatroptic overlap” and “Stroboscopic progression.”

Patrick Cheung

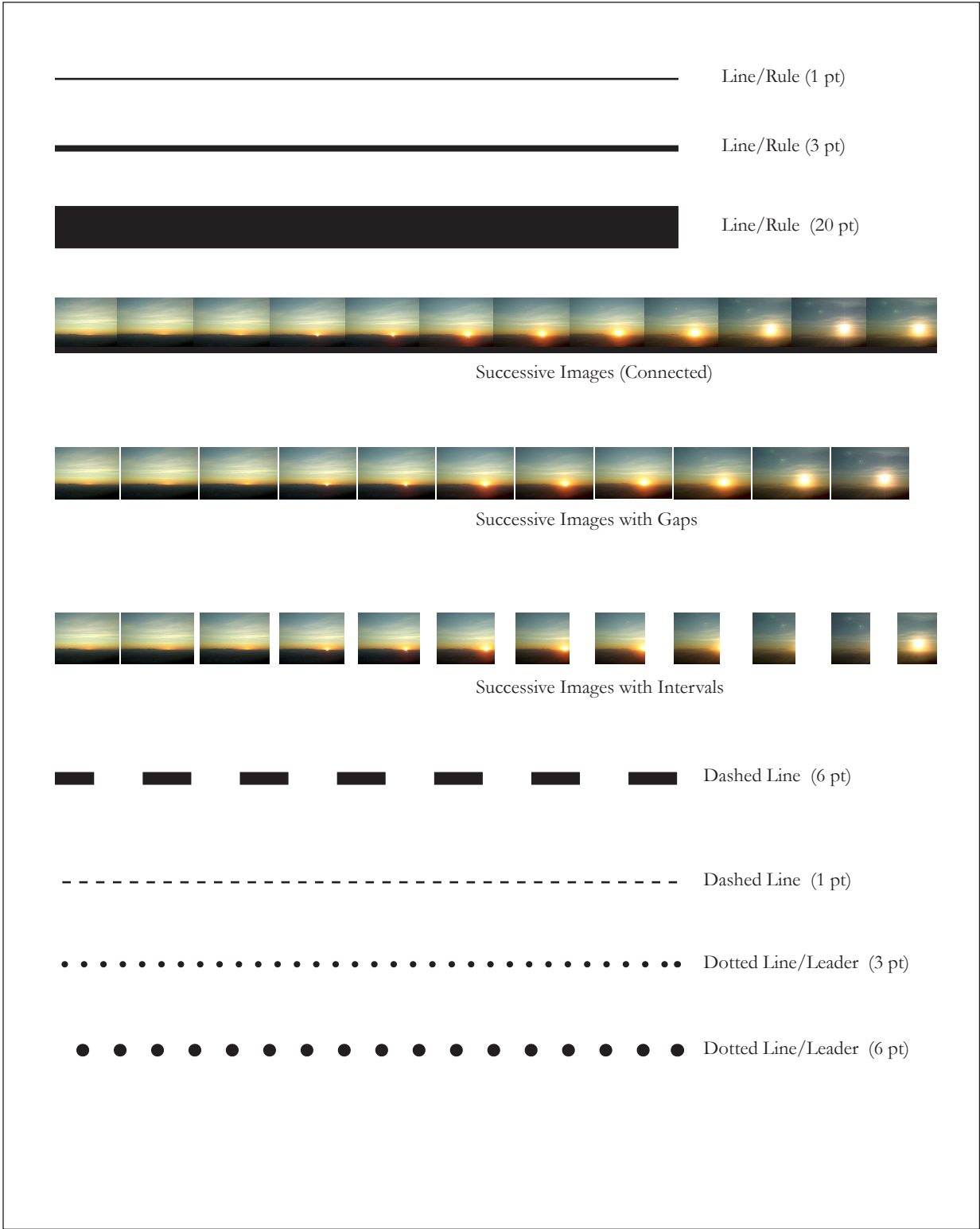


Figure 25. Lines and Implied Motion Comparison.

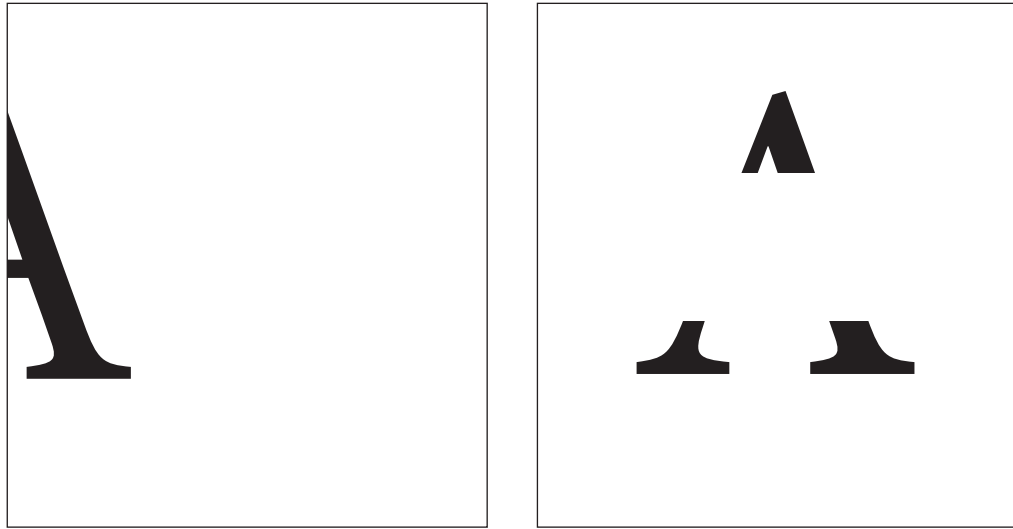


Figure 26. 1/3 of an A is presented in two different compositions.

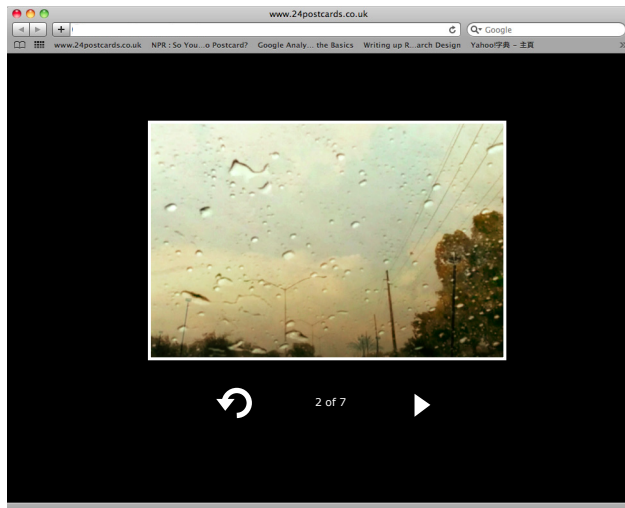


Figure 27. The interface of experiment one.



Figure 28. Video descriptions for experiment one

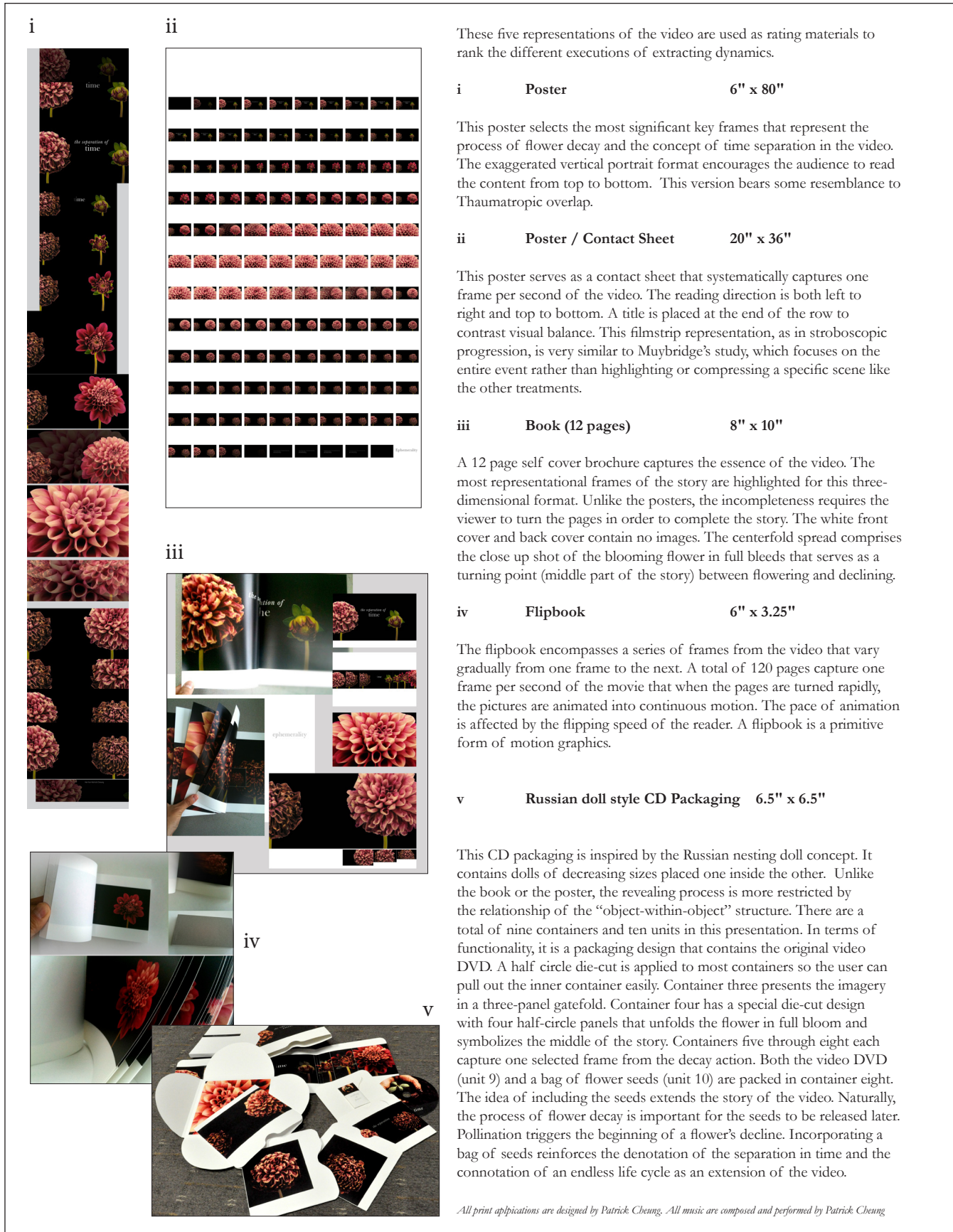
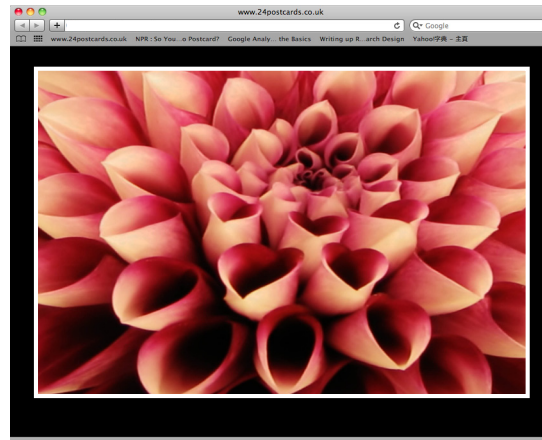


Figure 29. Descriptions for five print applications in experiment two.



A two-minute video clip shows the growth and decay of two flowers in a time lapse. Two flowers are presented next to each other. After the movie title “separation in time” is projected, the flower on the left starts to rot away. Once the flower to the left has completely decayed, the flower bud to the right starts blooming. The piano music synchronizes the visual transitions between the medium shot and the close-up shot of the modified lifespan of flowers. Eventually the right flower finishes decaying and the dead flower on the left unnaturally re-blooms as the video fades to black at the end. The beginning and middle parts of the video convince us of the natural time lapse sequence of the life cycle, while the end violates our mindset by bringing life back to the decayed flower from the present to the past. It symbolizes the power of using time-based media to control the impossible forming event in reality. As the rate of decay and growing are controlled in time, the sequence of “living” and “dying” becomes reversible for dramatic storytelling and interpretation.

Video are edited by Patrick Cheung. All music are composed and performed by Patrick Cheung



Video: The Ephemeral of Time 117 seconds
Format: 1280 x 720

Figure 30. Video descriptions for experiment two.

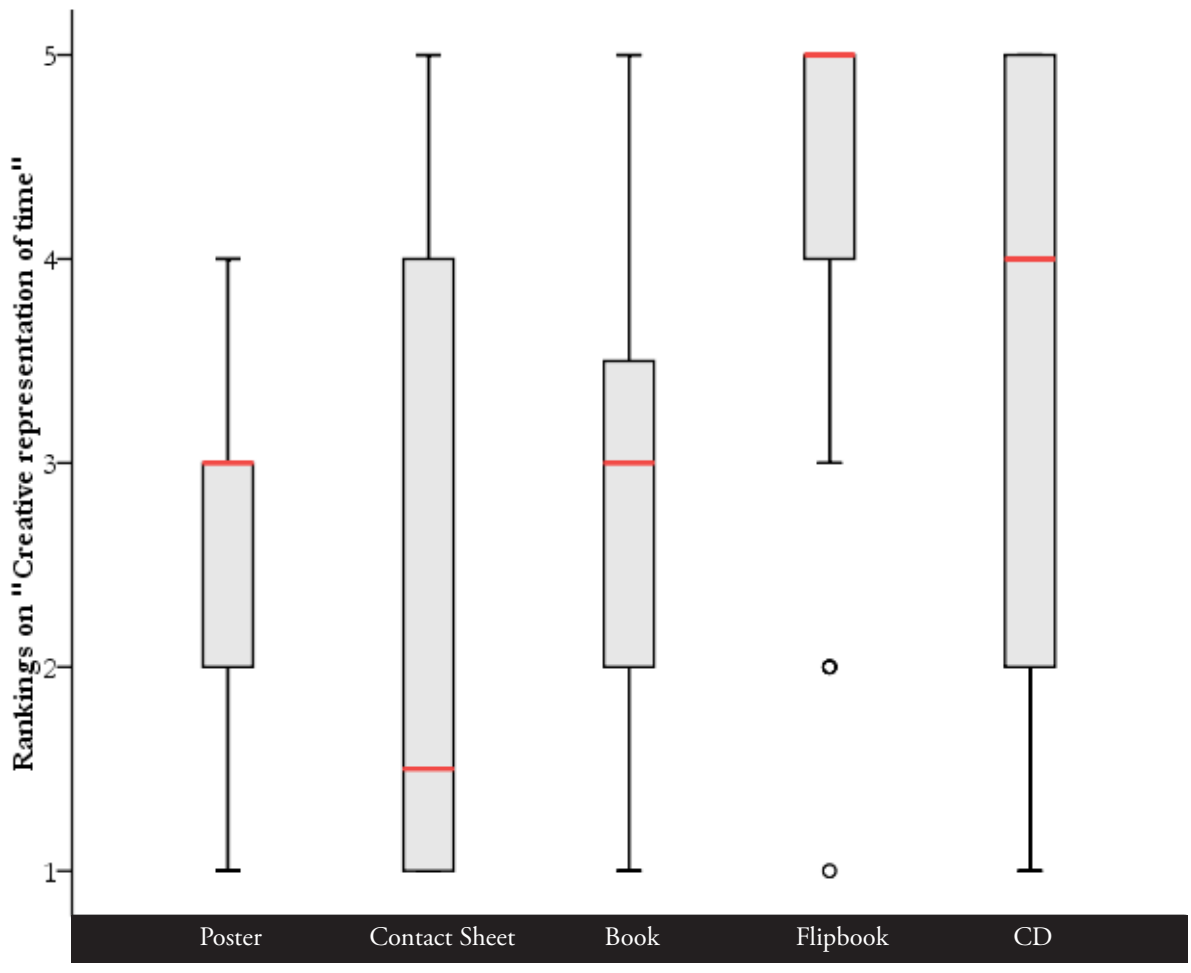


Figure 31. Creative representation of time.

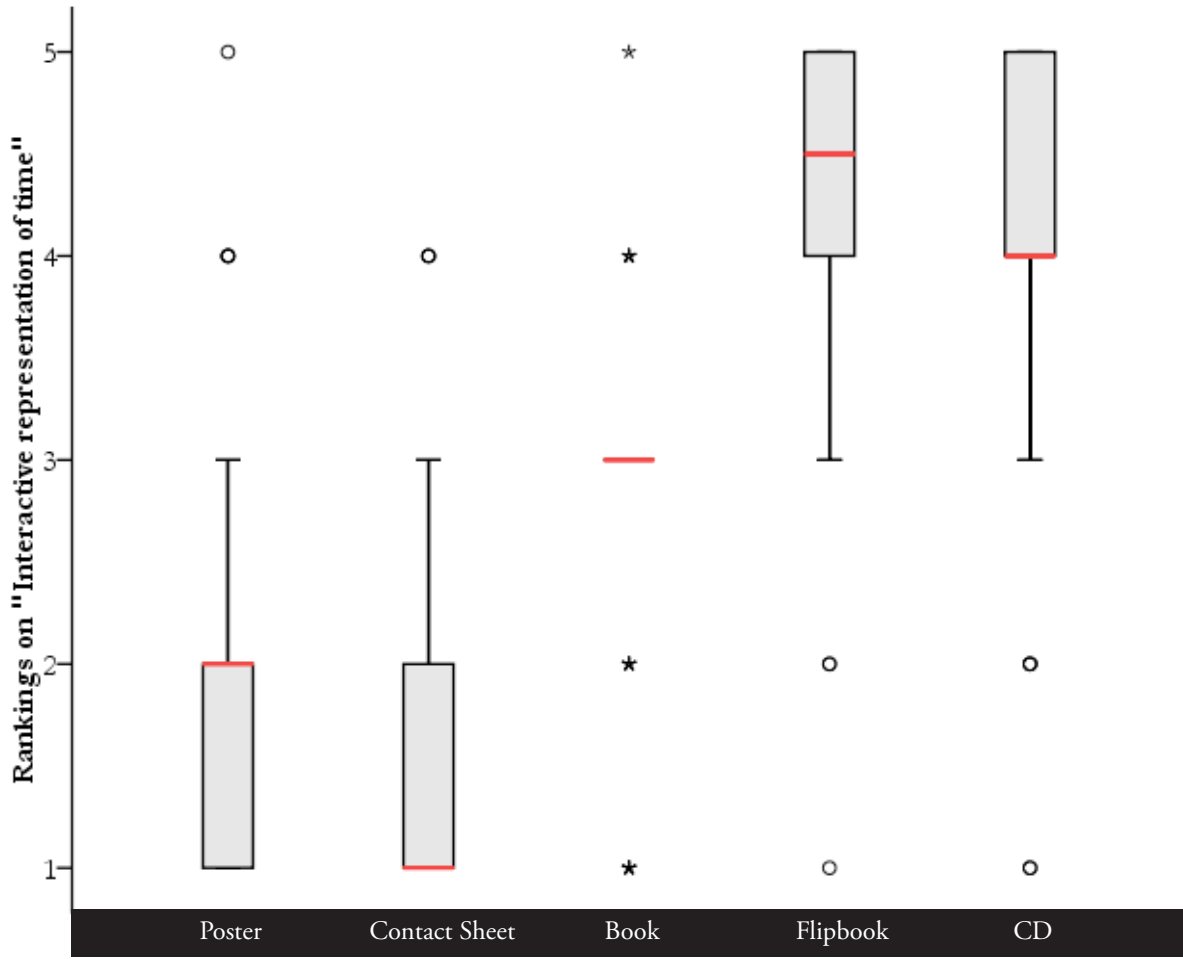


Figure 32. Interactive representation of time.

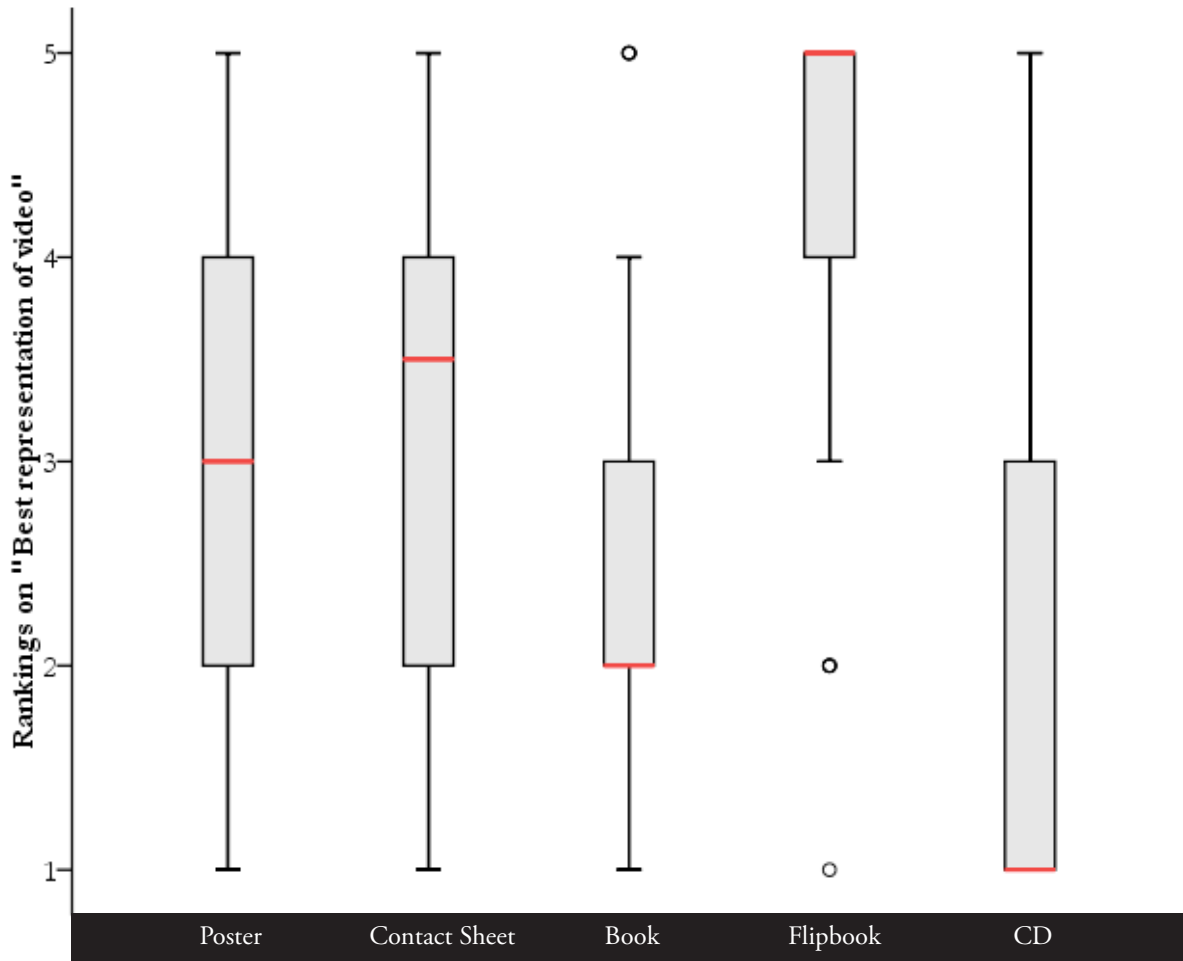


Figure 33. The best video representation.

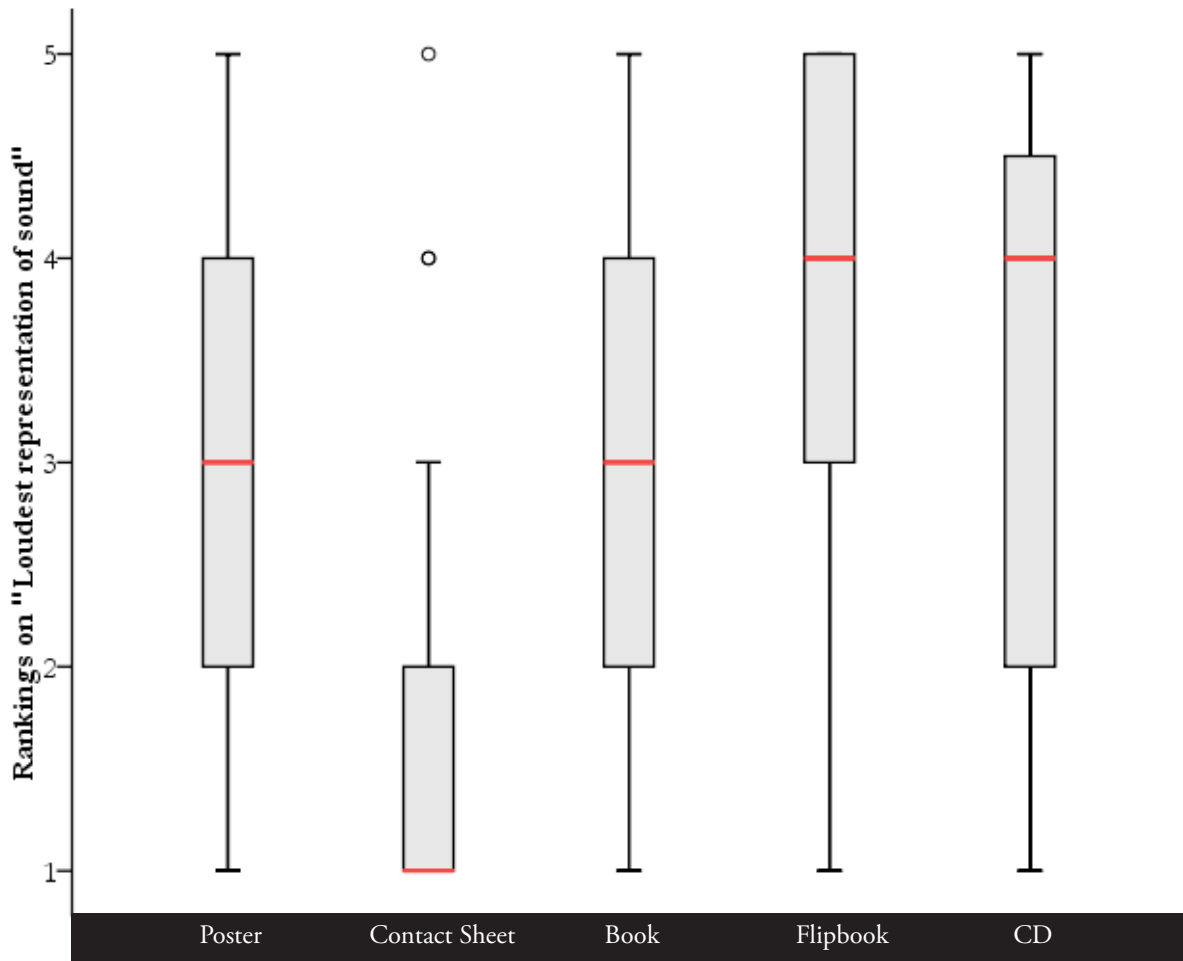


Figure 34. The loudest representation of sound

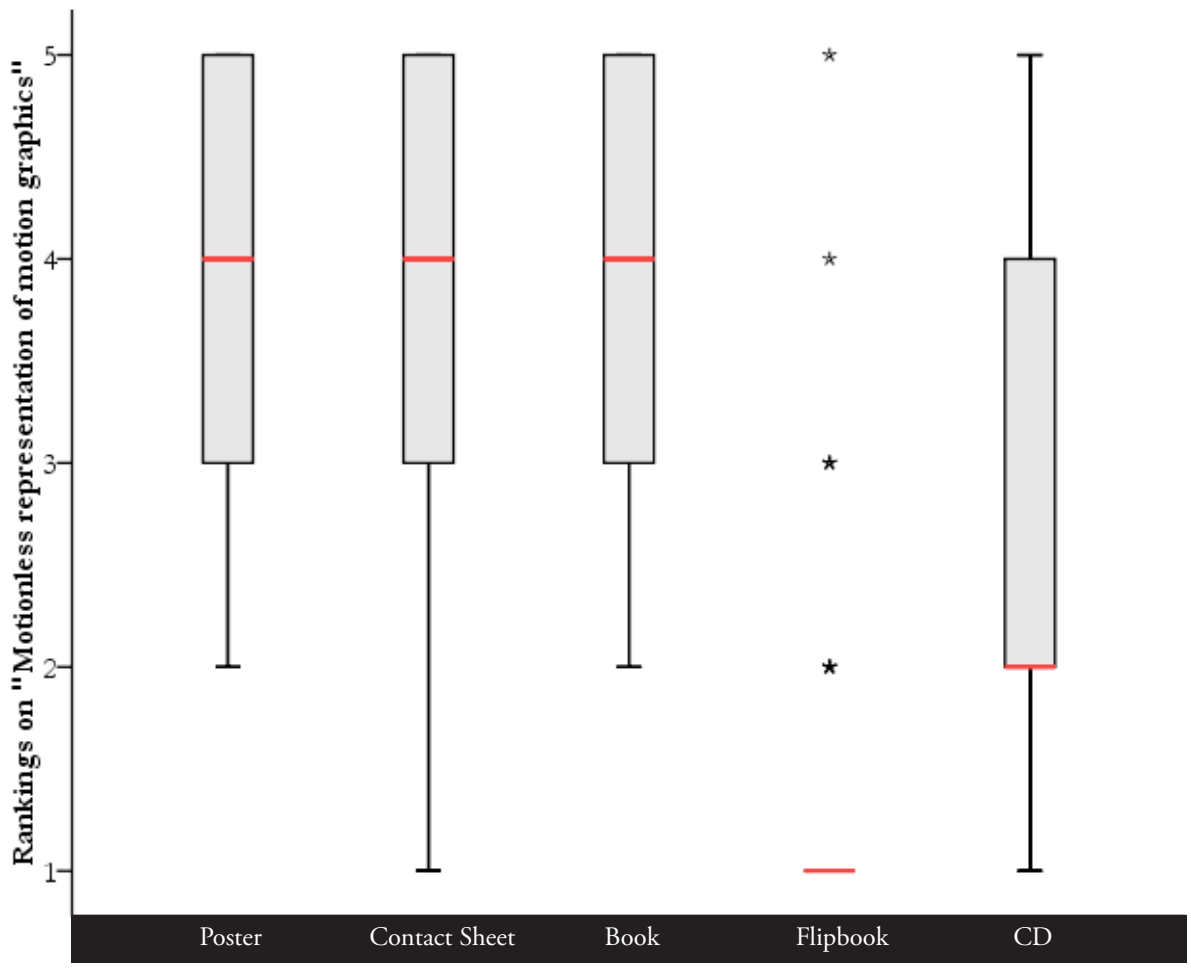


Figure 35. The motionless representation of video.

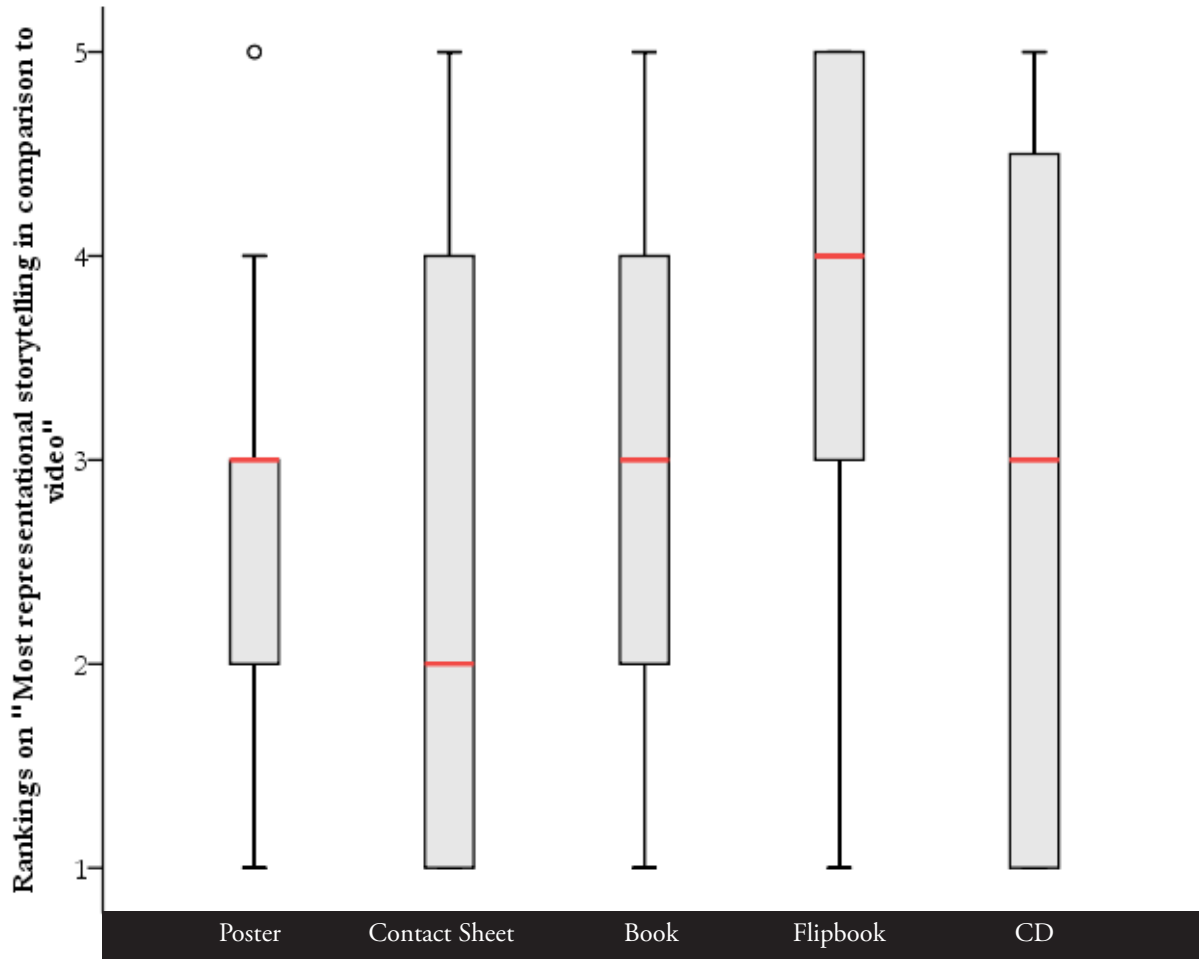


Figure 36. The most representational storytelling.

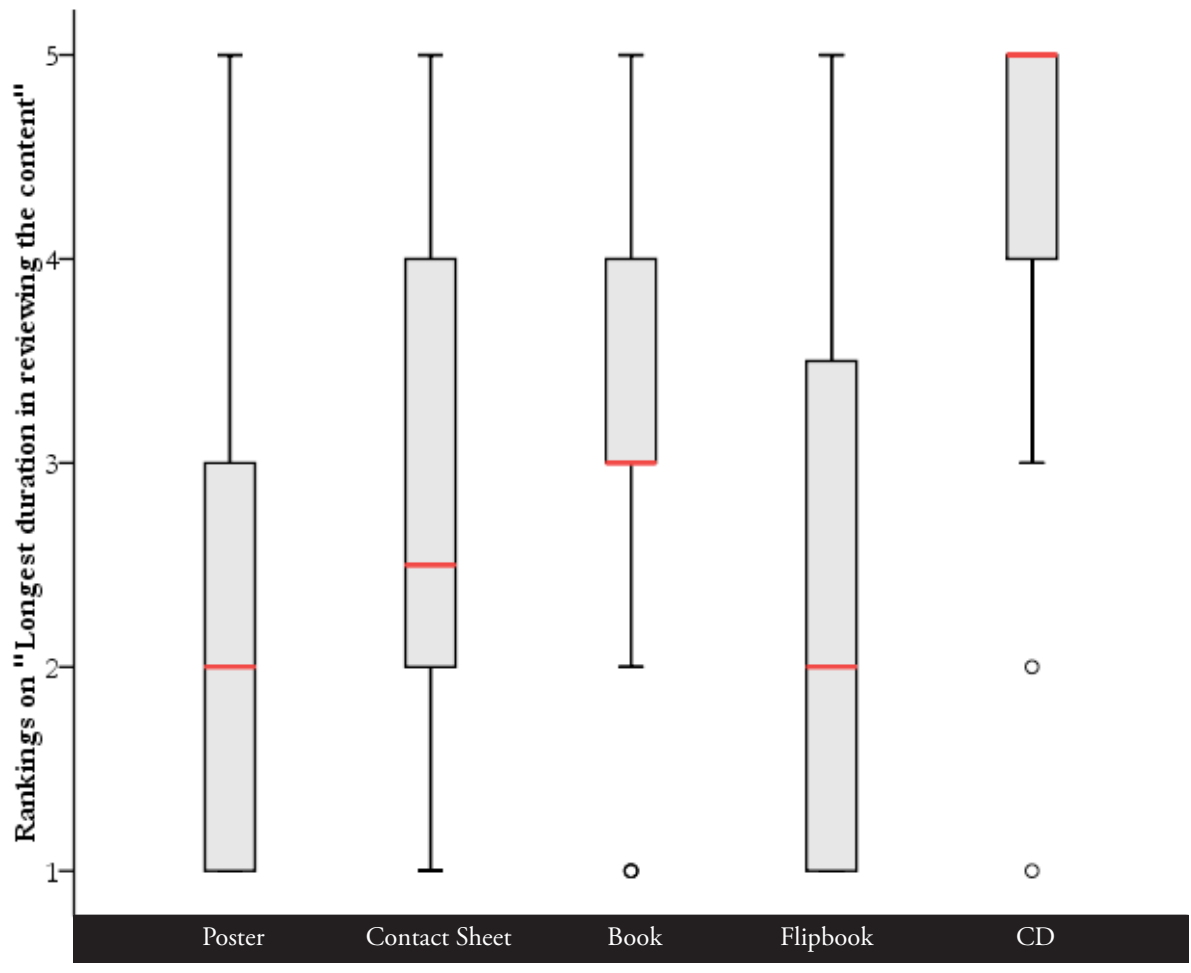


Figure 37. The longest duration in reviewing the content.

Representing Sight and Sound in Design Media: A Cyclical Time-based Model

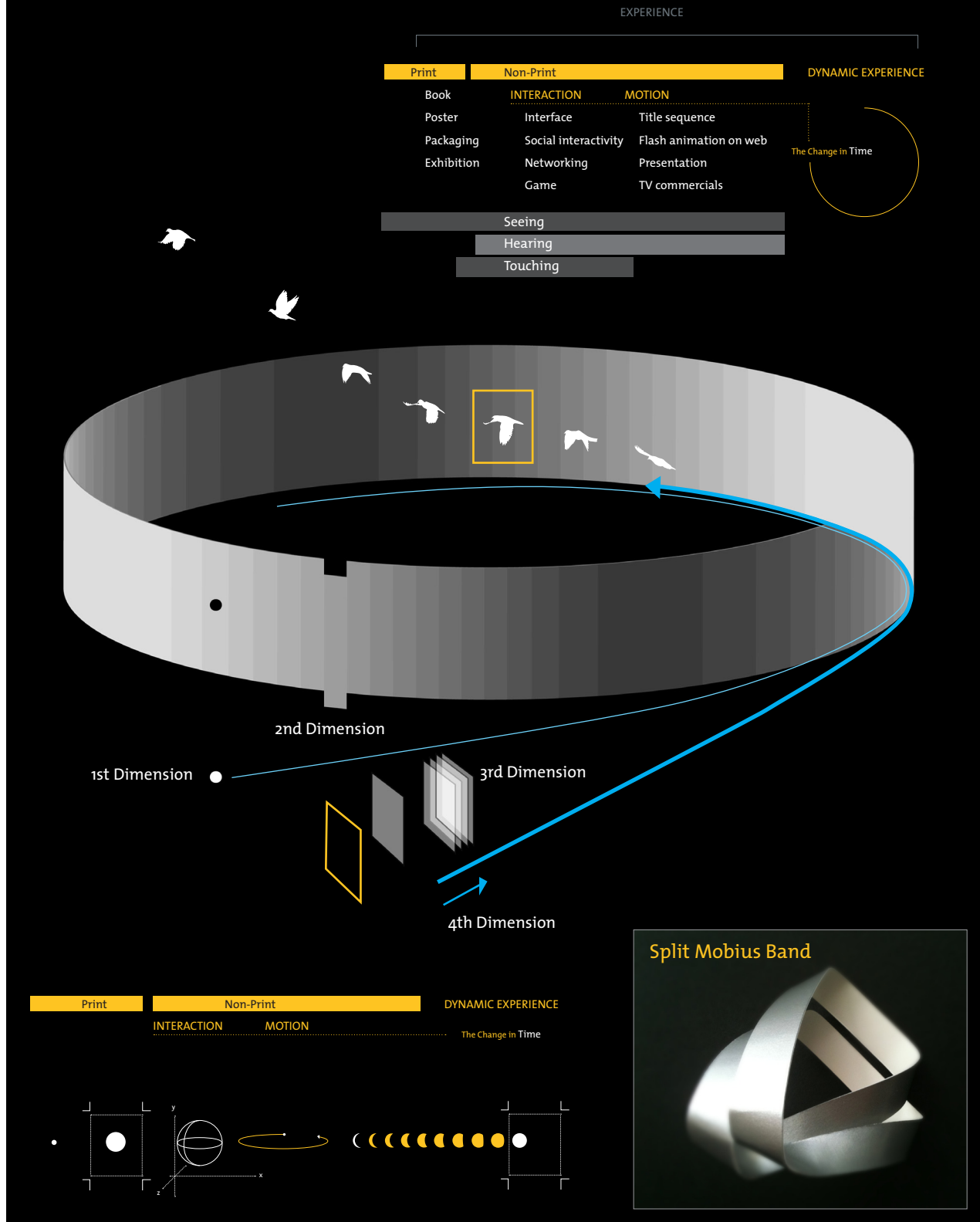
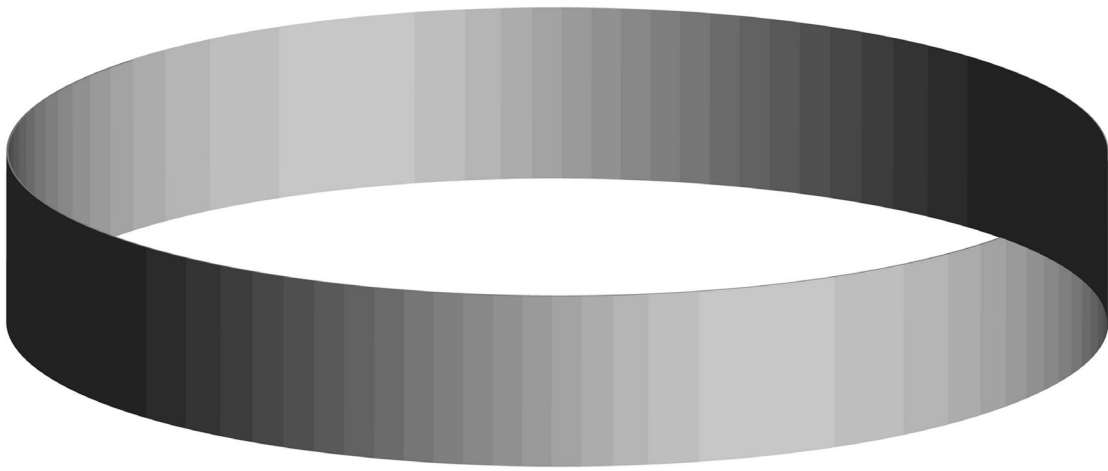
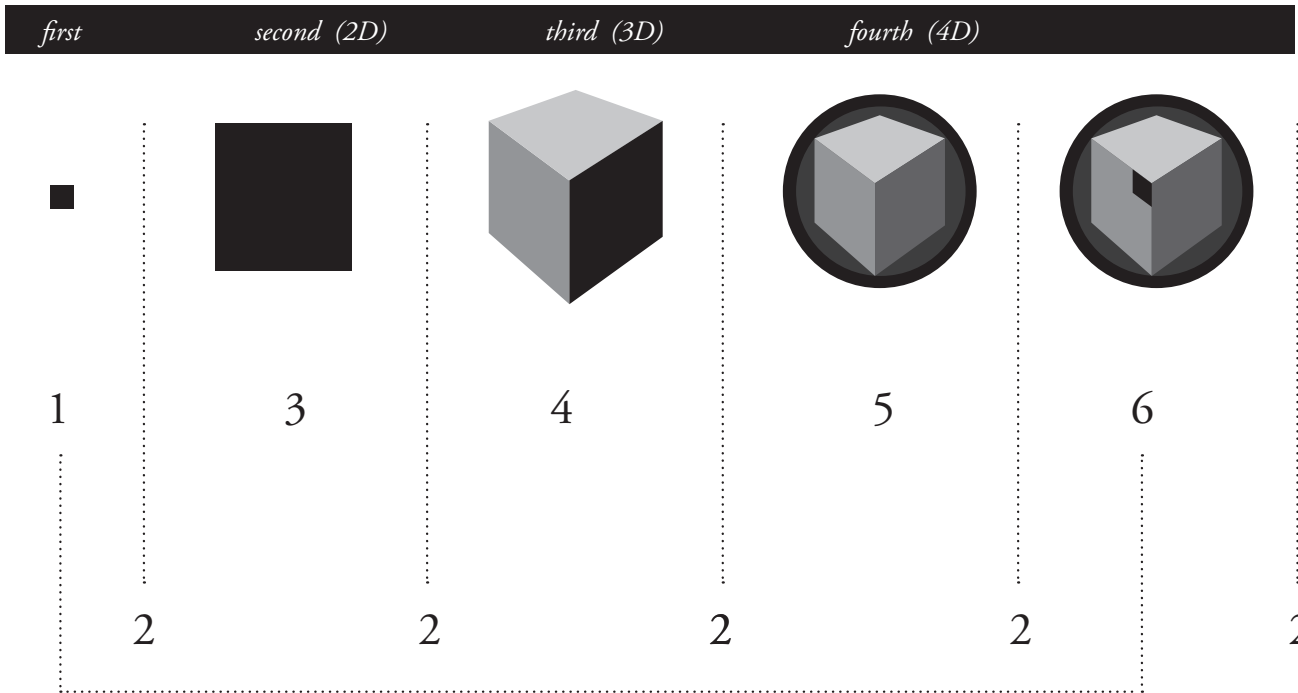


Figure 38. The cyclical model.



The Four Dimensions



The six steps in cyclical time-based model

- 1. Identification**
- 2. Transition**
- 3. Differentiation**
- 4. Time**
- 5. Story**
- 6. Re-Identification**

Figure 39. Six cyclical steps

ASU LightWorks

ARIZONA STATE UNIVERSITY

Light-Inspired Solutions

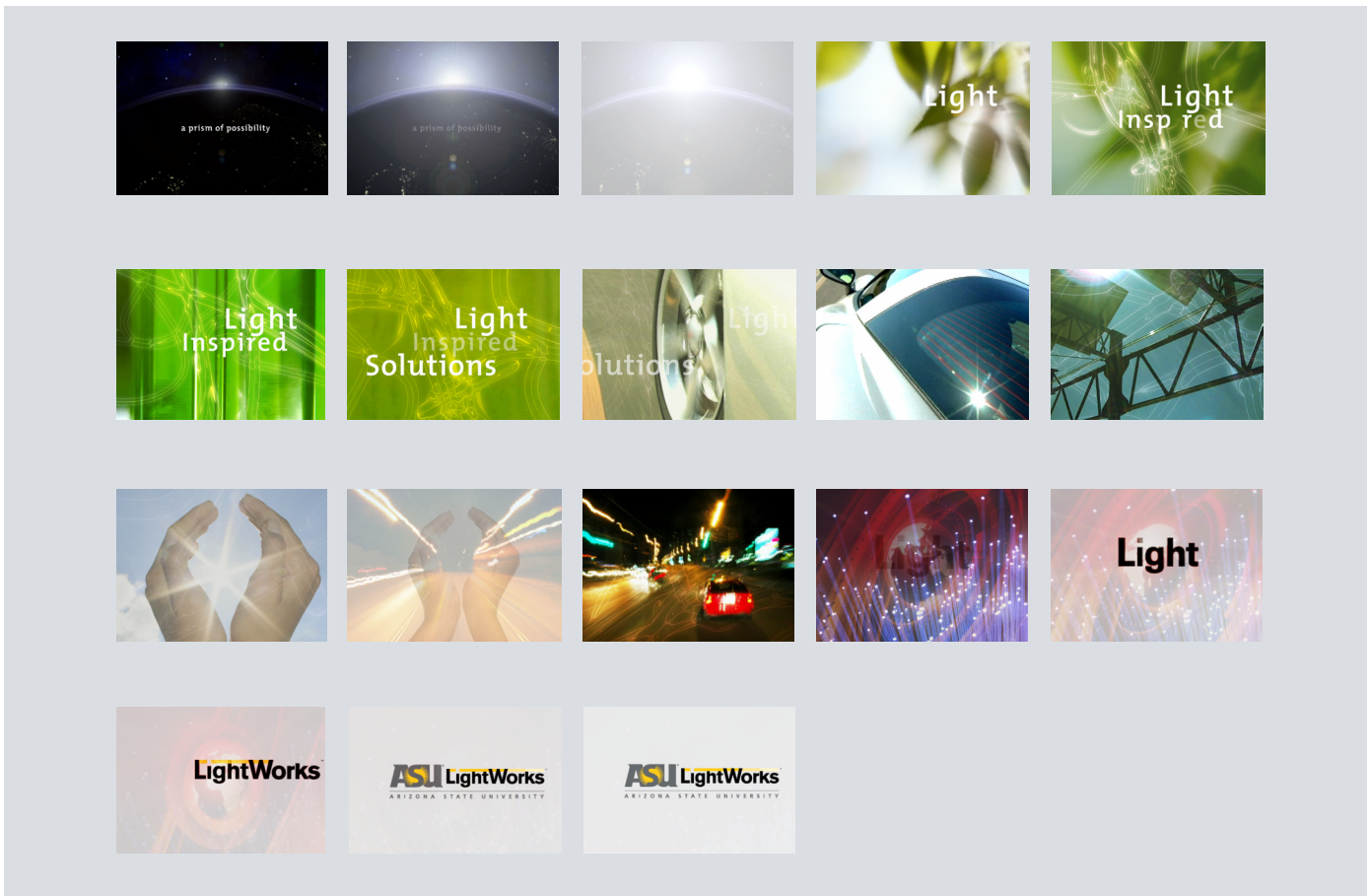
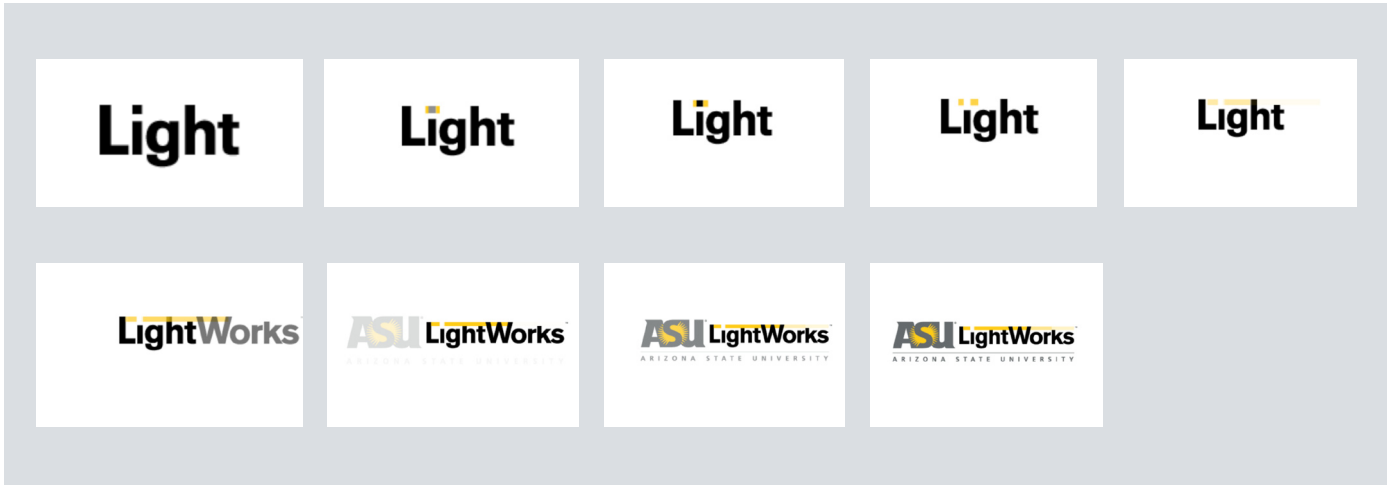


Figure 40. LightWorks Logo

APPENDIX C

HUMAN SUBJECTS INSTITUTIONAL
REVIEW BOARD SELECTED DOCUMENTS



Office of Research Integrity and Assurance

To: Alfred Sanft
ARCH

for **From:** Mark Roosa, Chair *MR*
Soc Beh IRB

Date: 03/16/2011

Committee Action: Exemption Granted

IRB Action Date: 03/16/2011

IRB Protocol #: 1103006192

Study Title: Experience Sight and Sound Motion Graphics and Print

The above-referenced protocol is considered exempt after review by the Institutional Review Board pursuant to Federal regulations, 45 CFR Part 46.101(b)(2).

This part of the federal regulations requires that the information be recorded by investigators in such a manner that subjects cannot be identified, directly or through identifiers linked to the subjects. It is necessary that the information obtained not be such that if disclosed outside the research, it could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

You should retain a copy of this letter for your records.

**INFORMED CONSENT FORM
MINIMAL RISK
ARIZONA STATE UNIVERSITY**

Experience Sight and Sound in Motion Graphics & Prints

INTRODUCTION

The purposes of this form are to provide you (as a prospective research study participant) information that may affect your decision as to whether or not to participate in this research and to record the consent of those who agree to be involved in the study.

RESEARCHERS

Alfred Sanft (Program Director of Visual Communication Design),
Hoi Yan Patrick Cheung (Graduate Student)

STUDY PURPOSE

The purpose of this research is to understand and evaluate to role of sight and sound in visual communication design. By providing descriptions/thoughts of your experience in different videos and print applications, we hope to develop new design principles and methods for design educators, designers and practitioners.

DESCRIPTION OF RESEARCH STUDY

As a study participant you will join a study involving research in experience sight and sound on motion graphics and prints. There are two experiments. Your task will be to review seven stories in its video, image and slides format in experiment ONE and evaluate five print applications after watching one video in experiment TWO.

In ONE, only your cursor's movement will be video-screen-captured for data analysis. NO identifiable photos/videos of you will be taken. You are allowed to skip or replay each one of the seven stories at your own pace. However, once you proceed to the next story, you will not be able to return to the previous one. Then a few questions will be asked. In TWO, one video and five print materials will be presented to you. You will rank and evaluate the print materials based on what you see on the video. Video will only be played once in experiment TWO.

If you say YES, then your participation will last approximately 45 minutes at the ASU Centerpoint office.

RISKS

There are no known risks from taking part in this study. If the volume of the video is too high, you are free to adjust the sound level. The audio content is all instrumental music with no profanity. There is no violence, sex or nudity in all videos.

BENEFITS

The potential benefits to the participants are exposure to creative videos, sound and prints. The benefits of this study are better understanding of synchronization (the use of sight and sound in media) and visual representation.

CONFIDENTIALITY

All information obtained in this study is strictly confidential unless disclosure is compelled by law. The results of this research study may be used in reports, presentations, and publications, but the researchers will not identify you.

WITHDRAWAL PRIVILEGE

It is acceptable for you to say no to participation in this study. Even if you say yes now, you are free to say no later, and withdraw from the study at any time. Your decision will not affect your relationship with Arizona State University or otherwise cause a loss of benefits to which you might otherwise be entitled. If you are a student, participation is voluntary and that withdrawal from the study will not affect your grade. If you withdraw, all your data will be deleted and/ or destroyed.

COMPENSATION FOR ILLNESS AND INJURY

If you agree to participate in the study, then your consent does not waive any of your legal rights. However, in the event of (harm, injury, illness) arising from this study neither Arizona State University nor the researchers are able to give you any money, insurance coverage, free medical care, or any compensation for such injury.

VOLUNTARY CONSENT

Any questions you have concerning the research study or your participation in the study, before or after your consent, will be answered by the faculty: Professor Alfred Sanft (Alfred.Sanft@asu.edu, 480-965-3238), or graduate student Hoi Yan Patrick Cheung (Hoi.cheung@asu.edu, 480.287.2524. If you have questions about your rights as a subject/participant in this research, or if you feel you have been placed at risk, you can contact the Chair of the Human Subjects Institutional Review Board, through the ASU Office of Integrity and Assurance, at 480-965-6788. This form explains the nature, demands, benefits and any risk of the project. By signing this form you agree knowingly to assume any risks involved. Remember, your participation is voluntary. You may choose not to participate or to withdraw your consent and discontinue participation at any time without penalty or loss of benefit. In signing this consent form, you are not waiving any legal claims, rights, or remedies. A copy of this consent form will be given (offered) to you.

Your signature below indicates that you consent to participate in the above study. Also, by signing below, you are granting to the researchers the right to use your performance - whether recorded on or transferred to audiotape or disk - for presenting or publishing this research (or for whatever use).

I CONSENT TO PARTICIPATE IN THE AFOREMENTIONED STUDY

Subject's Signature Printed Name Date

INVESTIGATOR'S STATEMENT

"I certify that I have explained to the above individual the nature and purpose, the potential benefits and possible risks associated with participation in this research study, have answered any questions that have been raised, and have witnessed the above signature. These elements of Informed Consent conform to the Assurance given by Arizona State University to the Office for Human Research Protections to protect the rights of human subjects. I have provided (offered) the subject/participant a copy of this signed consent document."

Signature of Investigator _____ Date _____

**RECRUITMENT SCRIPT
ARIZONA STATE UNIVERSITY**

My name is Hoi Yan Patrick Cheung. I am a graduate student under the direction of Professor Alfred Sanft, pursuing a Ph.D degree in Design at Arizona State University. I am conducting a research study of how people experience sound and visual elements in motion graphics (video) and print applications (book, poster and packaging design)

Your task will be to: (i) review seven stories in its video, image and slideshow format; and (ii) evaluate five print applications after watching one short video. If you say YES, then your participation will last about 45 minutes.

Your participation in this study is voluntary. If you have any questions concerning the research study, please call me at (480) 287-2524, or via email hoi.cheung@asu.edu.

Pre-Session Screening Form

Instructions: Please circle your answer in the provided spaces. All replies will be kept strictly confidential.

Subject #: _____ Gender: _____

Date: _____ Major: _____

Question 1: Are you 18 years of age or older?

Y N

Question 2: How many movie(s) have you seen in the past 6 months?

None 1 – 4 5 – 8 9 – 12 More than 12

Question 3: How often do you use your computer to watch video(s) per week?
(i.e. youtube, and vimeo)

Never Daily Every other day 3-4 times a week

Other _____

Question 4: Have you edited movies and music before?

Y N

Question 5: Age range:

18 – 29 30 – 39 40 – 49 50 – 59 60 – 69 Decline

Question 6: Education:

High School Undergraduate Graduate Doctor Decline

APPENDIX D

DVD ROM