Material-Based Imagination: Embodied Cognition in Animated Images

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ABSTRACT

Drawing upon cognitive science theories of conceptual blending [1] and material anchors [2], as well as recent neuroscience results regarding mirror neurons [3], we argue that animated visual graphics, as embodied images whose understanding relies on our perceptual and motor apparati, connect both material and mental notions of images. Animated visual images mobilize a reflective process in which material-based imaginative construction and elaboration can take place. We call this process as "material-based imagination," in contrast to the general notion of imagination as purely a mental activity. This kind of imagination is pervasive in today's digitally mediated environments. By analyzing a range of digital artifacts from computer interfaces to digital artworks, we show the important role of imaginative blends of concepts in making multiple levels of meaning, including visceral sensation and metaphorical narrative imagining, to exemplify expressiveness and functionality. The implications of these analyses collectively form a step toward an embodied cognition approach to animation phenomena and toward recentralizing understanding of artistic and humanistic production in cognitive research.

1. INTRODUCTION

Image has many meanings. It literally refers to the visual images that exist in material forms, like a photograph or a lithographic print. It also includes what we see, such as a shadow or a film projection. But the term has also been extended to mean those images that occur in our minds when we perceive something. Sometimes, the term image can even refer to an imaginative construct shared by a group of people, like the general image of a corporation. Hence, the term spans both the material and the mental.

However, since Ferdinand de Saussure introduced the association between the signifier and the signified (for Saussure both were purely mental constructs) [4], many thinkers exploring phenomena of semiotic interpretation have tended to separate the material image, e.g. a sound, a graphic symbol, or a picture from the mental image, which refers to abstract ideas in our minds. Such theorists typically focus on how people make and share meanings of images. There is a substantial volume of literature on how to relate the internalized idea to the shared belief among a group of individuals. Most of them rest on the socially or culturally established relationship, telling that any symbol, whether verbal or visual, is just conventionally linked to its meaning [5-8]. This idea confirms the abstractness of the mental image.

Meanwhile, there are other thinkers who dismiss the myth of mental images. Ludwig Wittgenstein asserted that images inside our brains (mental images) are no more abstract than images outside (material images) because we always think in terms of what we have already perceived, or what we are pointing at, regardless of whether they are verbal symbols or visual images [9]. We find that this view parallels insights from embodied, situated, and distributed perspectives on cognition, which are in direct opposition to mentalist perspectives or perspectives based in Cartesian mind-body dualism [10] [11, 12].

Practicing animators are well aware of the mental and material connection in images. Moving images can be tools to think with, exhibiting behaviors in their own right while viewers also feel visceral sensations and elaborative fantastic visions laid atop the marks themselves. In the tradition of Edwin Hutchins's instrumentally-oriented examples, take the case of a dial in a cockpit where a pilot imagines where the needle should be in contrast to where it is, the frame is stable, but the needle may be seen as an animated image dynamic and contingent. In the case of artistic production the animated image may be much more creative, evocative, strange, or fanciful. Yet, they can still act as material representations enabling specific forms of imagination where the images acts as its own representation that is combined with the viewer's elaborating cognitive processes.

It is these more contingent cases of material-based imagery that interest us. Instead of concentrating on goal-specific computation, we explore material-based, open-ended imagination through cases of fluid and flexible representations in the form of animated visual images that could be called *elastic anchors* for imaginative elaboration.

This paper presents multiple cases of material-based imagination in animation and articulates a case for the new

construct of elastic anchors through these illustrative examples. En route toward this end, we first present a theoretical framework clarifying our perspective on what animation is and how it functions, and necessary cognitive science ideas upon which our ideas are grounded. Ultimately, our paper serves a humanistic end. We believe the insights form animation studies and the arts are central to understanding and designing new and pervasive forms of computational media cultural artifact. Furthermore, these insights can drive development of new and transformative art forms based upon the uncanny ability of humans to interpret animacy in the moving inanimate lie on the horizon.

2. THEORETICAL FRAMEWORK

Our theoretical framework, in ongoing development, is strongly transdisciplinary. Its vantage point is strongly influenced by that of Paul Ward, one of the animation researchers who asserts that animation should be studied as a discursive field integrating multiple areas of knowledge. An account of areas that we integrate in our analyses follows.

2.1 Animation Studies

In this section, we present a brief survey of approaches to studying animation from film-based and computer-graphics-based perspectives. We then characterize the inadequacies of these approaches by highlighting their over-reliance on considering the medium-specific image in animation as the central object in their investigations. These medium-centric approaches inevitably fail to cope with the new paradigm of digital animation driven by emerging technologies and has failed to accommodate the material-based and imaginative cognition perspective that motivates this paper.

2.1.1 Film-Based Approaches

In humanities disciplines, animation is generally seen as a marginal type of film, often referred to as an "animation film." Scholars in the humanities have predominantly drawn on two approaches to animation research, namely contextual and textual analysis. [13] The former looks at production contexts, including the historical, industrial, technological, economic, etc. situations in which individual works can be understood. Many studies that utilize this approach review the national and cultural aspects of animation films within a film genre. The latter approach, more theoretical than the former, draws attention to the canonical texts of the specific medium. It entails performing close readings of works and performing comparative studies such as semiotic, genre, narrative, and other analyses. While this cursory overview certainly does not encompass the entirety of film-based approaches to animation, it captures at least a sketch of the prevalent and historical approach within the field.

2.1.2 Animation Studies

Animation theorists, interested in marking a new territory that centralizes animation within it's own genre, began to isolate their area of inquiry by attempting to define "animation." The majority of these theorists have focused on production processes and industrial practices, unanimously arriving at a definition that centralizes the frame-by-frame manipulation of images (Small, Levinson, Solomon, et al.). [14] On the other hand, some defined animation in terms of styles. Maureen Furniss has outlined a continuum of animation in relation to live-action imagery. She used "abstraction" and "mimesis" to represent the extremes of the continuum, which aims to encompass all different film styles and approaches. [13] Paul Wells has proposed a similar relational array between "experimental" and "orthodox," with a remark that animation should challenge the regime of live-action films. [15]

In contrast, Canadian animator Norman McLaren (1950) offered what has proved to be the most influential definition of animation. He defined it as about essence rather than process: "animation is the art of movements that are drawn." The emphasis on movement echoes Gilles Deleuze's view: "animation is not the transformation of images into one another, but the images being formed and dissolving through movement." [16]

2.1.3 Computer-Graphics-Based Approaches

In computer science, animation usually refers to the digital synthesis of a sequence of images. Early research areas included hierarchical modeling and rendering in computer graphics and development of efficient standards and encoding for multimedia. These concerns have been expanded by later work to develop work including representation of physical objects and materials, simulation of physical phenomena and organic behaviors, photorealistic rendering (and more recently stylized rendering, such as cel-shading) techniques, developing algorithmic approaches to generate movement such as flocking or other procedural patterns [17], implementing artificial intelligence (AI) programs to create animated behaviors (though work in this vein such as in [18] often focuses on creating digital characters with a sense of believable "aliveness," which often highlights modeling internal psychological states more than the type of perceived movement that is the focus of my concern with "liveliness"), and much more. Initial application domains were primarily scientific, medical, architectural, and cinematic, yet the marvelous illusions generated by computers has spread to other communal and personal entertainment platforms, including television, electronic billboards and displays, notebook computers, and handheld devices.

2.1.4 Beyond the Medium: Toward A Broader Perspective Based on Animacy, Interactivity, and Generativity

All of the above definitions still position animation as sequential images in a particular medium, whether filmic or computational. Any theory focusing on single medium is

inadequate for addressing issues pertaining to animation, such as experientially how and why humans perceive and imbue artifacts with the illusion of life. Hence there has been a movement among some animation researchers to legitimize a new study of animation, separate from film studies. (Cholodenko, Wells, Ward, Manovich, et al.) These researchers have pointed out the close relationship between animation and many early experiments in the creation of moving images, such as chronographs by Edweard Muybridge and Etinne Jules Marey, and many trick films by George Melies, Stuart Blackton, Winsor McCay, et al. Alan Cholodenko and Lev Manovich even provocatively claims that animation is the origin of cinema. [19] [20]

Cholodenko's latest view is exceptional in that he draws attention to the apparatus in addition to the animated image. [21] The "animatic apparatus," which refers to mechanical apparati that generate moving pictures, including the phenakistoscope and the zoetrope, manifests a double definition of animation: simultaneously meaning "endowing with life" and "endowing with movement." One could say it animistically gives life to inanimate images through mechanical movements like spinning, flipping, and illuminating. The tension between the illusion of life created and the mechanical movement in the apparatus is a useful analogy to the tension between digital animation (including various characters in CGI, or the moving icons in GUI), and the implementation techniques used to realize the visual interface elements we find in operating systems like MS Windows or Macintosh OS X today.

Following Cholodenko, we would like to add another double definition: interactive and generative animation incorporates a tension between control and feedback. Animation should not only refer to visual imagery, it also includes the operation of the apparatus, which performs the embodied and material realization of animation. Early animatic apparati seem on the surface level to involve only visual perception. Yet in practice, a certain degree of *embodied interaction* is required by these apparati because they are constructed to invite their viewers to peep in! Beyond this fairly simple involvement of embodied user action, in many cases the viewer needed to operate and maintain the function of such apparatuses by hand in order to "generate" the moving image. These early forms of animation that, in practice, highlight both the moving *image* and the operational *apparatus*, consist of an inextricable relationship between motor control and sensory feedback.

Apart from the viewers' perspective, this control-feedback connection can also be found on the producers' side. As Paul Wells put it, many instances of animist animation, epitomized by abstract animated films by Len Lye, Oskar Fischinger, Norman McLaren, et al., involved exploiting unconscious "hand/eye coordination" to achieve pre-rational and automatic expression. [15] Hence, it should be recognized that sensory-motor interaction is essential to both operation and reception of animation, although many subsequent cinematic apparatuses have distanced audiences from embodied interaction with the medium, gradually

As digital platforms become more personal and customizable, the illusion of life is merged with interactive systems that again require our sensory-motor input in order to drive their operation. There are numerous examples in electronic mini-games, mobile entertainments, computer interfaces, multimedia web applets (e.g., banners or viral advertisements), interactive comics (e.g., Hoogerbrugge.com, opertoon.com), procedural CGI (e.g., the procedural animation work of Ken Perlin [22], who uses procedural algorithms to generate lively patterns or rhythms), AI-based digital art (e.g., the behavioral animation work of Joseph Bates [18], who uses AI technologies to make digital characters believably responsive), and more.

2.2 Cognition and Perception (Cognitive Semantics)

Cognitive semantics, within the field of cognitive linguistics, propose that there exists an array of mental processes that operate pre-linguistically and often even pre-consciously in the construal of meaning from verbal text, pictures, and even films. [23] These processes, such as metaphorical projection and conceptual blending, highlight issues of context and situatedness rather than grammatical construction. [1, 24] Cognitive semantics-based analyses of animation exploring how "meaning" is uniformly and optimally generated by mental processes, poses a challenge.

2.2.1 Distributed Cognition and Material Anchors

Edwin Hutchins is one of the major proponents of distributed cognition. He asserts that material structures and patterns, like marks or diagrams, can provide us with stable images for complex mental operations, such as calculation done on paper. He calls these images material anchors, which "hold" information in place during mental manipulation [2]. It follows that a material image, for example, marks on paper, can act as a direct input to our cognitive process – the world is used as its own representation. In Wittgenstein's words, we compute by manipulating the marks in our minds. The material image of the marks is equivalent to the mental image. Hutchins' arguments mainly focus on human-performed computational and operational tasks, so his material images have to be stable and faithful representations of the elements to be manipulated in the cognitive process. However, this faithfulness does not necessarily apply to cases in which the outcome is not a priori clear and task specific, such as process-driven creative activities. For example in filmmaking, a storyboard is not strictly a faithful representation of the mental image inside the director's mind, but is also a device used for contingent reflection on a creative work-in-progress, projecting evocative sensation onto the work that goes beyond the physically represented information, and allowing that work to trigger generation of subsequent imaginative images.

2.2.2 Metaphor and Conceptual Blending Theories

Metaphor theorists propose that the understanding of many basic abstract concepts relies upon metaphorical thinking and analogy, and that metaphorical thinking arises from a basis in embodied human experience of the world (Varela, Thompson, and Rosch 1991, Lakoff and Johnson 1999). George Lakoff, Mark Johnson, Mark Turner, and others have studied metaphor as mappings from one conceptual space to another (Lakoff and Johnson 1980, Lakoff and Turner 1989), and have shown that there are many basic, entrenched metaphors that people use to express everyday concepts. These concepts are often structured by image schemas, "skeletal patterns" that recur in our motor-sensory experiences such as "Motion Along a Path," or "More is Up" as expressed respectively by metaphors such as "Life is a Journey," or "Good is Up."

Conceptual blending theory builds upon Gilles Fauconnier's mental spaces theory (Fauconnier 1985) and elaborates insights from metaphor theory (Fauconnier 2006). Gilles Fauconnier and Mark Turner's conceptual blending theory describes the means by which concepts are integrated (Fauconnier and Turner 2002), guided by "uniform structural and dynamic principles" both unconsciously in everyday thought and in more complex abstract thought such as in literary arts or rhetoric. Metaphoric blends are those that are asymmetric in the sense that one space, the "target" of the metaphor, is understood in terms of the other "source" space (Grady, Oakley, and Coulson 1999). Conceptual integration networks are composed of conceptual spaces and conceptual mappings used in blending the component spaces for situations that are more complex than a single metaphor. The basic elements of a conceptual integration network are (Grady, Oakley, and Coulson 1999):

1) Input Spaces (the conceptual spaces to be combined)
2) Cross-space mappings (links between analogous elements in different input spaces)
3) The Generic Space (a conceptual space mapped to both of the input spaces that describes shared structure between the input spaces)
4) The Blended Space (the space in which elements from the input spaces are integrated)

Fauconnier and Turner assert that the process of blending is structured by sets of "constitutive" and "governing" principles that exert pressure to produce optimal blends. The constitutive principles describe the structure of conceptual integration networks and the process of blending, while the governing principles optimize emergent structure in the blends all "other things being equal" (Fauconnier and Turner 2002). An expanded account of the foundational role cognitive linguistics plays in digital media analysis and design can be found in [25-27].

2.2.3 Physical Patterns in Conceptual Processes

Hutchins's ideas suggest that some input spaces to conceptual blends may refer to physical structures in the world. Perceived patterns can be material anchors for conceptual blends. For instance, we recognize a line of people as a queue by blending the perceived line-like structure with the concept of sequential order [2]. Similar associations of concepts with patterns have also been addressed by Arthur Glenberg. He has introduced the notion of mesh [28], in which patterns of embodied action are combined with patterns from memory. Therefore, recognition of a path arises from an alignment between the patterns projected from the environment and embodied knowledge from past experience. Both meshes and material anchors emphasize materiality and embodiment in cognition, but the former mainly deals with comprehension and realistic prediction whereas the latter aims to provide stability for complex mental operations. Neither focuses on the type of imaginative elaboration emphasized in conceptual blending theory. Our analyses require the emergent and dynamic structure of conceptual integration networks to be combined with accounts of physical structure so as to centralize materiality in imagination.

3. MATERIAL-BASED IMAGINATION: ELASTIC ANCHORS

As W. J. T. Mitchell puts it, a poet would like to "jot down" his mental image in words, which in turn can invoke another "verbal image." We believe that animated visual images transgress the boundary between the material and the mental even more vigorously, mobilizing viewers' motor-sensory connections and constituting embodied understandings of sensation.

Consider that the storyboard of a film in progress projects the director's approximation of the intended outcome. At some point, the director will need an animated visual image, technically called a "rehearsal," an "animatic," or a "rough cut," especially when one wants to elicit visceral sensations such as disgust, sorrow, nervousness, and others. There are many nuances of these "gut feelings" that static images may not be able to convey. Instead, they have to be performed as actions in animated images. For example, a viewer is able to distinguish an animated character's giggling from trembling, because the viewer perceives and understands it as exhibiting lifelike qualities previously experienced in her or his everyday life. This is quite different than the use of culturally specific symbolic conventions (such as trembling lines) without which a still image could not convey these distinctions.

While being careful not to overstate these claims, results regarding the activation of brain structures known as mirror neurons have been posited as suggesting that, when perceiving a performed action in a moving image, the viewer's interpretation relies upon evocation of the corresponding motor-sensory knowledge from a repertoire of her or his own embodied experiences [3]. The coupling of perception and action enables the viewer to "recall" the associated sensation. When we see someone jumping restlessly, we understand one's excitement, not by "reading," but rather "sensing." In short, animated images constitute an embodied cognitive process. By the same

token, a movie director can "feel" whether an actor's performance is matching his mental image, or an animator can "detect" if her or his character is moving right. This kind of visceral understanding largely takes place at the pre-conscious and immediate level, requiring minimal cognitive effort.

Cognitive semantics research also provides us with accounts of understanding sensation through perception. When discussing animacy, Mark Turner states that we cannot perceive others' sensations, so we can only infer their sensations by comparing their actions to our own reactions in similar situations [24]. He refers this analogical inference to a type of parabolic projection, or metaphor, in which partial structure of a source story of the perceiver, including action and emotion in particular, is projected to a target story of the perceived.

It follows that the director or animator can infer the sensation by cognitively projecting her or his own experience to the perceived action. This act of "inference" seems to be suggesting that the projection takes place at a higher cognitive level, demanding conscious mental operation. In fact, some mental projections can be cognitively effortless. This point can be illustrated in the terms of conceptual blending theory [1]. Some blends can be so tightly compressed (expressed at human-scale) that become automatic and unnoticed. Fauconnier has cited the computer interface phenomenon as an example of these immediate blends [29]. In this regard, we would like to add that for the director or animator, there is also a blend of a past experience and a perceived action yielding an inferred sensation. The blend is so tight that the animated image is immediately associated with the sensation. The image becomes a direct input to the emergent integration network.

As mentioned earlier, Hutchins coined the term "material anchor" to mean those material objects or images with stable patterns and structures "locking down" specific information in input concepts. We believe that animated visual images "hold" not only information but also sensation or meaning, which trigger imaginative elaboration in blending. We call these animated images "elastic anchors," which hold sensation in place, but not in shape.

3.1 The Material-Based Reflective Process

With elastic anchors, the subtle difference between the visceral sensation represented by the animated image and the mental image engenders imagination. For example, an animatic sequence might suggest a visceral sensation, with which the animator can compare her or his intended mental image, combining partial structures from the animated image and the mental image respectively to form a new imaginative image, and then triggering adjustment or modification to the material image. This reflective process iterates and ultimately approaches the imaginative interplay of the material image and the mental image.

Such nuanced interplay can be illustrated by the difference of natural moving images (e.g., incidental shadows) and author-intended animated images (e.g., shadow puppetry). The two images can be materially the same. To Hutchins, neither representation may be valuable as a material anchor because they are not faithful representations of an object, they are just silhouettes. However, the latter can be an elastic anchor for conceptual blends in which the silhouette in action associated with visceral sensation is blended with the viewer's mental image of an entity (whether human, animal, or even an anthropomorphic object) moving in a similar fashion, thus forming an imaginative understanding that the shadow is cast by an actual character in that mood.

On the audience side, this blended image is the meaning of the puppet show. On the puppeteer's side, this might be an interim image with which the puppeteer would fine-tune for another animated shadow. In both cases, the material image blends with the mental image to give rise to next imaginative image.

It follows that material images and mental images have a very intricate relationship. In computational operation, they can be regarded as the same. In creative operation, they may seem like dancing or boxing partners irregularly approaching each other, whether collaboratively or oppositionally. Moving images can be a vehicle toward reconciling our understanding of this intricate relationship because they constitute a specific type of embodied cognition process. Animated images, with their distilled visual forms and evocative movements, serve as a perfect elastic input spaces for conceptual blends because the flexibility and compatibility facilitate the partial structural projection of input concepts that gives rise to new blends and imaginative constructs. We call this imagination as "material-based" imagination, as opposed to the general thought of imagination as purely a mental activity. This kind of imagination is pervasive in today digitally mediated environment.

4. ANALYSES OF DIGITAL MEDIA ARTIFACTS

We have argued that animated images constitute the embodied cognitive process of sensation understanding and trigger imaginative elaboration. Today, animation can be seen in many digital media artifacts in which generative algorithms support interactive construction of animation phenomena. These artifacts include the graphical user interface (GUI) of many operating systems and applications, interactive multimedia websites on the Internet, entertainment or lifestyle applications on hand-held devices, and contents of many outdoor electronic displays in communal areas. A viewer makes meaning of these animated images and elaborates imagination through the motor-sensory circuit between her or his motor actions and perceived feedback from the artifacts. The following discusses specific examples in this range of artifacts in

more depth. In analyzing diverse kinds of artifacts, this article purposefully strikes a balance between rigorous cognitive science analysis in meticulous detail and more informal accounts of blending and related operations – in short we have chosen to focus on demonstrating the ubiquity of the emergent animation phenomenon rather than pyrotechnic feats of imagination in individual cases.

4.1 The GUI of Operating Systems

The first animation-driven imagination phenomenon we analyze here is prevalent in GUI features. For instance, in the Macintosh OS X environment, when a user clicks on an icon in the dock (alias icons grouped at the periphery of the screen), it responds with bouncing up and down. The user understands that the application is beginning the process of opening. Following Fauconnier's perspective on immediate blending, the user effortlessly blends the clicking action and bouncing feedback with socially recognized forms of body language for anticipation – restless shifting or bouncing as experienced in one's everyday life. The outcome is a new concept of calling a responsive and attentive application in. Meanwhile, if the user clicks on an icon of a minimized window, the window stretches and twists into place like a playful genie coming up from its lamp. The user knows the connotative meaning when blending the perceived twisting with the genie from film or television. This imaginative concept is a "powerful" genie application serving at your wish in a multitasking environment at the same time as suggested spectacular, magical function (in potential reading of the effect as spectacle or gimmick).

Figure 1. The "genie" effect in Macintosh OS where windows dynamically stretch and shrink.

On the recent well-received gadget iPhone, more evocative animation can be found. When the user enters the re-configuration mode on the home screen, all icons begin gently shaking and can be interpreted as appearing a little uneasy. The user automatically understands the sensation of uneasy waiting "performed" by the icons. When the user integrates this perceived action (also the sensation) with any critical or nervous moment experienced in her or his life before setting forth on a mission, the blended concept is that every icon got excited and nervous for upcoming new arrangement. The user immediately understands that they are prepared to move.

4.2 Traffic Lights

Animation provoking imagination is also pervasive in communal areas. Sometimes it is not only enjoyable, but is also very functional. For instance, the traffic lights in some cities (e.g., in Taiwan, Spain, and Mexico) display LED-lit animated "green men" to instruct pedestrians when and *how* to cross the street. During each green signal, the little green man walks in a cycle. He then starts running faster and faster as the system counts down to the red signal. When viewing this lively animation, a walker would immediately feel that the little green man is in hurry because the perceived motion evokes her or his motor experience, as the research of mirror neurons has suggested. Furthermore, the walker would blend the little green man's situation with her or his own situation of crossing the road. Linking the two input spaces with what Fauconnier and Turner term an "identity vital relation," an optimally integrated element in the blend space implies the real world walker now also running across the street [30]. This imaginative image compellingly suggests: "hurry up!"

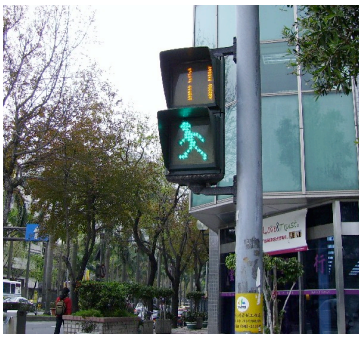

Figure 2. A running green man on a traffic light in Taipei.

Speculatively, the activation of mirror neurons has provided us with accounts of the understanding of sensation through perceived action in many of the aforementioned examples. One might notice that the argument is convincing in many cases of anthropomorphic animation, such as traffic lights or the iPhone, but it may not be applicable to addressing some animation phenomena that are not enacted by characters, yet persist in some lively natural environments. Fortunately, the latter can also be explained in parallel by theories in cognitive science like conceptual blending. As we have argued [31], many understandings of anthropomorphic animation in digital media take place at the *immediate* level. On the other hand, many other digital animation phenomena can incite imaginative elaboration and provoke imaginative understanding at the *metaphorical* level. A viewer can interpret rich imaginative stories and worlds through even the most rudimentary of animated images and simple motor-sensory interaction.

4.3 The Water-Level Interface

On the Japanese mobile phone N702iS, a proprietary interface displays computer-generated imagery of water that looks as if "contained" inside the phone's screen. When the user tilts the phone, the rendered water surface moves in response to the action. The simulated reaction to motor action constitutes a blend of the user's current situation of holding a mobile phone and her or his mental image of holding a water container, creating the illusion of a water-filled mobile phone. What makes the artifact even more intriguing is that the rendered water level represents the battery level. This articulation further incites the user to project a mapping from checking power consumption perhaps to an imaginative narrative about someone in some harsh environment checking how much water is left or a similar tale of water-conservation. The elaboration of such blend leaves the user a strong and provocative message: "save the juice!"

Figure 3. A mobile phone interface where battery level is indicated via the illusion of a water-filled container.

4.4 Multimedia Websites

Many multimedia websites are successful at creating illusory virtual environments that absorb users into imaginative worlds and stories. One of the exemplars is the greeting front page *SnowDays* at Popularfront.com. The page depicts a scene of a snowing day, in which every falling flake was "handcrafted" by a web visitor. The visitor can leave a message "inside" the flake and the receiver would be notified by the website. The receiver, or in fact any other visitor, may go to the page, look at snowing, appreciate the meticulous details of the falling flake, check out the message, and respond. The motor-sensory immediate blend comes about at examining a snowflake by zooming in, creating an illusion of looking through a "window" in a snowing day. When the viewer receives and responds a message, the metaphorical blend constructs an imaginative narrative of exchanging greetings with someone from a distance (through the sky) in a lonely winter day. The hidden meaning is evocative and affective: "you are not alone!" At the same time, there is an entrenched cultural narrative about the uniqueness of individual snowflakes. By conflating user representations and messages with snowflake images, the blend space may imply the uniqueness of users. Finally, the snowflake images are not photorealistic depictions of ice crystals, rather they resemble cut-out snowflakes that many people construct in elementary school. The memory of such experiences can be integrated into the experience of using the site, with all of the attendant visceral and nostalgic associations that may be triggered as well.

Figure 4. Cut-out snowflakes tailor-made by individual users carry their greeting messges evocative of personal memories.

In contrast, some websites absorb users and provoke imaginative stories not in a spatial environment but rather through a mini narrative. Comeclean.com invokes standard interface mechanisms such as data-entry and animated composite images to arrive at a metaphorical projection in which users can wash away sins. A user is first presented with a subjective view of looking down at a sink basin and is welcomed by a consoling voice speaking in English with a South Asian accent, prompting a confessed message. Once the user types in a message, the website shows that the message is handwritten on the photographic palm of a hand and then is washed away with a cleansing foam in a real-time composite moving image. The site, in fact, is an advertisement for cleaning supplies, yet the blend of the micronarrative of washing one's hands using particular cleaning supplies and the user's wish image of becoming spiritually clean after confessions of sin comes up with an imaginative image of the supplies cleansing both the body and the soul. Of course, the user is required to also blend her or his own hands with those depicted in the image regardless of their similarity.

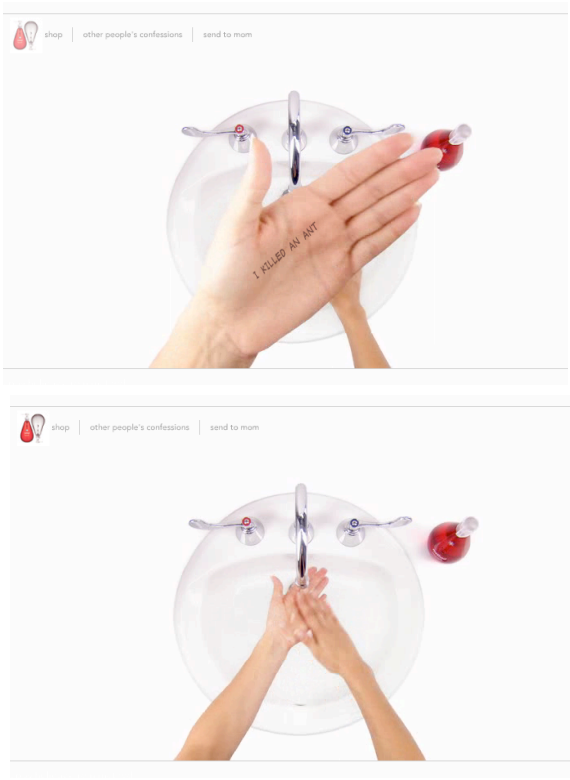

Figure 5. Screenshots of comeclean.com where confessed messages input by users can be washed away.

4.5 Video Games

Animation has been an indispensable part of major visual content in most video games. Immediate blends take place at most game mechanics entailing the motor-sensory connection between user action and animated visual feedback, such as controlling characters heroically exploring their worlds by pressing keys, mastering fighters' versatile martial actions with joysticks, or steering jets in simulation by tilting the handheld device. However, some games are able to incite metaphorical blends through very simple animation. Jason Roher's expressive indepedent game *Passage* presents the metaphor, "life is a journey," literally as a horizontal walkway with many obstacles. As meditation on life and death, and a reminder of mortality, a player starts the game with a character walking alone. The character sprite's fixed position on the screen shifts toward the right at regular time intervals. Simultaneously, the sprite is depicted as increasingly older (going bald and grey, becoming hunched, etc). When the character bumps into a companion, the couple walks hand in hand and becomes unable to pass through many alleys and collect treasures, though still able navigate the major passage. The player easily performs a metaphorical blend of the physical constraint facing the characters and his mortality and marital status. Through the identity vital relation again, one can arrive the author's intended imaginative perspective on how marriage limits possibility, not to mention the more prevalent metaphor of time as space and one's death is reaching the end of the road.

Figure 6. A screenshot of *Passage* with the player character at the beginning of his life journey.

4.6 Digital Art

Many digital artworks rely on simple animation and motor-sensory interaction to provoke imagination. One of the important installations in this area is Camille Utterback and Romy Achituv's *Text Rain*. The work shows a projection of animated letters falling like rain. A participant standing in front of the projection can move her or his mirror image on the screen to catch, lift, and then let fall any letters. During this embodied interaction, the participant immediately blends the projected moving image and her or his body movement, giving rise to an imaginative blend of dancing in the rain without soaking and being captured live by a magic camera or mirror. Since each raindrop is a letter coming from a poem, the participant can sometimes catch a word, or even a phrase, by accumulating letters along her or his silhouette. Whenever the participant reads the line, comes from the sky, held by her or his body, the experience provokes a metaphorical narrative of someone like a prophet receiving spiritual and celestial messages via the body and the surroundings. The animation of falling letters and the interaction with them generate what the artists might describe as an imaginative integration between body, nature, and soul.

Figure 7. A participant holding "letter" raindrops in *Text Rain.*

The comic artist Han Hoogerbrugge presents a series of interactive animated comics on his website Hoogerbrugge.com. The first work, *Modern Living* (1998-2001), featuring nearly one hundred short animated films, tackles small observations in his personal life, which also resonate users' lives. The collection can be seen as a documentation of his experiments with mouse-mediated interaction in which immediate blending helps us re-map mouse action to different intentions easily. For instance, in *#43 'Itch'*, a click makes the character "itch" wherever the mouse cursor is located. In *#54 'Jumpy'*, a mouse-over

action "drives" the character jump forward. In *#60 'New Religion'*, when the mouse moves across the characters, they stand up and then bend down forming a wave very much like the magnification effect in Macintosh OS X dock. In *#61 'Drowning'*, one can move the mouse to play hide-and-seek with the character. In *#68 'Obedience'*, keeping the mouse over the character's head can "bend" him down to his knee. In *#70 'Eternal Love'*, the position of the mouse determines the focusing point. Among numerous interactive pieces, some are more metaphorical. In *#83 'Possessed'*, the character would move his mouse according to the user's mouse position. The immediate blend here lets the user easily control the character by moving to desired location, like the mechanism of controlling shadow puppets by moving rods. When the user moving the mouse around, the character keeps popping bizarre appearances over his head, suggesting an imaginative blend, in which people surfing the World Wide Web, including the user, often have their attentions wandered. Another thought-provoking example is *#98 'Prelude'*. The character is depicted playing a piano. Whenever the mouse moves over his head, a piano note is heard. Most users can effortlessly understand that the mouse action triggers the character to hit the key. However, if we interpret the mouse action as hitting the character's brain, we would achieve another metaphorical blend, in which a pianist is brainstorming a melody for his new song.

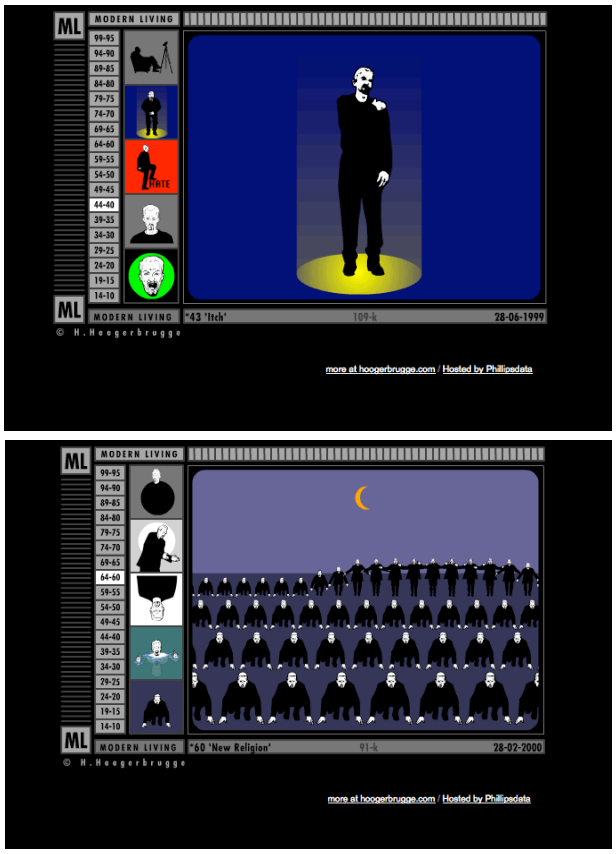

Figure 8. Screenshots from Hoogerbrugge.com where sensory-motor interaction provokes immediate and metaphorial imagination

5. CONCLUSION AND IMPLICATIONS

This paper started with a trajectory of thought about images, from the pictorial or visual for to mental representation. We believe that images not only exist materially outside of our brains and mentally inside our minds, but also emerge as imaginative constructions from the reflective process between material manifestation and mental operation. In this kind of material-based imagination, animated images work as elastic anchors for sensational, visceral, and elaborative conceptual blends because they more readily engage our embodied sensations through the coupling of perceived action and motor knowledge. Furthermore, due in part to their liveliness and relationship to embodied communication such as human body language, gesture, and facial expression, animated images easily absorb viewers in affectively rich imaginative stories and worlds. In all cases, imaginative blends of concepts are the key to understanding the artifacts, at both the immediate level and the metaphorical level.

We believe our analyses of digital media artifacts reflect an emergent animation phenomenon in today's digital age that destabilizes the border of mind and matter unprecedentedly. We require a new embodied cognitive model of movement and fluid images, topics currently underexplored in the theories of image schema [23] and conceptual blending from cognitive science. Of course, for cognitive scientists, the elastic anchor construct ultimately should be pinned experimentally, and explained in terms of cognitive processes. However, for humanistic analysis in the tradition of cognitive poetics, new theory consistent with a convergence of results form fields including neuroscience and cognitive semantics is quite consistent with the enterprise. Currently, our work is speculative, but rooted in both humanistic interpretation and cognitive science results. In the future we may elaborate the relationship of our constructs to the quite different, and at times apparently contradictory, epistemologies used in cognitive science and humanties-based media studies. We hope that this paper sketches a potentially fruitful of reconciliation of both types of research concerns and values.

Meanwhile, this research also brings concern for humanistic interpretation back to the center of cognitive studies, in which today productivity- or usability-oriented approaches pervasive. As the digital visual culture theorist Andrew Darley put it in his keynote speech at the latest conference of animation studies [32], the animation phenomenon persists in the digital age, bringing about a new meaning of "persistence of vision" by that vision is "visual imagination." Animation, as the most "sophisticated and flexible" of modern media as non-objectively suggested by the animation theorist Paul Wells [15], has become the "vehicle" of the kind of imagination that can be poetic and evocative, as well as constructive and beneficial, in our everyday lives.

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