Active Animation: An Approach to Interactive and Generative Animation for User-Interface Design and Expression

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Abstract

The traditional view of animation is a medium-specific perspective: animation is a sequence of images on film. In contrast, we employ a wider, interdisciplinary theoretical lens, based on a phenomenological perspective of animation. We describe animation as the experience of artifacts imbued with apparent "animacy," or "liveliness," and identify a range of media artifacts where an account of animacy is key to understanding and designing their functionality. These artifacts range from computer interface mechanisms such as bouncing and stretching icons to interactive cartoons that may be used for informational, entertainment, or socio-critical purposes. We introduce the term "active animation" to describe this range of artifacts. Insights from textual analyses in the humanities-based field of animation studies can enable analysis and design of active animation, and likewise animation studies can be informed by insights regarding agency in artificial intelligence research, theories of embodied cognition and conceptual blending from cognitive science, and psychological approaches to movement and perception. To exemplify the technical design potential of our approach, we present a cognitive semantics-based interactive and generative multimedia system that we have implemented called the Generative Visual Renku system as a case study active animation. The upshot is that our interdisciplinary animacy-oriented perspective highlights how gesture and movement allow interactive and generative digital artifacts to convey non-verbal meaning to users.

1. Introduction

Animacy lies at the heart of many media artifacts imbued with an illusion of life. Puppets and avatars, examples of traditional and digital user manipulated characters, become lively under the control and enactment of performers. Animatronic robots utilize mechanical means to produce the appearance of gesturing and perceiving viewers. Cartoons, manifested through sequences of pictures, can walk like real human figures. Although these artifacts differ from each other in terms of material form, control mechanism, and technology, all of them are animated in a literal sense. The animation of these artifacts hinges upon lively motion as the primary phenomenon of illusion of life.

Meanwhile, the term animation is often narrowly seen as referring to a particular medium, namely a type of film. Indeed, the celebrated filmmaker Norman McLaren describes animation as the "art of movements that are drawn." (Wells, 1998) Although his quote seemingly privileges motion over medium, the material condition of imagery as drawings is still presumed. In contrast, we call attention to views that deemphasize medium and emphasize liveliness. The animation theorist Alan Cholodenko attempts to generalize the notion of animation as sorts of technology geared toward "endowing with life" and "endowing with motion." (Cholodenko, 2007) In parallel, many digitally mediated environments such as computer interfaces, websites, and handheld devices have become lively, reactive, semi-autonomous, and graphical. They often construct meaning through perceived movement and embodied interaction. We call digital images engaged in such meaning-making processes "active animation." Given the ubiquity of such multimedia computing phenomena that are often overlooked as animation, there is need for theory to comprehend how such artifacts convey non-linguistic meaning via animacy and to formulate theoretically-grounded approaches for designing lively multimedia artifacts. This paper articulates this need and presents a new approach to addressing it, including a new form of active animation that we have developed.

2. Theoretical Framework

Our approach to the analysis and design of active animation arises from an intersection of multiple disciplines. Animation and image studies provide us a critical vocabulary for identifying the phenomenon of liveliness as definitional for our area of inquiry. (Arnheim, 1974; Metz, 1974; Mitchell, 1986) For thinkers such as Ludwig Wittgenstein and W.J.T. Mitchell, the term "image" is not limited to material images (e.g. screen images) or optical images, but also means perceptual images (through motor-sensory functions, including the kinaesthetic) or even mental images. It follows that the idea of animation should also extend to considering moving images on the basis of sensory perception and embodied cognition. Cognitive semantics research provides accounts of embodied meaning construction and generation of imaginative meaning through metaphorical projection and conceptual blending. (Fauconnier & Turner, 2002; Lakoff & Johnson, 2003; Turner, 1996) Psychological and phenomenological approaches to human-computer interaction are also relevant departure points for investigating the role of interactivity in the perception of liveliness. (Norman, 1988; Shneiderman, 2003)

3. Active Animation: Examples and Analyses

Toward analyzing and designing instances of active animation we introduce two levels of signification: the reactive and the metaphorical. At the reactive level, users make meaning out of liveliness of artifacts through a motor-sensory loop feedback between users and systems – i.e. users perform actions via an interface and perceive their animated effects in the system. Examples include user-interface mechanisms such as the many shrinking, stretching, and bouncing icons in the Macintosh OS X environment and interactive animated comics such as found at www.hoogerbrugge.com.

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

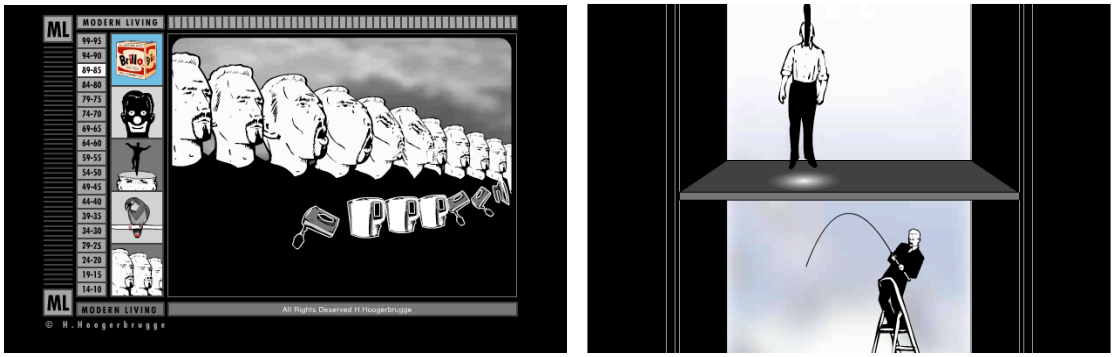

Fig. 2 Two screenshots from Hoogerbrugge.com where interaction drives provocative animated reaction

Such works imbue media elements such as windows and icons with a sense of liveliness formerly unknown in user interfaces. Motion is used to focalize user attention, add spectacle to basic operation, and to allow embodied user action such as clicking to play a role in realizing the meaning of animated content. (Arnheim, 1974; Lakoff & Johnson, 1999) Basic image schemata (skeletal patterns of motor-sensory perception) play crucial roles in user understanding of such works. (Lakoff & Johnson, 2003) For example, the "dock" area of the Macintosh graphical user interface becomes a container for windows, paralleling the container image schema articulated in (Lakoff & Johnson, 2003).

At the metaphorical level, users construct imaginative motion metaphors through the interaction between embodied gestures and multimedia feedback. The idea can be demonstrated by the water-level interface designed for the mobile phone N702iS and the electronic advertising viral campaign www.comeclean.com.

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

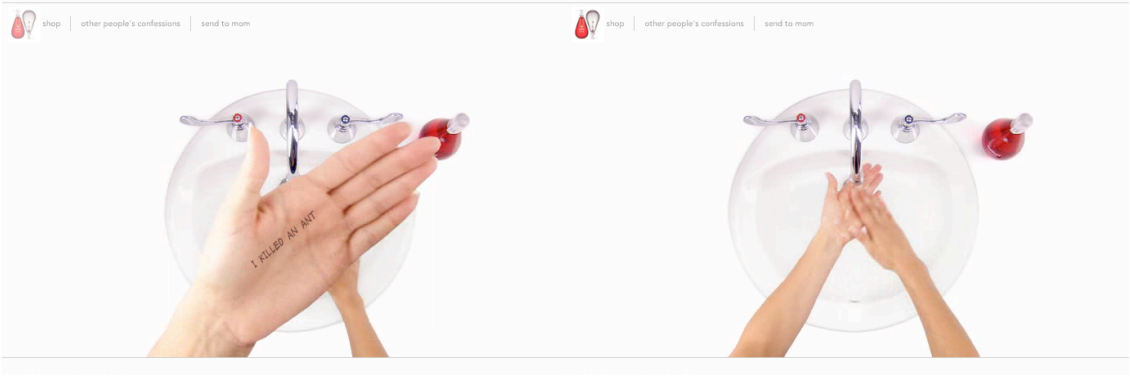

Fig. 4 Screenshots of an active animation web design at comeclean.com where mouse actions cause images of hands to wash away text input by users

The water-level interface in **Fig. 3** comprises a conceptual metaphor in which a container filled with water is integrated with a standard interface element depicting battery-level. This metaphor exploits the liveliness of animated water to present functional information in a lively and playful manner. The

website Comeclean.com invokes standard interface mechanisms such as data-entry and mouse-clicking to arrive at a metaphorical projection in which users can wash away the wrongdoings. The site is, in fact, an advertisement for cleaning supplies, yet the metaphorical mapping from washing one's hands using particular cleaning supplies to washing away confessions of sin is enabled by the active animation interface.

4. A New Form of Active Animation: Generative Visual Renku

As an example of multimedia system design based on our approach to active animation briefly we present an expressive project that we have developed called Generative Visual Renku. (Harrell & Chow, 2008) A polymorphic poem is a generative digital artwork that is constructed differently upon each instantiation, but can be meaningfully constrained according to aspects such as theme, metaphor, affect, and discourse structure. Our Generative Visual Renku project presents a work of active animation as a new form of concrete polymorphic poetry inspired by Japanese renku poetry, iconicity of Chinese character forms, and generative models from contemporary art.

Fig. 5 A Generative Visual Renku screenshot:

Users co-create animated maps by clicking visual icons, the system responsively selects subsequent images according to semantic constraints

In the Generative Visual Renku project interactive iconic illustrations are conjoined by a cognitive science based computer program called GRIOT into a fanciful topography. GRIOT, which is a system for composing generative and interactive narrative and poetic works, is used to semantically constrain generated animated output both visually and conceptually.

Conclusions and Implications

Today many multimedia computing systems show spectacular animated images that react to user actions with animated feedback. These artifacts manifest the notion of animation in a new horizon beyond the cinematic. The examples of active animation above illustrate this manifestation in both functional interface design such as the lively windows of Mac OS X and mobile phone water-level interfaces and in expressive works such as found at Hoogerbrugge.com or in our own generative visual renku. These works all evoke senses of liveliness, not only with perceptual movements, but also through generative multimodal feedback loops. They bring life to the computer, it can now feel more intimate to users through perceived emotion and even intelligence.

Active animation "enlivens" the computer by concealing its complexity with a "skin" like the shells of animatronic robots. Careful understanding of how users interpret active animation allows designers to "stage" and "veil" technology in order to create spectacles, suspense, surprise, and intuitive non-verbal meanings for users. This approach also brings concern for humanistic interpretation back to the center of analysis and design of multimedia artifacts. The integration of computational and cognitive research results with approaches from animation studies provides a new orientation for designing technologies that are more in line with our everyday, non-verbal, affective acts of communication and understanding.

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