

## **Dissection and Simulation: Brilliance and Transparency, or Encumbrance and Disruption?**

**Norm Friesen, June 10, 2010**

The increasing use of online simulations as replacements for animal dissection in the classroom or lab raises important questions about the nature of simulation itself and its relationship to embodied educational experience. This paper addresses these questions first by presenting a comparative hermeneutic-phenomenological investigation of online and offline dissection. It then interprets the results of this study in terms of Borgmann's (1992) notion of the intentional "transparency" and "pliability" of simulated hyperreality. It makes the case that it is precisely encumbrance and disruption --elements that are by definition excluded from simulations and interfaces-- which give dissection its educational value.

Keywords: simulation, phenomenology, pedagogy, intentionality, alterity

## Dissection and Simulation: Brilliance and Transparency, or Encumbrance and Disruption?

### Introduction

“To live,” Edmund Husserl writes, “is always to live-in-certainty-of-the-world” (1970, p. 142). In the phenomenological tradition, this lived certainty is understood in terms of *intentionality*: our connection with the world around us as it is solidified in our plans, projects and categories. To inhabit such certainty is to comport oneself habitually and naturally, dwelling in Husserl’s “natural attitude” (Husserl, 1983, pp. 56-57). In this connection, Merleau-Ponty has famously described phenomenology as an attempt to “slacken the intentional threads which attach us to the world and thus [bring] them to our notice...” (1962, p. xiii). Phenomenology, in this sense de-naturalizes, suspends habit, and in so doing, renders the world around us uncertain and even alien. My purpose in this paper is to carry out or enact such a slackening of intentional ties, focussing specifically on a particular set of educational experiences of habit and uncertainty, familiarity and de-naturalization. These are experiences associated with dissection in school contexts, specifically compared with those elicited in online or “virtual” dissection exercises. In carrying out this comparative investigation, I work to show that the slackening of intentionality invoked by Merleau-Ponty is as much a part of the phenomenological method as it is a part of education generally.

I base this investigation on van Manen’s descriptive hermeneutic phenomenology, which uses descriptive and interpretive writing as means for “contextualization and amplification rather than... structural essentialization” (Hein & Austin, 2001, p. 9). Widely employed in the fields of nursing and education, van Manen’s phenomenology focuses first on the gathering, development and refinement of descriptions of lived experience (van Manen, 1997). Experiential and existential themes emerging from these short lived-experience accounts are then explored and developed in reflective, interpretive writing. Such description, reflection and interpretation is practiced in this paper not only through the provision and interpretation of interview transcripts and descriptive passages gathered and in some cases developed by the author, but also through the use of to descriptive passages and quotes taken from some of the many articles on student responses to school dissection.

### Dissection

The pedagogical practice of dissecting of animals in school biology courses has long been associated with experiences, opinions, and debates of special intensity. Juliana Texley, an assistant school superintendent, observes:

“I Remember Biology,” parents often begin at their annual conference with the teacher. The odor and distaste the dissection experience evokes have been among the most pervasive memories of secondary school science for more than a century. But in the 1990s, environmental consciousness, curricular concerns, and political pressure on schools have changed biology... (1992)

Some of the factors that have changed biology have developed out of important legal cases concerning in-school dissection. In the American context, one of the most prominent of these was heard by the California Supreme Court in 1987. It began with Jennifer Graham, a 15-year-old California girl who refused to participate in a school dissection on ethical grounds. When

school officials refused to accept a project on amphibian behavior as an alternative, the young student took the school district to court. According to one report, “Graham became something of a celebrity, often called ‘the frog girl,’ who had the courage to stand up to the schools in her defense of defenseless animals” (Johnson, 1997). Today, in response to legal challenges and a number of other factors, schools and districts in the USA and Canada are relatively sensitized to students’ concerns and to other issues surrounding dissection. The issues that are now considered important are manifold – “rang[ing] from inhumane treatment of animals by the supply industry and the depletion of natural populations of affected species to concerns about the emotional responses of students who are ‘turned off’ to biology because of a dislike of dissection” (Haury, clearinghouse 1996). Many schools and districts now recognize the legitimacy of individual student’s wishes to opt out of dissections, with some institutions deliberately providing alternative assignments, and still others having dispensed with the activity altogether.

My aim in this paper is not to focus on the range of complex legal and moral issues raised by dissection activities; it is instead to compare the experience of dissection as an online activity with its offline counterpart. In doing so, I pay special attention to the sensory and experiential intensity of this activity, looking at the educational significance of the convenience and methodical design associated with online dissection, and the vivid emotional responses of students associated with its counterpart in the classroom.

### **Body and Relation in Lab Dissection**

Given its vivid and controversial nature, it is not surprising that there are a range of readily-available accounts of dissection in both school and university science classrooms. Already, we have a kind of compressed experiential description in Texly’s reference to parents’ recollections of working with “that terrible-smelling frog.” Accounts of classroom dissection typically follow a common sequence of events, beginning with initial, sensually intensive engagement and ending with a range of possible outcomes. In the course of this sequence, there are experiential moments of particular prominence that reappear with remarkable frequency.

One such moment is the experience of an initial encounter or sighting of the animals to be dissected. Students typically notice them as they walk into the classroom, spotting “flattened rats in a jar” (interviewee), “little dead pigs lying in the sink,” “a jar of pickled animals,” or a creature simply “tossed... into a plate” (quoted in Solot & Arluke, 1997 p. 34). A second moment in the dissection that stands out in even greater experiential relief is the act of touching and above all making the first incision into the dead animal or carcass. One ethnographic study of classroom dissection explains:

The initial incision ...the transforming cut and the only one made into a body that bears the obvious markers of “animal”... is frequently the hardest one for students to make. Even some students who had never dissected predicted that “opening” the animal would be the hardest part. (Solot & Arluke, 1997, p. 35)

Whether the students make the incision themselves, or whether others do it for them, their comments give special emphasis to the embodied and specifically *visceral* character of this

moment. For example, here is one student's account in a study of the "high school dissection experience" of a fetal pig:

The first day, I thought I was just gonna be sick when Linda was actually slicing this pig open. I felt nauseated.... I don't handle blood and that kind of stuff very well. I was very glad that it didn't have blood in it. If it was a pig that had just died and had blood, I would not have been able to handle it.... (Barr & Herzog, 2000, p. 64)

Other interviewees describe the act of "touching a dead pickled rat" as "the grossest part" of the dissection, also saying that the "first cut into" the animal, in which a liquid, presumably formaldehyde, "spurted" out, was particularly "gross."

The body in these cases becomes manifest experientially in a way that is rather forceful and direct. It is, in effect, subject to a kind of sensual assault—one that extends from the sight of the animal to the sound and the tactile sense of the first incision. This includes from the smells of formaldehyde, which "refuse to leave your hands" as one interviewee says, and of rotting flesh, which was said to "get a little riper with each passing session." It also includes impressions and feelings of the "gut" as expressed through terms or phrases like "gross," becoming "sick," or "nauseous."

### Body and Relation in Online Dissection

A *virtual* frog dissection provides a number of points of conspicuous contrast to the classroom or lab activities presented above. Such a dissection might well begin with the student clicking on a link on a course website; for example: "Frog Dissection: try the demo at froguts.com."<sup>i</sup> In the case of this specific simulation, the student would first wait for the software to load, and would then be greeted with pleasant musical tones, and an animated homepage advertising a number of demo simulations. Choosing the appropriate option, an image of what appears to be a life-size bullfrog fills much of the browser window --with a row of small buttons provided on the right. Underneath, text instructs the student to "press the pin button on the toolbar" so that the frog can be secured. When this text is selected, a box of pins appears on the right, in place of the buttons. The student would then click and drag these pins one by one to spots on the frog's arms and legs that are marked with small red "Xs" (inserting them with a double-click). When they land in place, they make a dull percussive sound. Next, a red, line running up and down the length of the frog's abdomen appears. The student is instructed to "make 3 incisions along the dotted red line." This is achieved by clicking and then dragging the cursor along the red line marking the frog's glistening and smooth but mottled underbelly. Any sense of unease that one might feel at taking a simulated scalpel to this simulated surface would be in conflict with the absence of other sensations accompanying this act: No unpleasant sounds or unusual feelings of resistance or elasticity, no moist membrane to puncture and incise are detectable --only the frictionless gliding of the cursor across the computer screen.

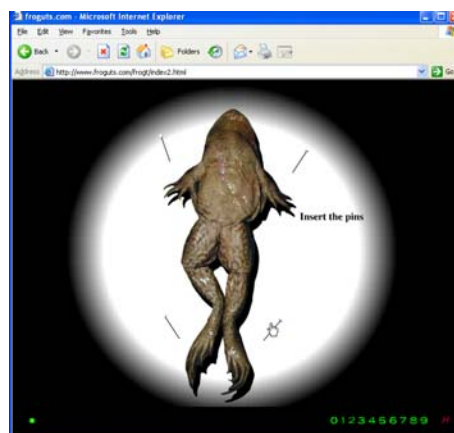


Figure 1: Frog dissection

This is a “virtual” scenario of dissection that illuminates aspects of the lived body that are rather different from those of the in-school dissection. The manifold sense impressions that assaulted the students in the previous descriptions are either absent or very much muted in this virtual exercise: There is no smell of formaldehyde or rotting flesh; there is no need to fear that blood or any other liquid might come “spurting” from the creature being dissected. Also, instead of first seeing the animal “lying in the sink” or “flattened” in a box or jar, the first experience with the frog occurs while waiting for it to load in the browser window. Handling and even cutting into the animal, furthermore, is a question of clicking on the correct button (the scalpel) and gliding it, in effect, across part of the screen.

Naturally, there is much more to a dissection than viscerally unpleasant and indelible sights, smells and other sensations. There are well thought-out and articulated reasons for its inclusion in science and biology curricula, such as knowledge of “the structure and function of organs” (Jordan School District, 2004) and safe selection and use of dissection “apparatus and materials” (Sackville High School, 2008). However, speaking experientially, impressions of disgust, nausea and repulsion initially seem to overwhelm other, less visceral and more intellectual aspects of the in-school dissection. As mentioned above, this barrage of sense impressions is registered in specifically *visceral* terms, in the stomach, in the form of feelings of nausea and sickness –the word “viscera” referring to the “the viscera or bowels regarded as the seat of emotion” (OED, 2007). A related term, “gross” –meaning “plain, not delicate” or “uncleanly or repulsive in quality” (OED, 2007)—is also prominent in accounts of lab dissection, appearing no less than three times in the remarks quoted above. In more formal accounts, the term “squeamishness” -- and its related meanings of nausea, sickness, queasiness and disgust (OED, 2007) – is repeatedly used to characterize student impressions of, and reactions to, dissection experiences (e.g., Barr & Herzog, 2000; Solot & Arluke, 1997). And “squeamishness” refers not only to a condition of the stomach, to the state of “being affected with nausea or qualms;” but it also corresponds to distinctly less visceral terms such as “disdainfulness,” “reserve,” or to “the quality... of being highly or excessively fastidious or dainty” (OED, 2007).

What is significant in these definitions is clear evidence of a connection between the mind and body, intellect and viscera. Defined in terms of “qualms,” “reserve,” or “fastidiousness,” words such as gross, visceral or squeamish can refer to an overwhelmingly embodied feeling on the one hand; but on the other, they can also designate a more mental or intellectual state or position of defense, discomfort or unease. A profoundly uncomfortable or disquieting situation or experience, in other words, can be experienced in terms of a deeply felt disgust or repulsion, and at the same time, take the form of intellectual disquiet or be articulated in terms of moral qualms. Consider one undergraduate student’s testimony in which he criticizes the ethics of dissection by recalling a particularly “sick feeling” that he associates not only with the literally visceral aspects of laboratory dissection, but also with less literally “visceral” events as well:

I feel a sick feeling thinking about those labs. The same sick feeling I felt as a child when I saw a dead frog, shot by a neighbor kid in my creek.... The same sick feeling I felt when I found that [an old railroad landmark] in Tolono had been bulldozed. And the same sick feeling I felt when I saw a pedestrian struck and killed by a car in Phoenix ...during a spring break trip. (Hassler, 2000)

The acts and the ethical implications of destroying a historical landmark, witnessing an accidental death, and dissecting a frog are obviously very different; but what is important in each case is the feeling of lived body that this student associates with each, and his reference to this recurrent feeling to justify an ethical and intellectual position against dissection. This further emphasizes the connection between embodied sensation and intellectual conviction, between feelings of the “gut” and impressions and decisions of the “mind.” In an article on the “guts” and learning, Robyn Barnacle (2009) observes the following about the “viscera” and knowledge:

recognition of the emotionality of the gut is evident in everyday expressions, such as gutless, which refers to a lack of courage, or a fearful gut. In addition, both the notions of ‘gut reaction’ and ‘gut instinct’ treat the gut as a site of specific responsiveness to the world, the former in an immediate, unreflective sort of way, and the latter, conversely, as a particularly fine-tuned and insightful form of intelligence. (p. 26)

The gut provides us with ways of knowing that can be instant and immediate, but also subtle and insightful. For example, in the descriptions of dissection provided above, there is experiential evidence of a kind of communication, connection or relation *between* bodies: Cutting into the soft belly of an animal, or witnessing the injury or death of a pedestrian are illustrative of a kind of experiential relation that can exist between our body and those of others—even if those “others” are mammals or other creatures. And although these examples of incision and even death are extreme, this kind of connection and relation can be said to exist in more commonplace and everyday contexts. This is a relation that is closely related to *empathy*, specifically as it is defined as the “project[ion of] one’s personality into (and so fully comprehending) the object of contemplation” (OED, 2007). This experiential aspect is the embodied or corporeal correlative to intersubjectivity, and is designated *intercorporeality*.

### **Distantiation, Care and Risk**

As the dissection progresses, it moves from an initial and explicitly intercorporeal encounter with the body of the animal and its tactile and olfactory characteristics, and becomes an exploration of its internal anatomy and physiology. As this transition occurs, a different set of experiential elements are foregrounded. At the same time, the experience of intercorporeality, as an empathic connection between bodies in the dissection experience remains an important but more implicit factor. One student interviewed for this study explains:

The rat that we were dissecting had its tongue jammed out of its mouth and had clumps of fur sticking everywhere; it kind of looked like Bill the Cat from the cartoon “Bloom County.” So my lab partner and I named it “Bill the Rat.” The fact that the rat looked like a cartoon character made the dissection easier to deal with.

Similar techniques of distantiation, de-humanization or “de-animalization” (as Solot and Arluke put it; 1997, p. 35) are apparent in other accounts. For example, Barr and Herzog report that some “students cover[ed] the face of the animals they were dissecting,” with one of these students explaining:

Every time we've worked on it (the pig) the face was covered. I couldn't cut the face. I could watch, and once the face was cut it didn't look like a pig anymore, and I could deal with that because it looked like - you know - a scientific experiment to me. (2000, p. 59)

In the place of a strong intercorporeal link between the dissected animal and the student doing the dissection, a different relationship between the two is gradually emerging. Instead of being marked by a visceral, acutely empathic response, concerns of a more intellectual manner come to the fore:

As these changes take place, the viewer's gaze is directed toward the newly exposed organs. One student observed, "You opened it up and the pig just like flapped down. You didn't see [the animal] when you looked at it. You didn't see the pig, you just saw like insides." ...One student, who expressed ambivalence about the prospect of dissecting, said, "I couldn't physically open it myself ... but once it's open then I can look." (Solot & Arluke, 1997, p. 35)

Although the smell of formaldehyde and rotting flesh certainly remain, they no longer combine with the sight of the animal's body to simply repulse students, making them squeamish, or "grossing them out." Instead, a different set of sentiments and impressions become possible. These include feelings of curiosity, a desire to explore and experiment, or in some cases, the emotional response of outright fascination. As one interviewee puts it, a kind of "conflict developed" for her "between the intricacy of the internal organs of the rat on the one hand, and its stinking and revolting body on the other." The interviewee also describes what was revealed in the rat's insides as a kind of "marvel: all of these little body parts, fitting and working neatly together like a sort of beautiful wet machine." Barr and Herzog say they "heard comments like "God, his liver is like a mushroom or something. His heart's kinda tough. Feel that," and "look at that. Ooh, its got a weird texture" (2000, p. 63). Reflecting a more playful curiosity—or simply greater bravado-- Barr and Herzog also report that

On one occasion... boys in a group cut out their pig's intestines and stretched them almost completely across the room, inadvertently demonstrating the extraordinary length of the viscera to the rest of the class. (2000, p. 61)

A pig's small intestines, it should be noted, form a tiny ball together with the large intestines, but when they are uncoiled they can stretch to 20 feet or more in length. Whether the act of uncoiling this organ across the length of a room is judged in bad taste or as a legitimate experiment, it is certainly a type of improvisation that would have no direct equivalent in an online dissection. It is also worth noting that this kind of activity brings with it a special kind of risk, since it may not be entirely neat or tidy, it is not reversible if done in error. As one student reports, "the rat got kind of mutilated," and sometimes the "organ or part that the instructor would point out would no longer be there."

The online dissection provides a similar emphasis on the work of accessing and exploring the deceased animal's viscera, but at the same time, of course, it provides many points of contrast. Following the incisions into the belly of the frog, the dissection software described above proceeds by showing the student a pair of scissors. The student is then asked to "cut upwards

with the scissors through the muscle tissue.” Clicking on the scissors a few times, the student cuts along the tissue. Half way up the belly, though, text pops up advises the student to “twist the scissors to avoid cutting the heart under the ribs.” To do so, the student clicks on yet another icon, and the scissors slip over to one side, allowing him or her to continue cutting.

Clicking and dragging through a few more steps, the internal organs of the frog gradually begin to appear. Then, the cursor abruptly turns into a magnifying glass, allowing the student to zoom in on the animal’s abdomen. A label appears for each organ as the magnifying glass passes over it. Clicking on each of the labels causes the organ’s name to be added to a list in a small notebook page that has appeared on the right side of the simulation window –making the whole process remarkably seamless and uninterrupted.

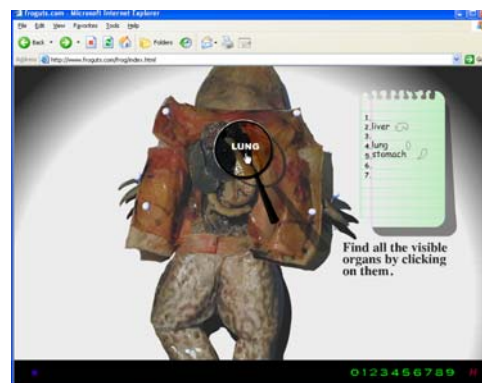


Figure 2: Organization of organs

Emotions and impressions of various kinds are manifest in the simulated dissection, as they were in the descriptions of classroom dissection. But their substance and intensity are rather different. In the simulated dissection, what appears as remarkable is the responsiveness of the interface, the ease and convenience with which the dissection steps can be negotiated. One instrument replaces another almost magically, and they function together seamlessly. The user glides and clicks on the mouse as one dissection instrument is automatically replaced by another, and as labels hover over the dissected animal’s body --to be recorded in the notepad with a mere mouse-click.

### Computer Use as a Relational Strategy

The ease with which the user can exchange one tool for another in the online dissection can be seen as a significant pedagogical advantage, as a convenient, carefully-integrated set of interactional possibilities or affordances that allow the student to focus on the anatomy of the frog rather than the mechanics of the dissection tools. However, it is worth reflecting briefly on precisely what is asked of the student when she engages with different tools in the classroom dissection, and similarly, what is required in engaging with the screen, keyboard and mouse in the simulation. According to Robert Rosenberger (2009), engagement with different kinds of offline tools involves the adoption of what he refers to as different “relational strategies.” To engage with a particular technology, Rosenberger explains, is to “embody” that technology in particular ways. Referring specifically to the example of using a magnifying glass, Rosenberger (2009) writes:

To embody a technology, one...must comport one’s body in a certain manner. I use the term *relational strategy* to refer to the particular configuration of bodily habits, intentions, and conceptions that make it possible for a person to take up a particular stable relation [with a given technology]. For example, for a person to use a magnifying glass to enlarge text on a page, she or he must possess a particular relational strategy for embodying the device... This relational strategy involves certain conceptions of the

magnifying glass, and certain bodily comportments and habits regarding its operation. (emphasis in original, p. 176)

Just as the use of a magnifying glass to examine a specimen or to enlarge text on a page involves a particular strategy of positioning and aligning the given object, the lens and the eye, the use of scissors in dissection requires a rather different set of approaches for coordinating forces and movements applied through the fingers, hands and arms. Similarly, engagement with a computer involves its own kind of comportments and habits: the face of the reader/writer and that of the screen must meet or “interface” at a prescribed angle, almost as parallel planes. Additionally, to do anything more than reading or watching the screen, both hands must also be kept on or near the keyboard and mouse. The computer can be remarkably fixed and inflexible in its demands on the comportments and dispositions of those engaged with it. Even in portable or hand-held incarnations, engagement with the computer is generally both “hands-on” (with a keyboard or other interface) and “face-to-face” (with the screen).<sup>ii</sup>

Writing on the topics of “new media” or “virtuality,” many have used the metaphors of “imprisonment” to refer to the way that the computer confines its users to the specific relational strategy of screen, the mouse, keyboard and other devices. In *The Virtual* (2003), Rob Shields, for example, explains how this technology “both liberates and incarcerates” (p. 11); and in *The Language of New Media* (2001) Lev Manovich, speaks of “the imprisonment of the body” (p. 105). Physical maladies associated with extensive computer use provide a different kind of evidence for these charges of incarceration or imprisonment at the hands of the computer. From “Blackberry-” or “gamers’-thumb,” through “work-related upper limb disorder,” to “carpal-tunnel syndrome,” these maladies are known collectively as “repetitive strain” or “repetitive stress” injuries- highlighting the very “repetitive,” narrowly-defined nature of embodied engagement with computer technology.

One significant historical precursor for the experience of the relational strategies represented by the fixed arrangement of desk, keyboard and screen is provided by the technology of the typewriter. Writing in the *Phenomenology of Perception*, Merleau-Ponty provides a description of this experience, simultaneously situating it in a discussion of habitual and embodied “knowledge:”

It is possible to know how to type without being able to say where the letters which make the words are to be found on the banks of keys... If [this kind of] habit is neither a form of knowledge nor an involuntary action, then what is it? It is a knowledge in the hands, which is forthcoming only when bodily effort is made, and cannot be formulated in detachment from that effort.... When I sit at a typewriter, a motor space opens up beneath my hands, in which I am about to ‘play’ what I have read. (2002, p. 166-167)

When we sit at a keyboard (and monitor), to paraphrase Merleau-Ponty, a space of action and of vision open up in front of our hands and eyes. This is a highly habitualized terrain, one that is intricately sub-divided in space and layered in time: Through hundreds of individual keystrokes, and acts of scrolling, clicking and dragging, this type of engagement can be said to represent a process of weaving and reinforcing a complex web of habit, perhaps best described as a combination of a small set of relational strategies.

The comportment or relational strategy required by a computer is different in (at least) one important way from those elicited by most other tools and instruments such as pins, magnifying glasses or scissors: instead of allowing the individual to undertake one task (such as fastening, magnifying, or cutting) the computer allows users to undertake the widest range of tasks. And in doing so, it requires only a single relational strategy. Cutting, magnifying, fastening and many other types of work can all be accomplished while seated in front of a screen, with hands at (or near) the keyboard and mouse. Unlike the earlier description of working with and switching between the magnifying glass, the writing pad and other dissection instruments, working with the simulation does *not* involve a change in disposition or mode of operation. There is no particular “relational strategy” that might involve “bodily comportments and habits regarding [any one instrument’s] operation” as Rosenberger says. Instead, dissection is exclusively associated with those facilities, dispositions and habits that are part of using a computer. These skills have no more obvious relation to the activity of dissection than they do to myriad other activities that can be undertaken using computers and networks. And for someone who has mastered these generic interface skills, the online dissection can indeed easily seem remarkably seamless.

Corresponding to the different relational strategies (or sets of these strategies) associated with each dissected object is a particular type of “care” or attention that each elicits. The online exercise instructs the student to take care to turn the scissors onto their side “to avoid cutting the heart under the ribs.” However, this particular instance of being “careful” and attentive involves a mere mouse-click. No one mouse click or keyboard stroke, of course, is necessarily more gently or skillfully executed than any other—at least as far as computer software is concerned. Further reducing the need for a particularly attuned care or caution is the fact that the simulation provides “back” or “undo” buttons or commands, allowing any one action to be immediately reversed. In fact, with the online dissection, there ultimately seems to be no chance of making an error with the incision or with any other part of the dissection activity overall. Taking “care” to avoid these types of errors becomes a matter of clicking and dragging in the ways and in the places that the simulation allows and instructs.

In the classroom dissection, irreversible errors, of course, *can* be made, and things *can* go seriously wrong. As mentioned earlier, parts of the dissected body can be cut or removed in error, rendering further steps in the dissection process impossible to perform. There are other aspects of the dissection that require special care: The razor-sharp scalpel can do damage to living, human flesh as easily as it can slice the body of the dissected animal. And gloves and goggles must be worn to protect students’ hands and eyes from the preservative chemicals which are deadly poisons. Different acts of incision, probing and exploration require different levels and types of dexterity and facility. One act of incision or act of probing can indeed be very different from another, in its quality, its effectiveness and its care. And there is no way to simply undo a particular action or decision: In keeping with its natural origins, the body of the rat, pig or other animal cannot be the subject of any sort of “undo” command --or be “refreshed,” “reset,” or “rebooted.”

## The Virtual Dissection: Pliable, Discontinuous, Brilliant

The experiential possibilities and limitations presented by simulated and in-school dissections can be further explored by looking specifically how theorists of technology have enumerated and described the qualities of these “virtual” “hyperreal” and “microworld” objects and settings. For example, Rob Shields (2003) describes how such virtual objects and spaces:

have an elusive quality which comes from their status as being both nowhere and yet present via [technology]. ...they also have duration but strictly speaking, neither history, nor a future. Of course there is a history of virtual spaces and of the technologies that make [them] possible... But inside a virtual space itself, there is only the immediacy of the scenario displayed. (p. 51)

Virtual objects, in other words, are not “worn out” or “used up;” they are not abandoned to decompose in a landfill. Unlike the formaldehyde-soaked carcass and organs of a dissected animal, virtual objects do not have to be “disposed of” once they have outlived their usefulness. They can be endlessly minimized, closed, reopened and refreshed. In this sense, virtual objects can be said to occupy a kind of placeless space, to inhabit a kind of timeless present or “immediacy.”

Augustin Araya (1997) uses the term “microworld objects” to describe other properties of these virtual things and spaces. He characterizes simulated objects as lacking “certain kinds of functional and physical properties; for example,” he says, “they cannot malfunction nor break in the sense that real objects do.” Although they can freeze up or disappear from the screen, they generally cannot be “broken” or “mutilated” in ways that go beyond the preconceived limitations of their designers. In the online dissection, for example, the user is simply not allowed to cut or explore the frog carcass in the wrong way. The only type of malfunction or breakage that can occur is instead a completely different kind: the simulation can seize up, or the browser or the operating system can crash.

In a critique of “hyperreality,” philosopher Albert Borgmann characterizes virtual contexts and objects as being (among other things) “pliable,” “brilliant,” “discontinuous and disposable” (1992, p. 87-102). Borgmann describes hyperreal objects as being *pliable* specifically in the sense that they can be “entirely subject[ed] to...desire and manipulation” (p. 88). This pliability is perhaps most vividly illustrated in the online dissection in the ease with which the virtual frog can first be sliced open, its organs revealed, then inspected with a magnifying glass, and finally noted with pencil and paper. As mentioned earlier, no one tool or task in these activities requires a particular disposition or comportment that would differ from any other. For all of these steps or tasks, only relatively repetitive movements of the computer mouse are needed.

Borgmann describes the *discontinuous* and *disposable* characteristics of hyperreal objects and environments specifically in terms of their relationship to context:

To be disposable, hyperreality must be experientially discontinuous with its context. If it were deeply rooted in its setting, it would take a laborious and protracted effort to deracinate and replace it. Reality encumbers and confines. (p. 95-96)

The description of classroom dissection above is rife with examples of encumbrance and confinement: This begins with the persistent odor that is a part of the preserved animal's "context," and extends to the irreversible incisions that might render certain organs absent or unidentifiable. Neither the process nor the product of physical dissection lend themselves to discontinuity or disposability in the sense that Borgman associates with the hyperreal: the toxic remains of the dissection are also all too persistent, and present particular challenges for safety, cleansing, and disposal.<sup>iii</sup> By way of contrast, undo and redo options or buttons on the virtual dissection are not so much convenient features as they are intrinsic properties for this virtual world—a world in which an object can be refreshed, rebooted or simply shut down at will.

Borgman describes the "hyperreal" quality of *brilliance*, in terms of an "absence of noise" and a heightening of an object's "attractive" features. The "truly brilliant reality," Borgman says, "would exclude all unwanted information," resulting in an experience in which only those aspects of explicit relevance are provided. In the online dissection, all (or nearly all) encumbering physical and inter-corporeal aspects of the activity are removed; what remains is indeed brilliant in Borgmann's sense, from the X's and dotted lines that appear in the places for fastening and incision to the appearance and disappearance of instruments, labels and other visual prompts.

### ***Educational "Brilliance"***

The inclusion of "brilliant" features in virtual contexts—and the systematic *exclusion* of all forms of encumbrance and confinement—is remarkably consistent with the way that virtual instructional simulations are conceptualized and designed. The tasks and activities to be included in such a simulation are analyzed and selected in terms of how they might contribute to the attainment of specific educational objectives or learning outcomes. Those parts of the task or activity relevant to the educational objectives are *included* or even *heightened* in the design. Those elements that are deemed irrelevant or unnecessarily confining and encumbering are simply *excluded*. Such a selection of elements is considered as a part of "instructional design," a field that works to "design...learning experiences" (Dede, Whitehouse, Brown-L'Bahy, 2002) so as to maximize their instructional effectiveness and efficiency. Practitioners in this field sometimes reference a quasi-mathematical formula that captures the processes of inclusion and exclusion specifically from a design perspective. For example, Jacobs and Dempsey explain:

The supposition we make is that one only needs to simulate those events or characteristics that allow the learner to perform in a proficient manner when performing in the operational environment, i.e., the real world. This representation of the characteristics of simulation has been characterized by Gagné (1962), and later by Clariana in the following formula:

Simulation = (Reality) - (Task irrelevant elements).

(Jacobs & Dempsey, 1993, p. 200; see also Smith and Ragan, 1993, p. 65; Leemkuil et al., 2003, p. 93; Chandra & Sharma, 2004, p. 106)

A simulation, in other words, is a representation of the reality of a task or activity, with only those elements included and represented which are required for the attainment of predetermined learning outcomes, or predefined measures of learner proficiency. All other elements and components would be subtracted or eliminated in order to maximize instructional efficiency.

As mentioned earlier, educational outcomes typically associated with dissection include “knowledge of [the animal’s] internal anatomy,” “skills and processes [for working with] primary data” (Scholl, 2007), and the “practice [and] understand[ing of] dissection [as] a method of scientific investigation” (Mondragon, 2005). It is precisely by eliminating those elements which do not explicitly or directly contribute to the attainment of these goals --and by including and heightening those elements that *do* -- that the online dissection simulation is designed. Its design and operation instantiates this in a way that is very deliberate, rigorous and systematic. Using Borgmann’s terms, it *excludes* “noise” that would “encumber” and “confine”--from the persistence of the animal’s body to the insistence of the smells emanating from it. And it *includes* those features --such as labels, pins, scissors and a magnifying glass--only when their presence is instructionally and practically desirable. The end product, then, is one which is as “pliable” and accommodating of “discontinuity” and “disposability” as possible; it is as fully deracinated from any environment --laboratory or otherwise-- as design will allow. In short, the simulation can be said to be “brilliant” in a way that is specifically instructional or educational. But does this completely capture and exhaust the pedagogical significance or value of the activity --whether it is virtual or real?

### **Dissection: Interface, Encumbrance or Upheaval?**

To begin to answer this last question, it is necessary to reflect specifically on the different *origins* of the objects or bodies being dissected. A virtual object, for its part, typically develops, or rather, *is developed* on the computer screen through the actions and interactions of instructional, technical and graphical designers, and other experts. In this process, as already indicated, all aspects of the simulation are developed and coordinated according to specific, enumerated instructional objectives. The original development of the organic object dissected in the lab, of course, occurs very differently, taking place through “natural” processes of (re)generation rather than through artificial acts of *production*. It occurs not in a workplace or on a computer screen, but in the warm and wet darkness of a body. This can be the body of the animal itself, or the womb of its mother. This development, in other words, occurs through a kind of propagation and differentiation of elements of flesh and bone -through processes of gradual folding and unfolding, shaping and reshaping of proliferating, living matter. Of course, this process does not revolve around explicit, educational objectives, but occurs for “reasons” (if they can be called that) which are rather different. To summarize simply, the virtual object is *designed by someone* for *explicit* human (educational) purposes, whereas its physical counterpart *develops on its own* for purposes that are (at best) *implicit* and are not directly reducible to human ends.

As something developed by experts for explicit, human ends, the simulation exercise differs in other ways from the in-school dissection. Like any other piece of software, students engage with the simulation via an “interface.” This refers to the means by which the various components and tools of the simulation are accessed and manipulated. A quick look at the language used in the literature of interface design reveals some interesting patterns related to phenomenology. This

vocabulary for interfaces includes words such as “seamlessness,” “transparency,” “translucency,” “playability,” “learnability,” “flow” and “intuitiveness” -all of which designate desirable design attributes for interfaces (e.g., see: usabilityfirst, 2010). This vocabulary makes it clear that one of the goals of interface design is a kind of comfortable certainty and familiarity. And this type of experience, moreover, is clearly resonant with the kinds of terms Husserl uses to describe *intentionality*. Intentionality, as discussed above, refers to the everyday purposes, plans and categories that connect us with the world around. It renders the world familiar, enabling us, as Husserl says, to “live in certainty of the world,” and in this sense sustain the everyday, commonsensical “natural attitude.” Terms such as seamlessness, transparency and intuitiveness all suggest that the person engaged with an interface or a computer (whether working or playing) should be able to become *familiar* with its features and functions in a manner that is easy or “intuitive.” The smooth operation of and interaction with the interface is thus rendered relatively clear or “translucent.” Further, the interface is then also able to provide a virtual domain in which an individual is able to operate in an uninterrupted, intentionally-directed “flow” -a flow that is said to represent a deliberately maximized or “optimal experience” (Csikszentmihalyi, 1990). Computers and particularly their interfaces, in other words, are designed to anticipate and facilitate what we want to do, when we want to do it. In the dissection exercise, as a very simple example, scissors appear precisely when an incision is required, and a magnifying glass takes their place when closer inspection is needed. This smoothly flowing motion from one tool to another is intended to provide students with an experience of uninterrupted transparency and flow, and a sustained but prereflective assurance of “living-in-certainty-of-the-world.”<sup>iv</sup>

Attempts to *simulate* experience of encumbrance and inconvenience on the computer highlight further important differences that separate online dissection from that undertaken in school: In particular, and as already indicated above, each involves rather different experiences of care. A very specific example of this is provided by the warning in the frog dissection simulation to carefully “twist the scissors to avoid cutting the heart under the ribs.” What the simulation actually requires at this point is a mouse-click that is no different --no more “careful” or skillful-- than any other. To simulate this type of care, and the encumbrance and confinement that it presupposes, is to work against the very logic, design and purposes of the computer and its interfaces. Attempts to simulate encumbrance, and confinement --and other experiences like deprivation or deprival<sup>v</sup>-- end up being experienced as either trivial or futile. They are seen as arbitrary or unnecessary irritations, rather than as challenges inherent to the task itself. If a more significant disruption takes place in the online dissection --a browser or operating system crash, for example--such a disruption would not be proper to or draw attention to the dissection exercise itself. It would instead draw the student’s attention to the computer or the simulation software itself, and perhaps also to the artificial nature of the simulation itself.

If the simulated dissection thus unavoidably confronts the student with herself -with an intentional and in some ways artificial ordering of an already familiar world- then the classroom dissection can be described as presenting the student encounters with that which is *not* the self, with that which is “other.” The “other” according to phenomenologist Bernard Waldenfels is something that is manifest as a kind of disruption of the self, its world, its plans and intentions. Waldenfels goes so far as to describe it as an “upheaval,” and he adds: “As far as such upheavals are concerned, one can only yield to them or withdraw from them” (2007, p. 30). One could say

that this choice between yielding and withdrawing captures the situation faced by the students in the in-school dissection exercise.

The purpose of drawing distinctions between the virtual and the “real” in this way is not to enter the fray of arguments directly for or against animal dissection. Instead, I am attempting to broaden the factors or criteria considered in such arguments –and in doing so, to say something about the nature of pedagogy and pedagogical experience. Like all experience, pedagogical experience is about an encounter between self and world. This experience can have the character of an upheaval or disruption, or it can be planned and optimized in advance, down to the finest detail. Both of these types of experience –experiences of inconvenience, encumbrance, or disruption *and* of familiarity, pliability, flow, and brilliance-- are important in education. For example, the attribute of “brilliance” that Borgmann ascribes to the hyperreal can be seen as being of significant pedagogical value (as the above reference to “educational brilliance” already suggests): The elimination of irrelevance or noise, and the foregrounding of that which is relevant or important is –with good reason—an indispensable part of lesson planning and instructional design processes. In many contexts, “educational brilliance” –and the associated phenomena of flow, transparency and learnability—makes sense as a pedagogical goal. But we should not conclude from this that such experiences represent the sum total of what is desirable for education. Opacity, disruption and upheaval –rather than always requiring withdrawal or protection—need to be studied and cultivated as learning experiences. Experiences that are emphatically embodied, mediated affectively and viscerally, are intrinsic to what it is to know, to learn and to educate. At the same time, it is evident that these experiential elements cannot be captured or engaged through the systematic categorization and planning. By definition, disruption and upheaval are mutually exclusive to processes of systematic planning—and run against the grain of the interfaces through which planned instruction is increasingly delivered. Opacity, encumbrance and disruption –with the upheaval and uncertainty they imply-- are instead disclosed only through a slackening the figurative threads of intention, categorization and planning. As a rigorous means through which these threads can be loosened and the grip of intentionality relaxed, phenomenology takes valuable first steps in bringing this experiential realm into focus.

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<sup>i</sup> This diagram and the multipart description for froguts.com combine characteristics of two versions of the online dissection simulation: one version was openly available in 2002-2003, and a second "demo" version was accessed 2008-2009. The description of student experience with the simulation are developed from the author's own engagement with the software during the two aforementioned time-frames (2002-2003 and 2008-2009).

<sup>ii</sup> Some exceptions are presented by adaptive and speech recognition interfaces, many of which allow differently-abled users to engage in a range of relational strategies.

<sup>iii</sup> At the same time, it is important to note that the animal in this dissection has itself been deracinated or uprooted from its own context –natural or otherwise. However, for this radical de-contextualizing to have been successful, a

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laborious and protracted effort is required: the animal's body has to be drained of its natural fluids, and these have to be replaced with strong preservatives; the body needs to be kept in a sealed container, and once the dissection has begun, further steps need to be taken for its preservation.

<sup>iv</sup> Indeed, as one phenomenological study (Leder, 1990) shows, the world of our own internal organs is generally experienced in either a manner that is shadowy and indirect, or in extreme emergencies, where our experience of them is essentially life-threatening in its danger and immediacy.

<sup>v</sup> An example of other experiences difficult (if not impossible) to simulate is provided in Marc Prensky's essay on "Digital Natives, Digital Immigrants." In it, he encourages the development of simulations for all types of curricula, even for subjects as problematic as the holocaust: "Create a simulation where students role-play the meeting at Wannsee, or one where they can experience the true horror of the camps" (2001, p. 6). The inability of simulations to render deprivation, encumbrance and confinement –along with experiences of risk and care—would clearly stand in the way of approximating the "true horror" of the camps.