ABSTRACT VIDEO

THE MOVING IMAGE IN CONTEMPORARY ART

EDITED BY GABRIELLE JENNINGS

FOREWORD BY KATE MONDLOCH

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INTERACTIVE ABSTRACTIONS

Between Embodied Exploration and Instrumental Control "Underneath Your Fingertips"

Katja Kwastek

This essay discusses abstract moving images generated or shaped by means of real-time audience interaction. As such, they differ from prerecorded compositions as well as from generative works based on preprogrammed operations, which cannot be influenced while being executed. The focus on audience interaction also excludes animations reacting exclusively to other (nonhuman) forms of data input, such as music, environmental data, or Internet data streams. Although such systems may rightly be determined as interactive, the focus of this essay is on humans' real-time interaction with abstract moving images.

Interactive video does not necessarily have to be abstract. It may make use of preexisting assets, which the recipient is encouraged to select or arrange, and these assets may well be figurative or even narrative. Since the 1980s artists like Grahame Weinbren or Lynn Hershman Leeson have experimented with such forms of interactive storytelling, and interactive television remains an undercurrent in mainstream media. And even if no preexisting assets are used, interactive video may be mimetic, as is the case in so-called closed-circuit video installations, which capture and replay the live image of visitors. So why would artists produce abstract interactive video, and what does the concept of abstraction entail when it comes to interactive imaging processes?

INTERACTIVE ABSTRACTIONS IN EARLY EXPERIMENTAL VIDEO, TV, AND COMPUTER GRAPHICS

While the real-time generation and manipulation of electronic images was an important aspect of early experimental video, there is little evidence of artists having granted control of the respective systems to their audience. Mostly, artists working in the field of experimental video wouldn't even perform live; they would record their experiments on film or present them by means of representative photographic stills.[1]

One early exemption was Nam June Paik.[2] Like many artists of the 1960s, Paik was greatly interested in exploring the aesthetic potential of indeterminacy. Heralded by Marcel Duchamp's interest in unintentionality and followed by John Cage's fascination with chance operations, the artistic exploration of the relationship between chance and control had become an important topic of the arts by 1960. Like Cage, Paik experimented with the inclusion of everyday material and technology into his works. In the early 1960s, he started to manipulate the electromagnetic signals of television sets to the point of full abstraction. In 1962 he claimed that "as the next step toward more indeterminacy, I wanted to let the audience act and play itself."[3] In fact, at his groundbreaking *Exposition of Music* (1963), visitors were invited to use a foot pedal and a microphone to operate two manipulated televisions (while other television sets had been prepared to react to radio programs and audio tapes). Paik continued to pursue these explorations in the different versions of his *Participation TV* (1963–1966) and *Magnet TV* (1965).[4] However, in his later work with the Paik-Abe Synthesizer, which, like other video synthesizers built in the 1970s, allowed for a sophisticated montage and electronic manipulation of moving images, he wouldn't surrender control to the audience.

The 1960s also saw the first phase of computer art. Computer scientists like A. Michael Noll and Frieder Nake started to explore the artistic potential of computer graphics, creating abstract compositions based on elaborate computational algorithms. The results of these operational processes were exhibited as printed images, each of which was seen as an exemplary sample out of a whole class of possible results of the programmed operation. The common visual output medium of early digital computers was the plotter.[5] It was only in 1963 that the electronics engineer Ivan Sutherland presented Sketchpad, the first user interface that allowed graphics to be immediately manipulated on a display screen by means of a light pen.[6] Earlier on, computational real-time operations had to rely on input devices like phone dials or buttons and knobs. Nevertheless, we might count early game-based demonstrations of these interfaces, such as Noughts and Crosses (1952) and Tennis for Two (1958), as the very first computer-based interactive abstractions.[7]

VISUALIZING INTERACTION

It took until the 1970s for interactive computer graphics to enter the realm of the arts. In 1971, Myron Krueger, who is considered a pioneer of interactive media art, created

Psychic Space, an interaction environment that detected the movements of the visitors by means of a touch-sensitive floor. In *Maze*, an application designed for that environment, recipients could use their own movements to steer a square through an animated labyrinth displayed on a vertical projection screen. As they did so, they had to deal with a complex and occasionally bizarre set of rules. Krueger wanted to explore and reveal the laws and conventions of interaction. Like the early video games, *Maze* was a symbolic environment within which abstract graphics served to visualize its underlying rule systems and to direct user interaction. In *Videoplace*, however, a system which Krueger developed subsequently, the visitor's silhouette was recorded via video camera, then digitally manipulated and projected. Though the silhouette significantly simplified the visitor's image, it still iconically referenced it, as opposed to the symbolic representation as a simple square in *Maze*. Even today, systems based on motion capture via video camera are one of the main means of interactive installation art. Similarly, the depiction of the user's image as an abstracted silhouette is still common.

In Krueger's works, the silhouette as well as the depiction of the objects and surroundings it could interact with were rather simple in terms of visual definition. One of Krueger's key statements concerning *Videoplace* is that "it is the composition of the relationship between action and response that is important. The beauty of the visual and aural response is secondary. Response is the medium!"[8] While one might suspect that Krueger's attitude was a rhetorical trick to downplay the fact that early real-time computer graphics were technically clumsy, it is all the more astonishing that we find comparable arguments in very recent statements, even concerning the video game. In a series of interviews published around 2007, Yoshikazu Yamashita, one of the lead developers of Nintendo's Wii, defends the simple appearance of the so-called *kokeshi* (which represent players in video game actions) as follows: "The kokeshi might be simple, but your mind helps make it more real. In Wii Sports Baseball, even though the arms and legs aren't shown when the fielders move, it feels realistic when you see them in motion."[9] Abstraction here serves as a means to facilitate the player's identification with his virtual counterpart. The schematism of the representation enhances its universality as a placeholder, to become meaningful only through individual interaction.

In other contexts too, visual minimalism has been used as a means to focus attention on the process of interaction itself. Andrew Hieronymi, in his installation entitled *Move* (2005) (fig. 10.1)—again based on motion capture via video camera—exposes the basic actions carried out by participants in video games, which he identifies as Jump, Avoid, Chase, Throw, Hide, and Collect. To enable and provoke the recipient to perform these actions, Hieronymi sought out very simple visualizations based on moving red and white geometric forms and dots. They are projected onto the floor to visualize core rules and tasks, which are easily deducible and challenge the participant to act. By separating the core mechanics of video game actions from their usually narrative context, Hieronymi puts these actions, their underlying rules, and respective user attitudes on center stage.[10] In this case, action is literally abstracted from any narrative content.

FIGURE 10.1
Andrew Hieronymi, *Move*, 2005. Interactive installation. © Andrew Hieronymi; assistant, Togo Kida.

In interactive works, abstract animations may thus serve to make visual the system's interaction potential and channel the resulting interaction. Often, such works feature rule systems with clearly identifiable goals and thus show close parallels to video games. However, while the video game started as an abstract symbolic system, with the increasing perfection of computer graphics, the tendency was towards seeking a maximum degree of realism, providing illusionistic game environments that mimic real physical settings. The underlying assumption was that games should be immersive and that immersion was facilitated by visual illusionism. As shown, this assumption has recently been questioned by, among others, the Wii developers. Katie Salen and Eric Zimmerman, in their book entitled *Rules of Play*, use the term "immersive fallacy" to denote the still widespread and dominant belief that game worlds should be as realistic as possible. They argue that an intensely pleasurable play experience by no means requires the illusion that one is actually part of an imaginary world.[11] Salen and Zimmerman emphasize that the main goal of games should be to create meaning for players and that such meaning arises through processes of meta-communication—that is, an attitude that is connected to but distanced from the real world.[12] In the same vein, interactive abstract video may offer behavioral systems that reference real-world rules

or actions but actually highlight or scrutinize their workings by abstracting or isolating them. Abstraction, in this context, is a means of visualizing structural conditions or generalizing phenomena by representing their core characteristics. This clearly relates to the original, philosophical notion of abstraction, denoting the generalization of the particular and the concentration on the essential as well as, within the arts, the depiction of general, immaterial or theoretical concepts.

VISUALIZING INTERPERSONAL RELATIONS

Scott Snibbe's *Boundary Functions* (1998) (fig. 10.2), another interactive installation based on camera monitoring and floor projection, also follows a minimalistic approach, this time aimed at directly visualizing interpersonal relations. As soon as more than one visitor enters a demarcated area, straight graphic lines are projected onto the floor so as to partition the area in such a way that each participant is assigned a section of equal size. In geometry, this kind of construction, which is based on distance calculations, is called a Voronoi diagram. As participants move, join in, or leave, the partitioning lines immediately shift to adapt to the new situation. The result is an abstract, dynamic line structure inextricably linked to the people it encircles as they trigger the lines that constantly adapt to their movement.[13] However, as opposed to the rule-based systems of Krueger and Hieronymi, *Boundary Functions* does not present a clear goal but invites recipients to freely explore the visualization and to reflect upon concepts and perceptions of personal space.

Another and more recent example of how abstract graphics can serve as a means to visualize interpersonal relations is Sonia Cillari's *Se Mi Sei Vicino* (If You Are Close To Me), first presented to the public in 2006. Upon entering the dimly lit room containing Cillari's interactive installation, the visitor's attention is immediately captured by a female performer standing motionless in the middle of the room and by two large abstract graphics projected onto two of the walls. Each of the graphics depicts a three-dimensional vertical structure—a spindle-shaped, flexible grid that stretches from the bottom to the top of the projection area. While the upper and lower extremities of this structure are fixed and immobile, the grid itself is in a state of constant, wave-like motion. The nodes of the grid are highlighted as white triangles resembling force arrows. When a visitor approaches the performer, the grid begins to expand sideways and to sprout horizontal peaks. At the same time, an arrangement of metallic sounds begins to play. Touching the performer intensifies the effect. The spaces in the grid begin to fill up, first with gray tones and then with colors. The sounds become louder and turn into a sizzling reminiscent of newly lit fireworks. Thus, the audiovisual feedback can be interpreted as an abstract representation of the performer—specifically, as a visualization (and sonification) of her reactions to people approaching her. These reactions are represented as structures that enter into motion, in the form of uniform rhythms, or momentary peaks or eruptions, accompanied by a crescendo of sound.[14]

FIGURE 10.2
Scott Snibbe, *Boundary Functions*, 1998. Interactive installation. Courtesy of the artist.

Again, though these audiovisual formations are abstract in the sense of being nonfigurative, they are nevertheless representational in that they represent or symbolize the invisible emotional as well as physical tensions that arise in interpersonal encounters.

IMMERSIVE ENVIRONMENTS

Cillari's example clearly evidences that formal reduction is not the only means of interactive abstraction. Interactive abstract video may also be formally elaborate and visually complex. It may even offer overwhelming, visually immersive experiences. The ultimate impossibility of a convincing and fully illusionistic visual imitation of the "real world" also led to concepts of virtual reality that focus on visionary worlds or imaginary environments.[15] Within these, abstract forms are not results of simplification or reduction but result from alienation or pure fantasy. Early and very famous examples are Charlotte Davies's *Osmose* (1995) and *Ephémère* (1998), three-dimensional immersive environments that allow recipients—which Davies calls "immersants"—to navigate virtual worlds. They are equipped with a head-mounted display and a motion-sensitive

FIGURE 10.3
Peter Kogler, *Cave*, 1999. Immersive interactive environment. Computer animation in cooperation with Ars Electronica Future-lab; sound by Franz Pomassl. Courtesy of the artist and Ars Electronica. Photograph by Pilo Pichler.

chest harness and can navigate the environment by means of their own breathing and movement. Though the displayed worlds loosely resemble forests, underwater worlds, or clouds, and—in *Ephémère*—also the interior of the human body, they are far from being realistic representations. These environments are independent of any material constraints or Cartesian rules. They appear blurry, painterly, immaterial, transparent, and ephemeral. As Christiane Paul emphasizes, "one of the extremely effective strategies Davies employs is to avoid representational realism in the creation of her worlds."[16]

While Davies worked with references to the organic and created vague and uncanny realms, Peter Kogler and Franz Pomassl realized an equally immersive, interactive virtual environment, which is, however, nearly exclusively based on graphic patterns and geometric structures and makes no attempt at triggering familiar environments. Their 1999 *Cave* (fig. 10.3) application was produced for the Linz Ars Electronica Center's CAVE environment, a space with rear-projection screens on five surfaces, within which three-dimensional effects could be experienced through special glasses. Kogler and Pomassl's work invited visitors to immerse themselves in a labyrinth of graphically patterned tubes, pipes, and passageways, accompanied by an impressive soundscape. By means of a joy-

stick, they could navigate this immersive system, inhabit and explore it.[17] While the visual style of this environment has few commonalities with Davies's organic shapes, both projects apply abstracted or nonfigurative compositions to heighten their respective visually immersive qualities, transporting the recipients into wholly artificial realms.

Interactive abstractions, as we have seen so far, may thus visualize processes of interaction, or they may invite recipients into a three-dimensional, navigable world. Both categories are aimed at modes of aesthetic experience that I have elsewhere denoted as experimental exploration. The recipient explores an artificial environment or a rule-based setting by means of experimental navigation or testing interaction. In the remainder of this essay, I will introduce another category of interactive abstraction and discuss works that encourage recipients to actually become expressive themselves, and to "create" abstract animations.[18]

(AUDIO)VISUAL INSTRUMENTS

Even before exploring the potentials of full body interaction in his installation pieces, Scott Snibbe's fascination with early experimental and abstract film had prompted him to devise screen-based installations that enable recipients to directly engage with visual forms. In 1989, he presented his first interactive application, named *Motion Sketch*, a kind of painting software for animated geometric forms, which resembled those used by Oskar Fischinger in his early films. *Motion Sketch* allowed users to select forms from a menu, control their size, color and speed, and set them into motion on the screen. In 1995, Snibbe also presented a multi-user version of *Motion Sketch*, entitled *Motion Phone*.[19]

Although *Motion Sketch* and *Motion Phone* were exclusively visual, the 1990s saw the development of several applications that aimed at audiovisuality, at a mapping or reciprocal control of electronic sounds and abstract graphics. Media artist Golan Levin has identified three metaphors that guide such mapping processes: scores, control panels, and "interactive widgets."[20] The reference to musical scores is evidenced in many works of Toshio Iwai. Between 1992 and 1994 Iwai developed a system called *Music Insects* in which recipients could use a mouse to create drawings on a monitor. The system assigned musical notes to the drawing's pixels, based on the colors in which they were drawn. These notes were activated by preprogrammed "insects" representing different musical instruments, which ran across the screen and functioned as pick-ups. As soon as an insect made contact with a pixel, the corresponding note sounded. In 1995, Iwai created *Piano—as Image Media*, an installation in which visitors used a trackball to draw shapes and patterns that were projected onto transparent gauze and animated so that the individual pixels of the patterns moved line by line toward a real piano, which—controlled by a computer—interpreted them as musical notation and played the corresponding notes. The pixels then appeared to traverse the keyboard, only to stream out of the piano and head upwards, changing into colored geometric objects as they flow.[21]

The second metaphor identified by Levin, the control panel, was widely applied throughout the 1990s but has more recently reached a high level of technical and artistic sophistication with a device entitled *reacTable*, a highly complex music table conceived and developed since 2003 by a research team at the Pompeu Fabra University in Barcelona. It is a round table on which various cube- and disk-shaped building blocks tagged with markers can be positioned. They function as sound generators, sound filters, and sound controllers, while the computer graphics displayed on the table visualize the current activity of the blocks as well as their interplay by means of circular graphics surrounding the blocks and connecting, dynamic lines indicating frequencies and rhythms.[22]

The third category of interactive audiovisual systems makes use of what Levin calls interactive widgets, "a group of virtual objects . . . which can be manipulated, stretched, collided, etc. by a performer in order to shape or compose music."[23] One example for such systems is *Small Fish*. In 1998 and 1999, Kiyoshi Furukawa together with Wolfgang Münch and Masaki Fujihata created this screen-based system consisting of fifteen different audiovisual applications. They all present predesigned geometric forms or painterly shapes, which trigger sounds while moving across the screen or encountering moving "pick-up-dots." The user can shift the sounding elements around in order to manipulate the composition.[24] The results are colorful animations of geometric or organic forms, some of them resembling abstract paintings of the classical avant-garde—Paul Klee or Joan Miró for example. However, while the user may influence their arrangement and movement, the shapes of the forms themselves do not change. This is why Levin criticizes the poor granularity of control of such systems, within which "canned ingredients, all too inevitably, yield canned results."[25]

Therefore, in 1997, he collaborated with Scott Snibbe in developing new kinds of visual instruments, aimed at creating "phenomenological interfaces that engage the unconscious mind directly."[26] They were searching for aesthetic solutions that, instead of relying on geometric or clear-cut predesigned forms, would reference the process of drawing, as pioneered by the abstract films of Len Lye. They acknowledge that in Lye's films, "for the first time the hand and the spontaneous mind are visible on celluloid—like watching the inner thoughts of the artist."[27] Fascinated by this effect, Levin and Snibbe sought out ways to make the process of drawing itself the direct point of departure for animation. In *Escargogolator*, for example, the user's mark (set via the cursor) was animated based on the geometrical construction of so-called evolutes, which resulted in a twisting and curling, expanding and shrinking of the original mark. Thus, the user created a dynamic mark that determined the conditions of animation. One could then "witness how those conditions evolve and disintegrate over time."[28]

In their subsequent individual works, Levin and Snibbe each explored a further aspect of interactive abstractions. While Levin continued to elaborate on the "painterly metaphor" and started to develop audiovisual systems, Snibbe further experimented with algorithms referencing geometrical figures or physical laws, creating dynamic

systems whose parameters can be controlled by the users. One example is *Bubble Harp* (1997), which, like *Boundary Functions*, is based on the idea of a Voronoi diagram. This time, in addition to setting singular dots on the screen to cause enclosing lines, the user can also draw lines, generating a sequence of dots each of which continuously repeats its initial movement and provokes enclosing lines to continuously adapt. As dots can be added endlessly, the animation may develop into a very complex, dynamic network. A further work of Snibbe, entitled *Gravilux* (1998), takes gravity as a point of departure. Here, the cursor serves to attract or repel the elements of an artificial grid of dots, whose color, proximity, and size can be controlled via a menu. The grid thus expands or shrinks, bends or curls, and dots may accumulate or diverge dynamically.

While Snibbe thus focused on allowing users to influence and play with systems that feature physical laws and properties (or at least reference them), Levin further explored the "idea of an inexhaustible, extremely variable, dynamic, audiovisual substance which can be freely 'painted,'"[29] creating a series of works entitled *Audiovisual Environment Suite* (1999–2000). In one application of the suite, named *Yellowtail*, shapes drawn by means of a mouse are animated as if backwards, reenacting the impulse that informed the act of drawing. In addition to the direction of movement, also the speed of the user's mark is measured and informs the breadth and animation speed of the shapes. Sonification of the shapes is achieved through the overlay of the animations with an inverse spectrogram, which interprets the graphics as sound notation. Thus the dynamics of drawing are represented and animated audiovisually; the generated animations actually represent indexical traces of the user's expressive actions, which may then be contemplated and studied, facilitated by the fact that the animations are looped continuously.

At the end of the 1990s both Snibbe and Levin abandoned the work with standard interfaces to create large-scale interactive installations. Snibbe started to explore the aesthetic potentials of the human silhouette, inviting recipients to perform movements that were replayed, collected, and countered with graphic animations on a big screen projection.[30] Levin continued to develop audiovisual systems but explored interface solutions that enabled gestural input, and thus more intuitive interaction. The so-called *Manual Input Workstation*, which Levin created together with Zachary Lieberman in 2004, allows the recipient to create and manipulate sounding shapes by using hand gestures in a kind of shadow play. Visitors can place cardboard shapes on the glass top of an overhead projector so that shadows of the shapes are projected onto the facing wall. A computer system records the shadows via a video camera, analyzes them, and generates animated audiovisual objects that are superimposed via a video projector onto the original overhead projection, the sound being played through adjacent speakers. Visitors can use hand movements and gestures to discover more sophisticated ways of creating dynamic shapes. The work offers different program modes. One of them, entitled *NegDrop*, invites the recipient to create closed contours that the system then fills with colored shapes. If the contour is opened, the shape inside drops to the bottom of the screen and bounces repeatedly, each time triggering a sound. The sounds vary,

depending on the size, the form, and the speed at which the shapes fall. The factors that contribute to the generation of notes (volume, pitch, and timbre) are directly assigned to the characteristics underlying shapes (volume, contours, and position). Thus, the possibility of manipulating the sounding objects in real time allows the recipient to observe the interplay between shape and sound precisely.[31]

MERGING OF INTERACTIVE AND GENERATIVE IMAGING

While Levin had thus shifted to focus on audiovisual interactions, the exploration of a painterly metaphor was restated in the 2000s by Camille Utterback, whose *External Measures Series* not only takes the idea of interactive abstract painting to the realm of full body interaction but also significantly advances the complexity of the resulting composition.[32] As opposed to the applications of Levin's *Audiovisual Environment Suite,* the works of the *External Measures Series* concentrate exclusively on visual expression. They elicit a wide variety of painterly marks within one composition, as if resulting from the use of different brushes, colors, and drawing and painting techniques, merging into one complex dynamic composition. Technically, the works are again based on an overhead camera recording the movement of people in space, which is processed and shapes a wall projection displaying the resulting composition.

In *Untitled 5* (2004) (fig. 10.4), the fifth installation of the series, the movement of a filigree network of black lines is controlled by the body movement of the visitor. The user's path is marked by a thin, curved red line, while it also effects blot-like forms at its contours. Once they have appeared, these blots start to move away from their point of origin and leave traces resembling brushstrokes.[33] Also the next work of the series, *Untitled 6* (2005), starts with a filigree network of lines controlled by the visitor's silhouette.[34] In addition, his direction of movement is represented by a sequence of small cartoon-style clouds. These cloudlike marks "store information" about the movements they represent. Utterback explains that "[a] second movement over these marks releases them to continue moving with their stored momentum."[35] Their prior direction of movement now triggers monochrome forms that extend like irregular stripes or ribbons, effecting openings within the picture plane. When these stripes or ribbons once again cross the path of the filigree network of lines controlled by visitor movement, they accumulate and bleed out into semi-transparent blots that seem to flow like watercolor, resulting in clouded contours.

We can see that, in these works, the impact of the recipient's action is not restricted to the actual moment of interaction, because the composition is also influenced by prior movements, thereby adhering to a complex and only partially controllable, generative process. As such, the works of the *External Measures Series* represent a merging of generative software and interactive abstractions, which had been heralded by works like Snibbe and Levin's *Escargogolator,* but are expanded here so as to result in a fully fledged painterly and dynamic composition.

FIGURE 10.4
Camille Utterback, *Untitled 5*, 2004. Interactive installation. Installation view. Courtesy of the artist.

But again, the painterly aesthetic is only one possible option for interactive abstractions including generative elements. Austrian artist LIA has been working on comparably complex applications that, however, instead of presenting organic shapes, focus on graphical elements and structures. In her works—some of which were freely available as online applications early on—a multitude of gossamer lines may grow, curl, or meander; geometric shapes may multiply, build formation, and wander across the screen, while the user can influence their evolution by selecting starting points or formal parameters.[36]

FROM SCIENCE MUSEUM TO APP STORE

Until recently, works like those discussed so far have been presented nearly exclusively in museum and exhibition contexts, notwithstanding early attempts to distribute them online or on CD.[37] Some artists have furthermore attempted to market their developments as audiovisual instruments. Toshio Iwai, for example, has created such an instrument together with Yamaha, called *TENORI-ON*,[38] and the *reacTable*, too, is available as a market-ready device. Another ambitious attempt to commodify this form of art was the *softwareARTspace* inaugurated in 2005 by Steven Sacks, director of the Bit-

FIGURE 10.5
LIA, *Sumo5*, 2012. iPhone/iPad application. © LIA, www.liaworks.com.

forms Gallery in New York. While distributing each piece as a limited edition of 5,000, he imagined a software art station in private households on which "you can easily switch amongst your collection."[39] However, the blog to this initiative contains only one entry, and no new works have been added to the initial selection, indicating that this attempt did not prove successful. Supposedly, this was also due to the launch of the App Store, a platform that, though mainly intended for purposes that lie beyond those of the art world, actually revolutionized the distribution of interactive abstract art.

Scott Snibbe recounts that he had switched to full-body interaction systems suitable to serve as museum exhibits, abandoning his early screen-based works, because he didn't see a way to distribute the latter. But with the advent of the iPad, "all of a sudden there was a direct channel to individual human beings, to offer them something seemingly absurd and useless and yet that would give them intense amounts of joy and pleasure. . . . With the iPad, I could just go directly to people and say: check this thing out."[40] The iPad enables an easy distribution of applications that provide "interactivity underneath your fingertips."[41] Snibbe thus reprogrammed his early screen-based applications to work as apps—as did Levin and LIA. In 2010, Snibbe released, among others, *Bubble Harp* and *Gravilux* as apps, followed by a relaunch of *Motion Phone* in 2012. By August 2010, the first apps Snibbe launched, together, had been downloaded more than 400,000 times.[42]

This success obviously attracted the attention of Icelandic artist Björk. Björk had worked with audiovisual instruments before and used the *reacTable* in some of her performances. For her album *Biophilia*, she commissioned Snibbe to direct the creation of an app for each song, released subsequently in the second half of 2011. In addition to the lyrics, each app contains an interactive play mode, accompanied by an "animation" (essentially a graphic visualization of the song) and the score of the song. Most of the play mode variants enable the user to explore or alter a sound layer that is closely related to the actual song, by manipulation or control of interactive graphics that allude to the theme of the song. They vary from visualizations of microbiologi-

cal processes like blood flow or virus attacks to astronomical references and abstract geometric compositions.

Some of the *Biophilia* apps make use of the tablet PC's new features, enabling an operation via multitouch (*Thunderbolt*) or a control by means of tilting the device (*Crystalline*). Also LIA is experimenting with the integration of new control features provided by the iPad and has implemented combinations of multitouch, tilting, and shaking in her iPad apps (*Sum05* [2012], fig. 10.5, and *PhiLIA 01* [2009]). The tablet PC thus not only provides a promising new distribution platform for interactive abstractions, but its technical features also allow for the implementation of new ways of control or manipulation. The following years will show how far and within which contexts these potentials will be extended. Possibly, they may further push the merging of visual arts and music, while also challenging the boundaries between art and entertainment, as well as between the arts and graphic and interaction design.

As has been shown, abstract video has played a central role within the development of interactive imagery. It is perfectly suited to channel or invite interaction with computer-based systems, be it in the form of visualizations of interactive operations, virtual worlds to be explored, or expressive tool. It is, however, important to note that, though such interactive abstractions are not necessarily narrative nor figurative, they may well be representational, in that they may reference reality in various ways, scrutinizing them by means of isolation or alienation. As such, they often provide models of visualizing real-world phenomena, theoretical concepts, or musical compositions that elude mimetic representation.

NOTES

1. For an overview of early experimental video, see, among others, David Dunn, ed., *Eigenwelt der Apparatewelt: Pioneers of Electronic Art* (Linz, Austria: Ars Electronica, 1992); and Woody Vasulka and Peter Weibel, eds., *Buffalo Heads: Media Study, Media Practice, Media Pioneers, 1973–1990* (London/Cambridge: MIT Press, 2008).

2. See also John Hanhardt's essay reprinted in this volume, discussing installation pieces presented in 1979 and 1980 by Stan VanDerBeek and Al Robbins, which involve the audience in various ways.

3. Nam June Paik, "About the Exposition of Music," *Décollage* 3 (1962).

4. Edith Decker, *Paik Video* (Cologne: DuMont, 1988), 60–66.

5. On early computer graphics, see the excellent study by Christoph Klütsch, *Computergraphik: Ästhetische Experimente zwischen zwei Kulturen: Die Anfänge der Computerkunst in den 1960er Jahren* (Vienna/New York: Springer, 2007).

6. Ivan Edward Sutherland, *Sketchpad: A Man-Machine Graphical Communication System,* PhD thesis, Massachusetts Institute of Technology, www.cl.cam.ac.uk, 17.

7. Tristan Donovan, *Replay: The History of Video Games* (Lews: Yellow Ant, 2010), 6; and Stefan Höltgen, Johannes Maibaum, and Matthias Rech, "Tennisspielen mit Physik," *RETRO Magazin* 24 (2012), 32–37.

8. Myron Krueger, *Artificial Reality II* (Reading, MA: Addison-Wesley, 1991), 86.

9. Yoshikazu Yamashita, quoted in "Wii Sports 2: A Question of Realism," Iwata Asks, www.nintendo.co.uk/Iwata-Asks/Iwata-Asks-Wii/Iwata-Asks-Wii-Sports/2-A-Question-of-Realism/2-A-Question-of-Realism-217824.html.

10. See Andrew Hieronymi, *MOVE*, http://users.design.ucla.edu/~ahierony/move/.

11. Katie Salen and Eric Zimmerman, *Rules of Play: Game Design Fundamentals* (Cambridge, MA: MIT Press, 2004), 450. This critique of visual illusionism as a hindrance to interaction may even lead to a total rejection of visual representations in interactive art. Canadian artist David Rokeby believes that the reproduction of a recipient's body on a projection screen is incompatible with its physical perception: "When playing with Myron Krueger's work . . . where you . . . had a visual shadow avatar on the screen, your feeling of being in your body was blasted away by negotiating the manipulation of an avatar separate from your body." Rokeby himself thus neither depicts nor represents the human body, instead using acoustic feedback to encourage physical movements and enable enhanced self-awareness. Lizzie Muller and Caitlin Jones, "Interview with David Rokeby," question 11, *Very Nervous System:* Documentary Collection, Daniel Langlois Foundation, 2010, www.fondation-langlois.org/html/e/page.php?NumPage=2187.

12. Salen and Zimmerman, *Rules of Play*, 450–53.

13. See "Boundary Functions, 1998," Scott Sona Snibbe: Projects, www.snibbe.com/projects/interactive/boundaryfunctions.

14. See my extensive analysis of this work in Katja Kwastek, *Aesthetics of Interaction in Digital Art* (Cambridge, MA: MIT Press, 2013), 241–48.

15. See my detailed discussion of the concept of immersion in interactive art in Katja Kwastek, "Immersed in Reflection? The Aesthetic Experience of Interactive Media Art," in *Immersion: Historical and Current Perspectives on a Key Term in Art and Media Studies*, ed. Burcu Dogramaci and Fabienne Liptay (Amsterdam/New York: Rodopi, 2015).

16. Christiane Paul, *Digital Art* (Thames and Hudson: London 2003), 127.

17. Pascal Maresch, "Peter Kogler / Franz Pomassl, CAVE," in *Lifescience*, ed. Gerfried Stocker and Christine Schöpf (Vienna: Springer, 1999), 364–66.

18. See my discussion of modes of experience in interactive art in Kwastek, *Aesthetics of Interaction*, 128–34.

19. Scott Sona Snibbe and Golan Levin, "Interactive Dynamic Abstraction," in *Proceedings of the First International Symposium on Non-photorealistic Animation and Rendering*, Annecy, France, June 5–7, 2000 (New York: ACM, 2000), 21–29, www.snibbe.com/download/publications/academic/2000Dynamic_NPAR.pdf.

20. Golan Levin, "Painterly Interfaces for Audiovisual Performances," MS thesis, MIT Media Laboratory, 2000, 34, www.flong.com/storage/pdf/articles/thesis300.pdf.

21. Toshio Iwai, "A Short History of the Works," Doors of Perception, 1993, http://museum.doorsofperception.com/doors1/transcripts/iwai/iwai.html; and Toshio Iwai, "Piano—as Image Media," *Leonardo* 34, no. 3 (2001), 183.

22. See Sergi Jordà, Günter Geiger, Marcos Alonso, and Martin Kaltenbrunner, *The reacTable: Exploring the Synergy between Live Music Performance and Tabletop Tangible Interfaces*, Music Technology Group, Pompeu Fabra University, Barcelona, Spain, http://mtg.upf.edu/files/publications/reactable_tei2007.pdf.

23. Levin, "Painterly Interfaces," 34.

24. See the project documentation at http://hosting.zkm.de/wmuench/small_fish.

25. Levin, "Painterly Interfaces," 46.

26. Levin and Snibbe, "Interactive Dynamic Abstraction."

27. Levin and Snibbe, "Interactive Dynamic Abstraction."

28. Levin, "Painterly Interfaces," 66.

29. Levin, "Painterly Interfaces," 56.

30. See Scott Snibbe, *Visceral Cinema: Chien*, exhibition catalogue (Los Angeles: Telic Gallery, 2005).

31. See my detailed analysis of the work in Kwastek, *Aesthetics of Interaction*, 225–34.

32. Camille Utterback, *"Untitled 6,"* 2005, http://camilleutterback.com/projects/untitled-6/.

33. Utterback explains that in *Untitled 5*, "animated marks are both pushed away by, and collect around the edges of people's silhouettes." Utterback, *"Untitled 6."*

34. This time, these lines are red and described as vein-like by the artist. Utterback, *"Untitled 6."*

35. Utterback, *"Untitled 6."*

36. See LIA's website at www.liaworks.com.

37. See, among others, ZKM's *artintact CDROMagazine*, issued yearly from 1994 to 1999.

38. Iwai also developed an early application for the Nintendo DS game console entitled *Electroplankton*.

39. Software{ART}space (blog), www.softwareart.blogs.com/.

40. "Scott Snibbe, Interactive Artist." *CNN*, The Next List, December 18, 2011, http://vimeo.com/39725809, 4 min.

41. "Scott Snibbe, Interactive Artist," 4 min.

42. Reyhan Harmanci, "For Digital Artists, Apps Provide New Palette," *New York Times*, August 19, 2010, www.nytimes.com/2010/08/20/us/20bciart.html?_r=0.