Animation and Vitality

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The world presented through digital technology is an increasingly animated world. World Wide Web content shifts and morphs through the use of rollovers, pop-up windows, and embedded movie clips and illustrations. Street signs and billboards shimmer and change to catch the eyes of passersby. Animated computer and video games are now one of the most popular entertainment forms (Kowaliski 2009), while older entertainment forms, such as films, increasingly incorporate computer-generated special effects. Despite the fact that our world is increasingly an animated world, only a handful of scholars have begun to consider the manifold ways that animation inflects the way we interact with the environments we find ourselves in.

One especially interesting application is the use of animation in scientific practice. Biologists are very keen to find ways to visualize the way that cellular components move, fold, and assemble. As Janet Iwasa, Lecturer in the Department of Cellular Biology at Harvard, recently confided to the New York Times, “Just listening to scientists describe how the molecule moved in words wasn’t enough for me…What brought it to life was really seeing it in motion” (Olsen 2010). Her collaborator, Tomas Kirchhausen, anti-intuitively suggests that it is the realism of animation that allows him to problem solve at the molecular level: “All that we had before — microscopy, X-ray crystallography — were all snapshots. . . . For me, the animations are a way to glue all this information together in some logical way. By doing animation I can see what makes sense, what doesn’t make sense. They force us to confront whether what we are doing is realistic or not” (Olson 2010). By allowing researchers to focus on interactions (as opposed to defining molecular components), animation can then serve as the
glue that allows the molecular scale of biological interactions to come to life. For instance, in one animation entitled *Mitochondria: Powering the Cell*, the mystical glue referred to by Thomas Kirschchenbaum above allows animators to quickly shift scales in time and space (BioVisions 2009). It does this very seamlessly, complete with cinematic effects like fly-through and circling shots, all accompanied by dramatic music.

The Harvard group is not the first to recognize animation’s special capabilities for depicting life. Disney artists Ollie Johnston and Frank Thomas also recognized animation’s ability to suggest an “illusion of life” (Johnston and Thomas 1995). Even the Latin root, *animat*, means to “instill with life”. Perhaps a detailed investigation into the processes of animation might help reveal new ways of thinking about change, time, and vitality? And why doesn’t the seemingly similar art of film carry the same strong associations with life?

**Animation and change**

Unlike film, animators must create a new world for every frame. This offers those of us who study animation an insight into the role of stability and novelty in change. For example, imagine one of the simplest forms of animation, line animation directly on the film. An animator confronted with a strip of blank celluloid must draw their elements in a way that allows for the continuity of form and location within each frame in order for the element to persist beyond the fleeting durations of the projected single frame. This already places the practices of animation at a conceptual distance from film. In film, the primary task is to capture the movement of a stable world already in motion. [1] The tradition of filmmaking thus isn’t forced to confront the importance of stasis in the creation of novelty. In animation, the immediate task is not, how do I put this world into motion (by directing the subjects in the film) and then capture it on film (by cinematography) but, rather, how do I best utilize the relationship between change and stability to create a perceptible world in constant change?

Much of the history of animation can be seen as an exploration of how to add...
stability to a world that has to be continually recreated. How the animator creates stability in her animated world informs that world with a unique poetics of change. For instance, the South African fine art animator William Kentridge works by drawing on paper with charcoal and capturing on film a drawing at a specific stage. He then erases and redraws parts of the drawing in order to allow specific parts of the world to change. Kentridge’s technique builds a world where gestures and objects precipitate from smudged black masses and linger, caught between the constant pulse of change and ghostlike traces of erased images. [2]

Animation’s balancing of ‘creating stability from change’ is very different from the metaphysics of ‘capturing movement’ that film seems best at. According to André Bazin, in his essay on The Ontology of the Photographic Image, “The objective nature of photography confers on it a quality of credibility absent from all other picture making. In spite of any objections our critical spirit may offer, we are forced to accept as real the existence of the object reproduced, actually ‘re-presented, set before US’ that is to say, in time and space. Photography enjoys a certain advantage in virtue of this transference of reality from the thing to its reproduction” (Bazin 1960: 7-8). According to Bazin, photography’s special qualities allow for the capturing and re-presenting of the real existence outside of the camera. It is also this ability to reflect reality that Bernard Stiegler grasps at when he suggests that photography is a “mirror reflecting the past”. The mirror of photography is good at capturing “what happened” but since this is always something that has just passed, this reflection is always an “adieu” to what has just occurred (Stiegler 2008: 16).

It is important to emphasize that my use of Stiegler and Bazin is not intended to deny that interventions happen during the photographic process. Cameras are positioned, exposure times chosen, scenes are edited, and elaborate scenes can be posed. Rather, I’m more interested in how analyzing the processes of filming and animation allow for a different emphasis on when and how these interventions are applied and how they help us understand a world in constant change. [3]

Film and Movement

Film is able to depict movement despite the fact that each moment is captured on a stationary frame. In a phenomenon referred to as “the persistence of vision”, the act of perception blends each frame together into a continuous movement. In order to do this, the frame rate of the film has to be within specific allowances of perception (in this case 1/24th of a second) and each frame needs to be separated by a gap. Movement is either continuous or discontinuous based on the relationship between frames. Large jumps in continuity between frames leads to the choppiness of the movement of a subject, whereas small changes can lead to the perception of slow, gradual change. Film’s ability to depict movement, then, is a manifestation of the relationship between the duration of the internal frame of a shot and the differential of the border of the frame. As Deleuze notes in Cinema 1, “It is movement itself which is decomposed and recomposed. It is decomposed according to the elements between which it plays in a set: those which remain fixed, those to which movement is attributed, those which produce or undergo such simple or divisible movement. . . . But it is also recomposed into a greater complex indivisible movement according to the whole whose change it expresses” (Deleuze 1986: 21-22). A complex world of change, the relative change of all the objects captured in a film, is then recomposed as the differential between framed images on celluloid.

A good example of this is the use of stop-motion animation. Here the animator uses the displacement of characters between frames in order to create a sense of movement in the film. If the animator wants to bring an object to life, she places the object differently in the frames. The object then appears to move by manipulating the relationship between frame and the composition of the shot, the de- and re- composing mentioned by Deleuze above. The resulting film allows for the appearance of an inanimate object to come to life through movement.
Recent scholars of animation have also noticed how important motion is for understanding change. The best of these also take a broad understanding of what constitutes movement. Perhaps no one has done a better job exploring this than Erin Manning in her book *Relationscapes*. In her description of the work of Canadian animator and filmmaker Norman McLaren, Manning writes:

> Like Étienne-Jules Marey before him, McLaren’s experimentation with the incipiency of movement involves creating new techniques to catch movement in passing. His interest in technique is an exploration with the technicity of the “how” of the movement moving: ‘How it moves is as important as what moves’ (McLaren 2006). The how of movement moving is movement’s virtual becoming, its preacceleration. (Manning 2009: 113)

The beauty of this quotation is that Manning, who has earlier worked through theories of movement of Henri Bergson, Alfred North Whitehead, and Gilles Deleuze, recognizes not just movement in its actuality but in its qualities (the “how”), its felt rate of change (the “movement of movement”), and in its virtual tendencies (the “preacceleration” of movement). Manning suggests that animation expresses this tendency to movement in a specific way, through the interval between frames:

> Movement’s preacceleration is expressed in animation through the active interval between frames. Thanks to the persistence of vision, the interval between the frames remains imperceptible as such, the moving-image apparently seamless unity across the cuts of the frames. Yes the interval is nonetheless active in the watching: it is a virtual event in which the spectator unwillingly participates. We do not actually see the interval, but we do feel its force as it infolds into the perception of the moving image (113-114).
This reliance on the interval between the frames is a reference to the specific dynamics of how the frames on a film relate to each other. The interval, or the space between one frame and another, allows for motion. It provides the ‘cut’ that allows for perceptible change across continuity. This broad conception of movement is especially useful for thinking about how non-movement can also highlight the tensions in a film. Since movement is always felt in relationship to its preacceleration, the lack of movement is always sensed as the potential for more movement. A pregnant pause can suggest future change through its stagnation and thus allows one to become aware of movement and its tendencies.

Elizabeth Buschman’s film in this issue of *Inflexions, downhile* (2009), is interesting in this regard. As the dancers repeat gestures while dancing on a hill during sunset, LEDs on their chests flash with each beat of their heart. Buschman choreographs a number of different types of movement by making the viewer aware of pre-accelerations. How does the motion of the heartbeats relate to the motion of the movement of the bodies? To the setting sun? Although a very tightly inscribed definition of movement would not be able to think about how different changes in the dance effectively relate, the broader definition of movement highlights the incipience of change and the non-reducible effects of movement relating to other movements (Buschmann 2009).

**Movement and Life**

These implications also bleed into how one thinks of life and vitality. Motion has long been implicated with life, where the vitality of a living being is judged by its ability to command movement. Many nineteenth century theories of life, for instance, privileged motion as not only an important indicator of life (remember that over long time scales, even plants appear to be in constant motion and bacteria engage in simple directed motions such as chemotaxis), some went as far as to suggest that motion was a key indicator for the development of consciousness. According to the turn of the twentieth century evolutionary biologist, David Starr Jordan, brains developed to keep animals from running...
into things. “All sensation has reference to action. If a creature is not to act it cannot feel. Wherever motion exists there is some sensitiveness to external conditions, and thus is of the nature of mind” (Jordan et al. 1919: 259). Movement was the privileged quality for ordering how different life forms related to each other. [4]

The benefit of this position is that by placing activity as a necessary condition for cognition it allows for a perspective of the world that is inherently embodied and doesn’t only privilege clear and distinct reasoning as a modality for processing the world. Subjects are always engaged through relating, perceiving, emoting, and moving, so recognizing how these inform experience is important. The problem of this position is that it can unwittingly emphasize an older conception of a dynamic agent, where movement is too easily equated with personal vitality and social worth. When the world is thought to be static, and objects are then put into motion across a static background, it is commonly perceived that the subject is doing the movement. What is lost is the perception of a world in movement that occurs around the subject.

There are other problems with this as well. Not only does this idea of a moving subject highlight a limited, subject-centered agency, it also tends to conceive of a world where all forms of force are thought of in terms of mechanics. We see this in the quote from Jordan above, when he quickly subsumes sensation to the importance of action. For Jordan, what is important is to remain active because action allows one to distinguish between one’s self and a static world. Although useful, sensation should direct but not overshadow action; to do so would be to literally reduce agency to vegetation. He even warns against the danger of ennui that can be brought on by reading too much French literature as it can lead to feelings that are divorced from the active principle of movement. If rendered too simply, thinking of force only in the mechanistic sense of the displacement of objects through space can lead to the dangerous equating of a subject’s vitality with that subject’s ability to move.

Yet, as we have already seen, the problematic of animation is not so much ‘how
to create movement in a stable world’ but ‘how to create stability from a world in constant flux’. Consequently, animatic perception is not so much about subjects and objects, per se, but about how animators choreograph differing periodicities of change to create unique worlds of preacceleration, change, and potential.

**Movement and time**

It is for these reasons that many who analyze animation do so by using ‘time’ instead of ‘motion’ as the main analytic. Many of these studies incorporate Gilles Deleuze’s construct of the time-image to help shift the emphasis of the analysis away from movement, per se, to the analysis of time as a quality dependent upon but irreducible to movement. [5] These studies do this however, by adopting a specific approach to manipulating film: that of the editor as she splices disparate images together in order to evoke a sense of time abstracted from the movement of elements within a scene.

Verina Gfader adeptly applies this strategy as she argues that the flickering screens seen in Phillipe Parenno’s animations rupture space and allow for animation to erase itself. Gfader uses Deleuze’s concept of ‘point flicker’ in her essay to explain the “moment in film where the image – a contrasting black and white screen, a ‘lighting’ that goes on and off – is constituted outside organic representation (i.e. the figurative), and is explicitly associated with dynamics inherent to animation” (Gfader 2008: 150). Parenno’s use of flickering screens, then, operate much like the dynamics of the ‘cut’ in the time-image, where the relationship between frames is broken through dis-continuous juxtaposition. This allows for an experience of time not wholly dependent upon content and a type of perception that moves beyond the recognition of organic forms in motion.

It is important to note that Gfader’s use of the time-image still relies on the cinematic elements of the integrity of the frame and the juxtaposition of frames. The difference is in how the manipulation of the relationship of frames allows for new ways of relating time and space. The movement-image used the gap
between the frames to create the illusion of continuous movement. Parenno’s flicker films use the gap between frames to disrupt sequential movement. As Deleuze recognizes in his description of the time-image in the Preface of the English edition of *Cinema 1*, “it is no longer time which is related to movement, it is the anomalies of movement that are dependent on time” (Deleuze 1986: ix). These discontinuous juxtapositions disrupt the movement of the subject and allows one a sense of change independent of the movement of actors or objects.

It is important to recognize that although this disruption in continuity gives the viewer a new way of thinking about change, it does so in a very limited fashion. The problem is that the time-image still conceives of the image frame as the producer of change. The frame operates as a “closed system” where the differential between frame and gap create information (Deleuze 1986: 12-18). This is very much an editors’ and directors’ view of change where the director puts scenes into motion through framing and the editor brings together disparate motions by creating cuts in sequences. Change then only becomes that which breaks stasis to create either movement or time.

At this rudimentary level, the problem with this is that it assumes that force is creative only when it breaks stasis. What we are left with is a binary metaphysics: inside frame/outside frame, change/stasis, or force/representation. Is it possible to think of a type of change where change itself is primary and stasis is only a by-product of the combination of different rates of change? Is it possible to see how all the elements in a filmic sequence contribute to giving that sequence its own unique sense of change beyond the skills of the editor and director? For instance, can we imagine how the trees might sway at a different rate of movement than the accelerating automobile and come to understand how this contributes to our feeling of time and movement within perception?

An investigation into animation allows one to see how change can also occur as a product of the differentials within a frame (through the compositing of layers) in addition to the differential across the inside and outside of a frame (through
frame, scene, shot, and cut). These differentials are what Thomas Lamarre has recently named the “animetic interval” (Lamarre 2009). This double set of differentials, i.e. the binary inside/outside of frame and multiply diverse composition between layers within the frame, provides profound insights into the relationship between motion, time, and life beyond the negative connotation of change as disruption of representation.

**Animation and change**

Although animation shares with film the importance of the cut between frames, it also adds another compositional element: the use of multiple layers to compose the complex temporal relationships within the frame. To balance change and continuity, the animator must hold some forms in the film static while others morph and change. The animator, then, never just puts an object in motion in front of a static background, or just disrupts continuity through editing, she is always choreographing the changing rate of relationships, and she needs to break up each frame into layers to accomplish this.

This approach is best envisioned by imagining how cel animation is created, an art made famous by Max Fleischer, Walt Disney, and Warner Brothers as well as others. Every image in cel animation is a composite of the layered images of multiple sheets of celluloid. The scene moves, or comes to life, when the objects on one sheet move in relationship to the objects on other sheets. For instance, animating two characters talking in the park requires the construction of two celluloid layers: 1) a background layer with grass, trees, and shrubs and 2) a subject layer with two figures in different poses (Lutz 1920: 70-71). The subject moves by changing the layers of the subject in relation to the layer of the background. The difference between the rate of movement between the objects depicted on each of the surfaces allows for the appearance of differential rates of movement in the world. The animator recomposes each frame of film by folding together these different rates of change. This process of folding layers together to make a complex image is called “compositing”.

The more seamless the composited image, the more animation appears to be like...
a simple cinematic shot, capturing a world as it unfolds. This is because in film, the relationship between durations within the cel are already compositied and flattened by the camera’s remarkable ability to instantaneously record complex information about relationships. All one needs to do to film the scene of two people talking in the park is to let a camera roll. Film automatically flattens all the temporal information into a series of single frames. In a sense the camera has already compositied the differential rates of change of many different elements within the image. One of the values of studying animation, therefore, is that it makes apparent how the relationship of two items in differential rates of movement can lead to a greater sense of life or vitality in the scene as a whole. Motion then emerges as a quality of the differential rates of change of elements within the film and not just through the changes in duration presented by different frames. The use of layers guarantees the durations of the motion of an object is always gauged in relationship to the durations of motions of other objects on the other layers of celluloid. [6]

This is not a trivial difference: the metaphysical differences between ‘putting an object in motion’ and ‘choreographing the changing rates of relationships’ are profound. In one, one takes the movement of the world for granted; in the other, one assumes continuity needs to be created from a changing world. In one, one places the premium on putting objects or subjects into movement and thus privileges a conception of movement in relationship to subjects; in the other, one places a premium on the means for creating a stable world and thus privileges a conception of movement as a quality in itself. One highlights a physical world predicated on mechanical causality; the other a physical world predicated on the thermodynamics of entropy and order.

The cinematic and the animatic should not be thought of as contradictory or competing systems of thought, however. They share distinct but similar histories and are increasingly used together in contemporary filmmaking. Just like it is possible to understand some things about mechanics through thermodynamics, it is also possible to explain ‘cinematic’ techniques through animation. The point is, rather, that these two techniques shouldn’t be too quickly elided by thinking

of them as the same. A careful analysis should be able to hold these qualities as separate and able to inform each other.

In the past, eliding the cinematic and the animatic has too often led to the assumption that animation is a special case of filmic practice. This denies the amount of work that goes into making animation seem like film. There has been a rich history of technological developments, for instance, intended to tighten the compositing of the animation (such as the multiplanar camera or tweening between key frames) or to lend especially cinematic camera views (such as panning or flying through). It also tends to deny the diversity of animation techniques, many of which develop from the material constraints and resources of the medium and tend to present change in their unique ways.

**Vitality**

Rob Mitchell’s recent work on bioart is a useful place to begin thinking through how insights on the dynamics of animation directly implicate how we think about life and vitality. For Mitchell, “bioart” is any form of art that takes biology and biotechnology as its problematic. Thus a play, where living actors perform, would not be bioart unless it somehow problematized biomedical issues. Mitchell then distinguishes two broad categories of bioart: the prophylactic and the vital. Prophylactic bioart aspires to safeguard against specific outcomes in society’s use of biotechnology. In order to do this, it often relies on representational practice to present a troubling outcome. Vitalist bioart, however, uses the material of life in the artistic product and is more closely aligned to performative traditions in the arts. As Mitchell notes, the effect of much prophylactic bioart is to create greater conceptual distance between the observer and the observed. Vitalist bioart, on the other hand, minimizes this distance by directly engaging viewers in the project or by more indirectly playing on fears of unsafe outcomes or by evoking disgust.

Mitchell recognizes that the idea of vitality might seem a strange and troublesome anachronism. At first glance, it appears to appeal to a vital impetus,

or an *élan vital*, that was thought to inhabit and give life to an otherwise mechanistically inclined universe. [7] In some theorists’ hands, this led to a sharp division between the metaphysics of living objects and the metaphysics of non-living objects. Most recent authors agree that this distinction is difficult to maintain. Richard Doyle, for instance, has argued that we live in a “post-vital” period where the distinction between the “vital’ and the “mechanical” is no longer tenable or possible (Doyle 1997). Even more recently, Jane Bennett has argued for holding a theoretical position that is “neither vitalism nor mechanism” in thinking about the agency of materials (Bennett 2010).

Mitchell’s contribution to this discussion is his appeal to a tradition of experimental vitalism instead of the well-known tradition of theoretical vitalism. Experimental vitalism did not worry about making metaphysical distinctions between what was mechanistic and what was living, instead they were more interested in the object or system’s capacity for change. According to Mitchell, “Vitalist bioart is . . . primarily exploratory and experimental: that is, rather than seeking—or seeking to safeguard—the “meaning of life,” vitalist bioart instead explores what life can do” (Mitchell 2010: 32). This then shifts the register of the debate away from identifying or defining what life *is* to a way to gauge the potential for *transformation* in a specific context. Or as Mitchell aptly notes, “In describing one tactic of bioart as vitalist, I have in mind this sense that science must keep itself open to the future, to concepts and practices that have not yet come into being” (33).

It is this sense of vitality as potential for change that best applies for understanding why animation has been so closely been linked to living processes. Animation not only demonstrates how an object or a milieu may change but how a change in the potential for change can affect the sense of vitality in a particular scene. As we have seen, animation’s use of frame rate and the persistence of vision allows for a perception of the continuity of movement while the disruption of this continuity can give a sense of the passage of time irreducible to movement. The addition of the animatic interval, however, allows for the perception of differing rates of change within a specific scene. Imagine a scene where an object is

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moving at a slow rate, while the background of the object moves very quickly. The object moving slowly would have a different felt potential for change because of the movement of the other objects. The result is the registration of a quickening or denouement in the capacity for change and not just the straightforward suggestion of a capacity for change. The implication of this is that a constantly changing world may not feel vital if the rates of change remain stable. A vital world, instead, has discernible changes in the capacity for change, either in the increase or decrease of potentials. [8]

In the hands of a virtuoso animator the world can crackle with possibility. Stephanie Maxwell’s film Currents (2008), created in collaboration with the musicians Michaela Eremiasova and Jairo Duarte-Lopez, effectively demonstrates what I mean. Stephanie Maxwell uses the differential relationship between layers in compositing as well as adding a new layer of direct work on the film in order to give her work a sense of liveliness, captivating the viewer with a vivid sense of transformation and change.

Maxwell renders the animetic interval visible through the obvious layering of image on top of image. This allows her to manipulate gestures and shapes as waves rippling across frames, some growing, some attenuating, but never all beginning or ending on the same cut or edit. Thus we see the undulations of waves before we see the filming of the sea and these undulations persist even after the sea makes its appearance. Maxwell also works directly on the film. She applies splashes and lines of paint that further accentuate the animetic intervals within and across the frames of the film. The effect is a sense of liveliness of the image as it shifts, flickers, morphs, emerges from, and dissolves into other images. Stephanie Maxwell’s work is useful in summing up this discussion as it helps us see how the vitality of animation comes from the difference in two relationships, the relationship between the frames that allows for the perception of motion (as in film) and the differential relationship between the layers composited on each frame that allows for the perception of the change in the potential for change (through the animetic interval of open compositing).

And this brings us back to the animation of the mitochondrion that I started this article with. The parts of this animation that best suggest vitality are the small moments when the techniques of animation become the most apparent, when the animators are unable to fully close the compositing of the frames, and the animetic intervals disrupt the cinematically overdetermined movements of organelles or molecules. These moments allow for a sense of the potentiality of change, a feeling that the unexpected may happen. These moments are also important as they allow for a sense of how dynamics at molecular scales are especially unstable and resist easy definitions of movement. The molecules visible in these films exist through the vagaries of energy and molecular effects, such as Brownian motion or surface tension. The smaller the molecule, the more open and less determined are the kinetic interactions actually portrayed on film. In these cases, animetic intervals can even suggest the different types of change required in complex biomolecular interactions precisely because they do not collapse all change into a single duration.

This implies that there is no divide between vitality and molecules or between life and mechanism. Vitality emerges as the differential in potential rates of change, in this case between molecular and cellular scales, and not as a special property of life, per se. This is an interesting and novel way of thinking about organic and non-organic processes where vitality is not a special process or substance of the living, it isn’t even a tendential relationship of some forms of organized matter; rather, it is the felt discontinuity of potentials that emerges from the differential energetics of scales folded upon each other.

And, finally, it is important to recognize that animation will only become a more important tool in the future of biomedical research and education. More and more scientists will look to animate the data they collect in order to see how complex interactions can be enabled through molecular interactions. I expect that these animations will be used to convey much useful information about biological processes. One of these uses will surely be the visualization of the movement of molecular and cellular processes to see how radically different sizes, durations, and thermodynamic states mesh. I also hope that there is room

to use some of the special qualities of animation to help lend a sense of the incredible vitality of a world that changes at different rates. The benefit of this would be to give its viewers a sense for how the vitality of the world emerges from but should not be reduced to an analysis based on objects, motion, or time.

Notes

[1] As Deleuze argues: “In short, cinema does not give us an image to which movement has been added, it immediately gives us a movement-image” (Deleuze 1986: 2).

[2] A useful depiction of Kentridge at work can be found in the documentary William Kentridge: Anything is Possible from 2010.

[3] Although few today give photography the type of authorial credibility that Bazin conferred on it, it is important to note that the material forms and practices of cinema and animation present differing problematics in the depiction of change. These problematics relate a “more than human technicity” that ensure that these technologies are not simple extensions of human capabilities and that they have shared but unique historical developments (Himada and Manning 2009). In fact, part of my goal in rendering these distinctions so strongly in the beginning is to recognize why “compositing” as a compositional technique is often overlooked in the history of film.

[4] Henri Bergson is another interesting example of this. In Creative Evolution, for instance, Bergson discusses the importance of the “sensory-motor system”: “the progress of the nervous system has been effected both in the direction of a more precise adaptation of movements and in that of a greater latitude left to the living being to choose between them” (Bergson 1911: 125).

[5] It is interesting that most analyses of animation that use Deleuze’s construct of the “time-image” do not reflect Deleuze’s own opinions about animation. Deleuze thought animation was not aligned with modern cinema in that it relied on the more formal qualities of special times and special moments. Cinema, for
Deleuze, develops its own trajectory when it makes each moment “any moment what-so-ever” and thus amenable to innumerable breaks, splices, and disjunctions. See the discussion on page 5 of Cinema 1.

[6] A note here on terminology: I will be following Deleuze’s analysis of Henri Bergson’s concept of duration found in his Bergsonism, 73-89. Although the term “flux” may seem more appropriate at first, it eventually ignores my overall argument that the study of the animation process by concentrating on layers as surfaces allows one to turn what may be a flux or rhythm into a perceived and manipulable duration.

[7] A quick glance at what has been labeled “vitalism” in biological thought resists this easy but persistent characterization. In fact, this is one of the great values of Mitchell’s strategy as it calls for a greater understanding of the different types of vitalism. Few vitalists fit comfortably in positing an absolute distinction between vital and material substances. Even Hans Driesch claimed that vital process did not break laws of physics, they just “suspended” the more straightforward mechanical energetics (Driesch 1914: 202-206). Mitchell is also smart to locate vitalism in empirical as opposed to theoretical accounts. Many of the theoretical accounts appeal to the importance of the experimental work in developing their views (Driesch 1914). A good accounting for the continued vitality of vitalistic thought can be found in Cangulhem 2008. Unfortunately, despite the work of those like Jane Bennett (Bennett 2010: 66-81), most recent studies of “vitalism” have sought to locate continuities behind the claims of those who were labeled vitalists. This approach has led to an overemphasis of Aristotelian metaphysical distinctions without the benefits of Aristotelian models of causation. This is the approach of Bechtel and Richardson 1998, for instance.

[8] Another way of thinking about the “felt change in the capacity for change” is in the changing capacity of the world to present novelty. See for instance, Thurtle and Mitchell 2007.
Bibliography


