Human Action and Social Groups as the Natural Home of Assessment: Thoughts on 21st Century Learning and Assessment

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The "Natural Home" of Assessment: Human Action and Social Conventions

In this paper I start with learning and assessment as they occur in everyday action, which is, I argue, their "natural" home. I then discuss how social groups life assessment out of everyday action in order to formalize it as a way of mentoring and policing newcomers. Then I take up the issue of the yet more formalized forms of assessment we use in our schools and other institutions. I argue that this latter enterprise has much to learn (including ethically) from the previous two settings. I will also discuss the role new forms of digital learning can play in making learning and assessment deeper in school and society.

Assessment is today largely associated with institutions and the word carries the connotation of institutionally sanctioned assessors and methods. I want to argue, however, that assessment, as a "natural" practice, has its original home in human action and learning. I will argue that good and fair institutional assessments must be grafted onto that base and grown from it.

To make the case for this claim let's think about a woman—named Mary, say—engaged in action. Assume she acts based on a goal. She then must reflect on whether her action has moved her closer to her goal or not. She must ask herself: Was the result of my action good for my purposes or not or somewhere in between? She must make a judgment. Once she has answered this question, then she acts again, revising, adjusting, or advancing in some fashion her earlier action, unless her goal has already been reached. Then she reflects and judges again about whether this new action is good or not.

Through action, Mary is basically probing the world. She is asking the world a question. Then she sees if the answer (the world's response) is adequate, acceptable, correct, or good for her purposes. She is assessing the quality of her actions, a form of "self-assessment". Of course, in getting and considering this answer from the world, Mary can, as one of her possible moves, rethink and revise her goal.

I do not want to engage in a philosophical theory of action here. Let me just say that the pattern of "goal/probe/response from world/reflect/new revised probe" is one basic and important pattern of human action (Gee 2003/2007, 2004; Schon 1963).

Formalized, it is also a basic procedure of experimental science, where the goal becomes a hypothesis.

When Mary asks whether her action is good or not, how does she know the answer? She must have a **value system** in terms of which she can make such a judgment. Research in neuroscience (Damasio 1995; 1999, 2003) has made it clear that such a value system is driven both by cognitive factors and emotional ones. Unless Mary cares in some fashion about her possible choices of action, it is hard or impossible for her to make a choice as how to act next, no matter what "reason" alone tells her. It is here, of course, that we touch on the foundations of such things as "motivation", "interest", and "engagement".

This value system, the system that tells Mary whether the result of her action/probe is adequate, acceptable, correct, or good or not, is what I will call, following Donald Schon, her **appreciative system** (Gee 2004, 2007; Schon 1963; Vickers 1973, 1983). I call it this because it is the system through which she appreciates the results of her actions/probes.

But where does Mary's appreciative system come from? How did she get it? Does she just make it up herself? Usually the answer is "no". Imagine I wanted to make a drought resistant garden in my back yard. If I start knowing little about the matter, I could do this through a long process of trail and error. What I would normally do is find out what other more expert people have done, what they have learned from their communal history in making such gardens.

Thus, when Mary acts/probes and then reflects on the result/response from the world, it is usually not Mary alone who determines what "counts" as acceptable, adequate, correct, or good. What often determines this is some social group that has developed **conventions** for what counts as acceptable, adequate, correct, or good and how to go on, a social group that has informed Mary.

Whether playing baseball, courting a mate, doing a proof in mathematics, engaging in a business deal, or creating a drought resistant garden, some social group (sometimes a group as large as a "culture") has conventions—has learned things—about what counts as acceptable, adequate, correct, or good and what counts as a way to successfully go on in a trajectory of action to accomplish certain sorts of goals. These

conventions, of course, vary across different groups and situations as to how rigid or open-ended they are, how much room they leave open for choice, variation, and adaptation.

The conventions are often based on a shared social history of discovering and passing on what works. If Mary is engaged in science, for instance, the conventions are connected to "theories" or "methods", as well as normative practices. If she is engaged in designing and uploading clothes for *the Sims* to the Internet (a video game), then we don't always use elevated terms like "theory" and "method", though all social groups have their theories and methods and "tried and true" favored ways of proceeding.

The word "convention" here may offend some. Some groups, of course, have conventions about favored ways of proceeding that are not very effective from the point of view of reality testing (e.g., astrology) or conventions that lead to evil (e.g., KKK or neo-Nazis). But all this shows is that choosing a social group and its conventions is often a moral choice.

Back to Mary: In many cases, Mary must know the conventions in order to know how to go on. She may well discover many things for herself, but she is unlikely, in most cases, to discover everything for herself. Her appreciative system is her internalized version of the conventions with whatever personal variation can, in a given case, be added. So, then, too, it becomes relevant to ask how Mary learned the conventions. This amounts very often to asking what her relationship is to the social group whose conventions these are. The best way to learn a group's conventions is to participate in the group, but one can learn such conventions through observation and study, as well.

The argument I have developed so far—as readers will have noted already—is an amalgam of Donald Schon (1983) and Ludwig Wittgenstein (1953/2001). Let me call the "goal/probe/get a response from the world/reflect based on an appreciative system/new revised probe" cycle a "basic circuit of human action". I will add one more element to this circuit below—namely, identity.

It is important to note that, in this circuit, learning and assessment are not separate, but, rather, part and parcel of each other. Mary learns something from the world's response to her probe, in terms of which she revises her next action/probe. She learns through "assessing the situation" via her probe, the world's response, and her

reflection on that response using her appreciative system. Learning and assessment are here really inseparable as part of this basic circuit of human action.

Mary's learning and assessment are not, as we have seen, just individual. Her appreciative system reflects, in part, at least, the conventions she has gained from interactions with, or observations of, some social group. Her appreciative system, in fact, does not have to be entirely in her head. Appreciative systems are not just "mental". Mary can make use, if need be, of other people and various tools (including texts) that also participate in those conventions, in order to supplement what is in her head. Appreciative systems are represented out in the world as well as in heads. They are, in that sense, "distributed" across heads, other people, texts, tools, technologies, and practices.

By the way, Mary can transform the conventions if her actions vary from them in some way, just so long as her variation catches on with some social group that uses those conventions. If people who use those conventions recognize and accept what Mary has done—with the variations she has added—as falling under those conventions (as being acceptable, adequate, correct, or good) then she has transformed the conventions in a small or big way. This is, of course, the key source of innovation (Gee 1990/2007).

This rather arid philosophical discussion about action, learning, appreciative systems, and social norms or conventions is motivated, in part, by the reality that today digital media allow people to engage with more social groups and their conventions than ever before. If I want to engage in drought resistant gardening today I can readily find not just texts, as I could at an earlier time in a library, but whole communities on the Internet ready to share their knowledge and conventions with me.

But, for now, we will leave Mary and move on to a real situation. This will allow me to give a concrete example of what I have been trying to get at and bring in one more crucial notion—the notion of identity—so far left out.

Becoming a SWAT Team Member: Identity and Domains

When people act, they are usually acting in accord with their appreciative systems, which, in turn, are usually connected to the conventions of some social group.

Furthermore, social groups and their conventions always operate in a given **domain** (Gee 2003/2007). Their conventions are not about everything, but about some specific domain of knowledge and practice.

Domains are almost infinitely variable and new ones arise all the time. Academic areas are domains, but so are popular culture practices like *Yu-Gi-Oh* or video gaming (and within it specific types of games and gaming practices). Domains arise any time a social group creates conventions about how to act and value in regard to some particular and characteristic set of beliefs, knowledge claims, and practices.

Domains are crucial to assessment. Since domains—actually the social group whose domain it is—define what counts as the "right way(s)" to "go on" in a chain of action to accomplish goals, it is problematic to engage in assessment outside any domain whatsoever. Where would one's appreciative system come from? How would one know how to "go on"? Of course, in rare cases, someone may have, through trial and error, made up everything by him or herself. But in the case of most sophisticated domains, this is unlikely.

In order to move to a concrete example, let's reflect on the domain of a SWAT (Special Weapons And Tactics) police team. As I talk about SWAT, readers may want to replace SWAT with their favorite science domain, for example—they will see that things work much the same way in SWAT and in science. Though we don't usually think about science, especially as a school subject, in the ways in which I am going to talk about SWAT, I argue we should.

Let's think about someone trying to take an action as a member of a SWAT team. One issue that we did not discuss with Mary is this: How does one begin to act when one is just a beginner, a newcomer? A newcomer has not yet developed an appreciative system by which to "assess the situation" after he or she has acted/probed.

Lots of times—especially if we are thinking about schools or workplace training—we think of learning in terms of someone learning facts or skills, what we might broadly call "content". However, since both acting and learning are usually tied to a social group that gives the learner an appreciative system, both acting and learning must start not with facts or skills, but with an **identity**.

Our SWAT team newcomer must start with the identity of being a SWAT team member. Why? Because it is this identity that tells newcomers in the first place what goals they should have and how, in general, they should "appreciate" or "assess" their actions towards those goals.

The word "identity" is used in many different ways, so what do I mean by it specifically here? I mean a "way of being in the world" that is integrally connected to two things: first, characteristic **goals** (namely, in this case, goals of the sort a SWAT team has); and, second, characteristic **norms** and **values** by which to act and evaluate one's actions (in this case, these norms and values are those adopted by SWAT teams). "Identity", in this paper, means the goals and norms/values that flow from a given social group and its conventions.

The norms and values amount to a value system. For example, in regard to SWAT, some of the norms and values are: don't shoot people, even if they have a gun, until you have warned them you are a policeman; don't ever enter a room in a way that unduly risks the safety of your team or innocent people in the room; secure any situation before moving on; never lag in vigilance; and other much more specific recipes for action, adjustments to action, and the repair of action, down to specifics like "what I just did left my back facing an unlocked door; that is bad, I need to revise my action and quickly"—see my discussion on rubber doorstops below.

Now, of course, to accomplish goals within certain norms/values, the SWAT team newcomer must master a certain set of skills, facts, principles, and procedures ("content"). But only after he or she has some understanding of—and has accepted, if only provisionally—what I have called an "identity" (here as a SWAT team member) does such "content" make sense or become useable.

So our basic circuit of human action has to be revised a bit. It is: "identity/goal/probe/get a response from the world/reflect based on an appreciative system /new revised probe" (iterated).

As newcomers begin to master "content" (facts/information and skills) in an enterprise like SWAT, they are given tools and technologies that fit particularly well with their goals and norms/values and that help them master the content by using these tools and technologies in active problem solving contexts. [Too often in school, by the way,

content is introduced without identity or tools/technologies or simply with the identity of being a "good student" "doing school"]

These tools and technologies have an interesting property. The mediate between—help explicate the connections between—the newcomer's identity (goals, norms/values), on the one hand, and the content the newcomer must master, on the other. They tie goals, norms/values, and content together, integrate them.

Something as simple as the SWAT team's doorstop device is a good example (it's just a rubber doorstop, nothing special). This little tool integrally connects the team's goal of entering rooms safely and norm/value of doing so as non-violently as possible with the content knowledge that going in one door with other open doors behind you can lead to being blindsided and ambushed from behind, an ambush in which both you and innocent bystanders may be killed. Of course, the SWAT team has many pieces of equipment and technology more sophisticated than the doorstop.

We can think about such tools and technologies in quite expansive ways. In SWAT, tools and technologies include types of guns, ammunition, grenades, goggles, armor, lightsticks, communication devices, door stops, and so forth. But they also include one's fellow SWAT team members, who model correct skills and knowledge for the newcomer and mentor newcomers. Such modeling and mentoring almost always integrate goals, norms/values, and content—for example, in stories experienced members tell newcomers or in after-action reviews (debriefings) teams do with each other.

Some will be bothered by the way in which I treated people as tools for helping other people act and learn. However, in today's global world, being able to use and be a part of "distributed knowledge systems" is a crucial 21st-century skill. In such a system, knowledge is stored, spread, and networked across people, their environments, tools, and technologies.

Taking inspiration from Bruno Latour (2004), we could call the human members of the SWAT team, as well as their tools and technologies, and even objects in the environment that the SWAT team members use as tools (e.g., corners to hide behind), "actants" (Latour 2004: 237; Callon & Latour 1992). On this perspective, not just humans are "actors" (effective agents involved in causing things to happen) and so we name them all—humans, tools, technologies, and objects—"actants". Of course, humans

beings have forms of intentionality and desire that objects, tools, and technologies don't. But, in turn, objects, tools, and technologies have their own "affordances" that we ignore at our peril and that help us to be effective in the world when we honor them.

We can see the real "team" as composed of all these things, and not just humans all by themselves, and call it an "ensemble" [of humans, objects, tools, and technologies] (Latour 2004 uses the term "collective" and Latour 2005 uses the term "actor-actant network"). All these things—people, tools, technologies, and objects—have to "dance" with each other if coordinated action is to be pulled off.

It is a dance in which humans have to learn both to lead and follow; to coordinate other people, tools, and objects, but to get coordinated by them, as well (Knorr Cetina 1992). Humans have to be active and passive both, to get into synch with others, with tools, with technologies, and with objects and the environment. This is why, for example, activity theory (Engeström 1987) stresses evaluating learning not in terms of individuals, but in terms of "systems", something like what I have called an "ensemble" here. Learning becomes about forms of participation and engagement with others and with objects, tools, and technologies in "systems".

Keep in mind that this is how Latour describes science—really the work of the sciences (Latour 2004)—as well. Furthermore, I intend my SWAT example to be generalizable. Other enterprises work in similar ways, whether it is a branch of science or being a *Yu-Gi-Oh* fanatic. It should be noted, as well, than even were a SWAT team member to operate alone, he or she would still be operating by the social goals and norms/values of the group. So, too, with scientists and *Yu-Gi-Oh* fanatics. For us humans, individual action is also social action.

Of course, humans belong to many different social groups. Their membership in each group—and the characteristic goals, norms, and values they have as actors in those groups—can affect how they act within each other group. Thus, each individual's actions are never totally predictable or the same as other people's actions within any group.

What I have said about SWAT could be said about other domains, e.g., gardening, cooking, video gaming, biology, Catholic theology, law, dentistry, street gangs, blogging, bird watching, and many specific types within each of these. Each of these is a domain (there are domains within domains: for example, real-time strategy video gaming within

video gaming). Domains are not, of course, separate from each other. They exist within a larger social, political, and economic structure that imposes other rules, conventions, norms, and values on them. Some domains are closer to others and they all exist in a complex web of relations of similarity and difference, affiliation and opposition.

So I have introduced a variety of terms that I argue are central to assessment in its most indigenous, natural state as part and parcel of human action and learning: identities, domains, goals, norms/values, probes, responses from the world, reflection, revised action, revised (rethought) goals, appreciative systems, conventions, social groups, actants, tools, technologies, objects, and ensembles (of humans, objects, tools, and technologies). These are not the terms of art in current work on formalized systems of assessment (in schools, for instance). But I will argue that they should be if we are interested in learning that leads to participation, production, and problem solving. Of course, the real "proof" of this claim will only come when we develop concrete examples of new assessment systems that are built around these "terms of art" and not our current ones.

It is pretty clear that it would silly to formalize assessments (made, say, by some institution) of SWAT team members outside the terms of art above. Silly, too, to formalize assessments of, say, scientists outside these terms of art. Even if one was to make up a "fact test"—instead of, say, a performance-based assessment—for a SWAT team member or a scientist of a certain sort, the facts chosen would certainly be selected against the background of the characteristic identities, values, norms, goals, conventions, and collaborations and actions with other people and with tools and technologies in these domains. At least they would if we cared about "authenticity" and "transfer" to real problem solving. Formal assessments that are authentic and transfer are made relative to deep knowledge of a domain.

Lifting Assessment Out of the Basic Circuit of Human Action: The First Step

So far I have argued that assessment has its "natural" home in human action. But I have also argued that human action involves an identity and an appreciative system, both of which are tied to some domain and the social group whose domain it is. So it is

not surprising that assessment (and, of course, learning too) can be and is lifted out of the basic circuit of human action and "formalized" by these groups themselves.

SWAT teams, scientists, and *Yu-Gi-Oh* fanatics want to know how newcomers are faring. They want to know this both in order mentor newcomers and in order to police them and, in the act, defend the group's norms/values.

Assessment at the group level (beyond an individual's appreciative system) for most social groups is both a form of mentoring and policing (Latour 2005). In some cases this means being sure that norms are adhered to. In other cases, it may also mean that newcomers and others are encouraged also to improve the "rules of the game"—as we hope happens in science domains at their best.

Mentoring and policing are not as opposed to each other as it might at first seem (and as they often are in school). Newcomers usually want to "live up to" their new identity and, since this is an identity they value, they want that identity "policed" so that it remains worth having by the time they gain it more fully. They buy into the "standards". Surely this is how SWAT team members, scientists, and *Yu-Gi-Oh* fanatics feel. This is, of course, a significant condition to state. Students in school may not "buy in" enough to have this condition met.

Of course, if people are being forced to take on an identity they do not want, then there often is a real opposition between mentoring and policing for these forced newcomers. This is a practice that I would count as violence towards the basic circuit of human action (because it either substitutes not caring for caring or fear for caring in the newcomer's use of an appreciative system—remember emotions and not just reason are crucial). Again, this is a dilemma for schools.

We need to ask how different groups (SWAT teams, biochemists, *Yu-Gi-Oh* fanatics) take assessment out of the basic circuit of human action (its natural home) and "formalize" it through mentoring and policing. To answer this question we would have to engage in specific ethnographies, since different groups do different things. This would, indeed, be a worthwhile and important project, since such social group assessments are closer to the natural home of assessment than are assessments run by institutions (like schools) removed from these groups (I am leaving schools aside for now, though, of course, they constitute themselves quite distinctive social groups).

However, one important thing that social groups have in common when they assess their newcomers and members is this: Whatever practices they engage in, these must, for the most part, end up forming and influencing the newcomer's appreciative systems. That is, more formalized assessments must, in some way, become internalized into the learners' appreciative systems (or, at least, be useable by the learner through texts, tools, and other people). The learner must become a self-assessor. Learners must learn to mentor and police themselves. So, then, too, the question arises as to how people go from group assessment to self assessment. I would offer a largely neo-Vygotskian account of this in terms of development within a "zone of proximal development", but must leave the matter aside for now.

Another important thing that social groups have in common when they assess their newcomers and members is this: At least some of this assessment (mentoring and policing) is done when the learner is part of what I called an ensemble above and is, in fact, an assessment of how the learner behaves as a member of the ensemble. This is "in situ" assessment, but of a special type: it is assessing how the learner can coordinate and get coordinated by other people, tools, technologies, and objects in the "dance" (sometimes called the "mangle", see Pickering 1995) of practice. [If you want to know whether someone is a good birdwatcher, you want to assess how they "dance" with birds, bird books, binoculars, environments, and other birders].

Let us call this "ensemble assessment"—keeping in mind that "ensemble" has a special meaning here (we could call it "dance assessment" or "mangle assessment" as well). Needless to say, such assessment requires the presence (in reality or virtually, as we will see below) of other people (who share identities and appreciative systems), tools, technologies, and objects.

"Sim Domains": Simplified Simulations of a Domain

The reader may well wonder why I chose SWAT as my example. Here is the reason: I have played the video game *SWAT4*. *SWAT4* is a simulation of a SWAT team in which the player is a virtual SWAT team member commanding three other team members (Gee 2007). Such games/simulations (or related ones) are used in training real

policemen. In real training, however, sooner or later, the real world becomes the training space. Such games are also used by everyday people who have no intention of becoming a SWAT team member (like me).

In terms of learning, assessment, and acting, a game like *SWAT4* operates in many ways like actual SWAT teams. However, much real-world complexity is removed in such a game. The game is a simplified and idealized simulation. Simulations are a type of model. For my purposes here, models are simplified representations of real objects or systems where the representation is similar to some ways to the object or system it represents. Think, for example, of a model plane used either in play or in a simulated wind tunnel for scientific tests or of various sorts of diagrams, graphs, and blue prints—more abstract models. Simulations (which these days are often virtual worlds) are just large and intricate models that seek to represent relationships in a system.

Models and simulations enhance learning by creating a well designed learning space that controls complexity and orders what is to be learned in effective ways. Learning of this type does not, of course, have to be a game. We can use models and simulations of a great many different types to simplify a domain and render understanding and problem solving more tractable.

From the standpoint of learning, games like *SWAT4*, and simulations more generally, do several things: First and foremost, they give players/learners an "empathy" or "feel" for a complex domain, a domain initially too complex or dangerous to confront directly.

Second, such games prepare players/learners for future learning in the domain should they want or need to engage in more such learning, including in the real world (Bransford & Schwartz 1999). Third, such games give players/learners some facts (information) and skills, acquired through participation in the practice, thus, acquired as meaningful, not as "decontextualized".

It should be said that not just young learners use simulations for these purposes. They are used for just these purposes by scientists, as well. Even for scientists, the real world is often too complex to confront directly, without simplification and ordering.

While not everyone will think that SWAT is an important "educational" domain, we could imagine using digital media to do the same thing for domains more closely connected to common educational goals (see Shaffer 2007), for example, urban planning, engineering, chemistry, space science, law, the courts, and many other such domains. For instance, an urban planning game could engage even young learners with empathy for the complex domain of urban planning and in the act teach skills from a variety of "academic" areas like sociology, economics, ecology, and even the mathematics of flow for traffic (for an actual example, consider the commercial game *Sim City* or the educational urban planning "epistemic game" made by David Shaffer, 2007).

Play

Games like *SWAT4* are used as forms of play, as well as, in more professional versions, as forms of workplace learning for policemen. A chemistry game could be used as a form of both play and learning for students in school, reaching the same learning goals as *SWAT4*, but in a domain we think of as more educational. Play, in this sense, is not necessarily antithetical to learning, even in school.

But there is another sense of play that, at first sight, seems not at all at home at school. This is play in the sense of "being playful" and "playing around with things". I have in mind here imaginative play, play like what a child does in a sandbox or with a doll house.

When young children are playing house or children or adults are playing the *Spore* creature creator (where you make colorful and weird fantasy creatures), they are in a fantasy space where they are using their imaginations and where failure need not be an issue. This is why some people talk about this sort of play as being done from within a "magic circle" (Huizinga 1950) that shuts out the harsher aspects of reality (e.g., sorting, consequential failure, and harsh competition).

We have long known that children can learn important things and ready themselves for life through such imaginative play (much as young animals practice adult activities in play). There are also those who believe that older children and adults can, through such imaginative play, develop creativity that can eventually lead to innovation in more serious domains (Gee & Hayes, in press). Even professionals and scientists

sometimes just "play around" and try things out away from the strictures of professional activities and duties.

This type of play I will label a domain (though of course it is a very special type of domain) and call it the "domain of play": but by "play" right now I mean only imaginative play of the sort I have been talking about. As the child or adult plays—say, makes a creature in the *Spore* creature creator—the person is outside real world academic, professional, and specialist domains. No social group is directly norming or policing the child or adult. Indeed, if it is a scientist playing around, the scientist may be engaging in such play precisely to free him or herself up from such norms.

However, norms and values—and appreciative systems—do play a role in such play. Even in play—when a child role plays a mother or when I make a creature that tickles me in the *Spore* creature creator—in order to act I usually have to ask myself if I like the outcome of my action and whether I want to change that action in some way to get another outcome. That is just to say that even when I play I often have to have an appreciative system (there may be exceptions, but clearly in many cases, when people are playing, in the sense I am now using the term, they often revise what they are doing based on whether they like the outcome or not—in fact, children playing house, for instance, often debate such things).

But where in such play does the appreciative system come from? It comes from the appreciative systems of real world domains—e.g., the domain of parenting for the child playing house or the science domain the playful scientist knows. However, in imaginative play I am free to play with these domains' conventions.

In such play, we can ask questions like: What happens—how would I "go on"—if children ordered their parents around or fathers stayed home? What happens—how would I "go on"—if I thought about this problem in sociology the way gardeners think about gardening? Of course, such play has, in history, had real consequences later on in the world, though we can never tell when such play might have such consequences.

In reality, such play is, in fact, play with—being fast and loose with—appreciative systems in a space where the domains whose appreciative systems you are playing with can't "get you", can't enact any bad consequences on you for breaking or varying their conventions.

But note that in such play you cannot break all the conventions all at once, since if just "anything goes", then nothing goes and you would not even know you were playing house. The fun, of course, is in keeping some convention and breaking others and seeing what happens, how things fit together or don't, what it feels like to have changed the domain or combined different domains in new ways.

The play domain is a source of creativity and innovation. It is important for very young children in their early socialization in life (e.g., consider children playing school). It is important, too, for people who have become adept at and comfortable with—perhaps too comfortable with—the norms and values of real-world domains.

Play, in the sense I am using the term here, disallows evaluative sorts of assessment from the outside (the player is, of course, assessing in the sense of appreciating from the inside). If we start to "grade" people for their play, we destroy it. We could of course watch our children playing in order to give them better dolls or dolls that afford different forms of play—this is what Will Wright did when he created *the Sims*.

Can we imagine—beyond kindergarten—young people playing in schools? College students? There could not be any grades. We could only resource their play. And one resource we could give them is lucid understanding and engagement with real-world domains that they can then "play with". I have seen this happen in schools in programs that were not graded, admittedly at the periphery of the curriculum. In one striking case, the teacher could not tell which kids were "Special Ed" and which were not, since all the kids were quite creative—and the teacher attributed this to the fact that she did not grade.

So, in the end, free play involves appreciative systems and domains, just as do more formal learning and work. We cannot exit appreciative systems and domains; we do not normally live in situations where just "anything goes"—because we would then not know how to "go on".

Five Learning Environments

The *SWAT4* example is useful because it allows us to distinguish different ways of setting up learning environments. In order to discuss these learning environments I need first to introduce a few technical terms.

First, it is crucial—or nothing but confusion will ensue below—to see that a domain (as I am using the term) is **not** defined by a set of facts, skills, and principles ("content") but by the **uses** people make of certain sorts of facts, skills, and principles. One and the same fact, skill, or principle—or word, for that matter—may be used quite differently in different domains. So, for example, when I call physics a "domain", I do not mean physics as a set of facts (that one might find in a textbook). I mean physics as certain sorts of activities, practices, norms, and values engaged in by people who use certain sorts of facts and skills in certain ways to carry out these activities and practices and instantiate these norms and values.

It is useful to distinguish between specialist domains and what I will call the "lifeworld" domain (Habermas 1981). Domains like SWAT, biochemistry, law, video gaming, and *Yu-Gi-Oh* are "specialist" in the sense that people in these domains take on specialized identities and specialized forms of language. But we humans also all often live and act just as "everyday" people, not as specialists of any sort.

Of course, different cultures have different ways of enacting (in words and deeds) being an "everyday person". When we are acting as "everyday people", I will say we are acting in the domain of the "lifeworld". People learn what it means to be a culturally distinctive "everyday person" through their initial socialization in life and in their later interactions with their "local" communities. They do not need school for this.

It is useful to point out, as well, that among specialist domains, one is particularly important and special. Most humans live in societies where there are identities, appreciative systems, and skills that integrate people into something "bigger" than the various family and community sub-cultural and class identities they start learning as children. I will call this the "public sphere" (Habermas 1989), the place where one is a "citizen" of a "larger" society (or even the global world).

The pubic sphere is a specialist domain because it involves dealing with institutions and practices that incorporate specialist language and practices (think about going to the motor vehicles department, getting a passport, or going to court). Everyone picks up such language and practices after their socialization early in life has started them well on their way to their lifeworld identities.

Now I want to distinguish five learning environments, five "spaces" where learning occurs. These are ways in which people learn beyond their lifeworlds, so schools are relevant here, since that is one of their purposes. Of course, people learn in these environments outside of school as well.

1. Actual Environment Learning: Such learning involves actually joining—and being mentored and policed by—the social group that forms one's identity and appreciative system in a given specialist domain (like becoming a SWAT team member, a biochemist, a *Yu-Gi-Oh* fanatic, or a "citizen").

2. Pretense Environment Learning: Such learning involves going through the actual real world learning processes in a given specialist domain (as in 1 above), but with no intention of actually joining and staying in the social group whose domain it is. A journalist undergoing SWAT training to write about it would be an example. So would a spy. So would some forms of ethnographic research. I do not here mean anything invidious by the term "pretense", only that we are here involved with a certain type of "pretending".

3. Sim Environment Learning: Such learning involves gaining empathy for a domain's identity and appreciative system through a simplified and/or idealized version of the domain via a simulation. The learner need not actually join the social group whose domain it is. Sim Learning does not have to be in a virtual world, of course. A teacher can set up a simulation in her classroom of what it means to be a scientist of a certain sort and do science of that sort. Such learning is not "Pretense Learning", since the simulation will not be the actual real-world situations in which scientists learn to be scientists of that sort. Further, such simulations do and should simplify the actual domain

in various ways to focus on important aspects in ways that are fruitful for learning—that is the point of simulations. Many so-called "inquiry" approaches to science learning fall under the heading of Sim Environment learning, though not all are coherent (see below). When we engage in Sim Environment Learning, what is going on is "real" or "authentic". But it is also simplified and puts a premium on trying things (probing and reflecting) and not on failure and the cost of failure (as can happen in the "real world" when a mathematician fails to get tenure, say).

4. Play Environment Learning: Such learning involves imaginative play with appreciative systems and different domains' conventions safe from bad real-world consequences.

5. Generic Environment Learning: Such learning is tied in the here and now to no specific domain (remember, a domain is not defined by content, but by uses of content), but deals with information and skills that have historical ties to specific domains and might eventually apply to any, all, or some specific domain in the future. It is a sort of domain promissory note.

Readers who do not remember that a domain is not defined by its content alone, will immediately object: Why can't a kid just learn (memorize) a fact or principle from physics? Isn't that learning physics in some non-generic way? Why bother with social groups, like physicists? Why can't we just have physics as facts?

This to me is still generic learning. The student has just memorized something. If he or she tries to act on that knowledge, the whole issue of an appreciative system will immediately come up (how to decide what is a "good" result; how to go on). That will, in turn, immediately bring us to specific social groups and their identities, conventions, goals, norms, and values. Until then the fact learned is generic, because it is just waiting around to see if it ever gets applied or used in a domain or a simulation of one. And, of course, often the student cannot use it and it remains forever generic or becomes forgotten.

If the student is to act (probe the world), that student must have internalized some appreciative system tied to physics as a social group and activity in the world. Thus, the student—if he or she is to act—must have learned more than a fact, skill, or principle in isolation from identities, conventions, goals, norms, and values connected to physicists and physics as a practice.

Of course, someone will say: "Wait a minute, kids in school cannot all be expected to do physics in the sense of living by the actual norms and values of real adult physicists". Well, they certainly can engage Sim Environment Learning and play by the rules in just the way I played by the SWAT rules when I played *SWAT4*. In this case, they will at the very least gain an appreciation for physics as a "form of life" (Wittgenstein 1953/2001) and see how physics "facts" are in reality tools for doing things and solving problems.

One can immediately see the problem with schools here. There really are only five choices and Actual Environment Learning and Pretense Environment Learning are often impracticable or impossible in school (though I will discuss important exceptions below). Generic Environment Learning is a mainstay of schooling, but is not always very motivating or effective. Sim Environment Learning is today more practicable than ever before, thanks to new digital media that allow us to make games and simulations.

School does often engage in Actual Environment Learning and Pretense Environment Learning, but in an odd way: It creates a specialized domain we might call "doing school" (that is being good at school in and of itself, even when school practices have no important tie to any other domain) and apprentices people to that domain. Some students are just engaged in pretense when they engage with this apprenticeship, others take it "for real". Some people find something useful in "doing school"—and it probably fits one for being a quiescent participant in society and the workforce—but I have no particular brief for it. It is odd to think that so much of our standardized testing apparatus, and preparation for such tests in school, is a form of this "doing school", even when called "science" or "mathematics". In any case, the old literature on the "hidden curriculum" in school is replete with discussion and critique of "doing school" (which usually serves as a "sorting device") and I don't have anything more to say about it here.

Generic Environment Learning

There are times Generic Environment Learning is necessary or useful. A good example would be learning to decode print. Learners will most certainly use decoding in lots and lots of specific domains later on. But as we move on in reading, there comes a limit to the usefulness of generic learning.

There are some substantive generic comprehension strategies that apply to almost all domains that recruit reading, but much in comprehension and vocabulary growth (necessary for comprehension) requires integration and embedding in specific domains. Generic comprehension and vocabulary strategies will not by themselves allow a student to comprehend natural science, say, as against social science or literary criticism.

Because generic learning has grave limits, we get a phenomenon like the so-called "fourth-grade slump" (see Gee 2008 for discussion and citations) when we overdo it. The fourth-grade slump is the phenomenon whereby many children do all right learning to read early on in school—often through generic learning—but cannot read well to master academic content later on with its own distinctive forms of complex language that requires more than generic language and literacy skills.

There may be some point in young people learning "content" (facts, skills, and principles) connected to a domain like physics without actually engaging with the real domain or a Sim version of it. Perhaps, there are "facts" everyone should know and, surely, knowing lots of such facts facilitates reading "content area" texts or, at least, textbooks. But, again, there are grave limits here.

Such facts are retained in only a superficial form, at best, after schooling ends if they are never connected to acting and appreciating in a domain. One certainly cannot make decisions using such facts—even as, for example, an "informed citizen" using science facts—since such decisions would require some hold on a domain's appreciative system (otherwise how would one know the decision's results were "good" or "bad"?).

However, when schools try to leave generic learning and enter another environment devoted to non-generic learning, they run onto trouble. They immediately face arguments about what to teach since there are so many specific domains. They face problems, as well, with delivering either a real domain or a lucid Sim version of one in

the classroom. We have seen above that it can be done, but it often requires substantive change in the "grammar of schooling".

Non-Lucid Pseudo-Domain Learning in Schools

There are many educational approaches that claim to be engaged with domain learning. Such approaches sometimes use the term "inquiry", though this term covers many different approaches, some good, some bad. In some cases, these approaches engage students in some potpourri of science or math facts and activities, for example, with no worry about how these actually tie to any real domain, its appreciative system, and the uses made of such facts.

We could call this another form of generic learning or we could just recognize it as non-lucid pseudo-domain learning. This is learning where no one is really clear what the domain is specifically or how the classroom learning actually relates to any real domain.

I don't want to discuss specific cases here. So let's just take an example not based on any specific curriculum. Imagine we are told that children will study a pond. The children are told that they are going to be "investigators". They will ask questions of the residents around the pond; they will count the birds in the area; and they will test the water in the pond to see if it is affected by local construction.

But we can now ask: Where does the identity the children are supposed to adopt come from? Where do they get the norms and values that will form their appreciative systems? What are the "rules" here, what conventions should they follow? Where did these conventions come from? What domain or domains in the real world are the answers to these questions tied to?

If the answers to these questions are not clear to the teachers and the students, then this is non-lucid pseudo-domain learning. Just because kids are taking samples of water and testing for things like acidity does not mean they are engaged in science. After all, people who own pools regularly test their pool water, but they are not engaged in any domain of science.

It is not enough just to have a goal, hypothesis, or question, such as "Is local construction near the pond impacting water quality?". The key thing is that learners need to know where this goal came from, why it is a goal of the domain from which it came, and how to assess the results of each action (probe) in an ongoing trajectory of activity towards accomplishing that goal. They need to form an appreciative system and to do this they need mentoring and policing (for real or within a simulation) in the conventions, goals, norms, and values of a domain (one or more).

Different domains count birds and count them in different ways for different purposes. There are a number of domains in the world that might sometimes call their members "investigators" or, at least, say they are engaged in "investigations". There are none that just use the term generically. So, too, there are lots of scientific domains, none of which just calls itself just "science".

The point of domain-centered learning should be to achieve lucidity so that learners understand what they are doing and why, and so that that contextualize their learning in terms of meaningful practices and ways of being in the world. Of course, there are now in the world any number of jobs—certainly many service jobs, but even some professional ones—where people just follow rote rules and use technologies the insides of which they do not understand. But the purpose of school, in my view, is understanding and, in particular, understanding of how knowledge is built and debated in practice. Such understandings are also important, I believe, for the development of informed citizens, especially in our crisis-filled, high-risk, global world replete with interacting and potentially dangerous complex systems.

Pro-Am Communities

As I have said, it is sometimes hard to bring an actual real-world domain into school, though it is, of course, possible to bring in a Sim version of the domain. However, popular culture today gives us important examples of significant Environment 1 (Actual Environment) learning that could go on in school, but almost never does.

Today young people are using the Internet and other digital media outside of school to learn and even become experts in a variety of domains. We live in the age of

"Pro-Ams": amateurs who have become experts at whatever they have developed a passion for (Anderson, 2006; Leadbeater & Miller, 2004).

Many of these are young people who use the Internet, communication media, digital tools, and membership in often virtual, sometimes real, communities of practice to develop technical expertise in a plethora of different areas. Some of these areas are digital video, video games, digital storytelling, machinima, fan fiction, history and civilization simulations, music, graphic art, political commentary, robotics, anime, fashion design (e.g., for Sims in *The Sims*). In fact, there are now Pro-Ams in nearly every endeavor the human mind can think of.

These Pro-Ams have passion and go deep rather than wide. At the same time, Pro-Ams are often adept at pooling their skills and knowledge with other Pro-Ams to bring off bigger tasks or to solve larger problems. These are people who don't necessarily know what everyone else knows, but do know how to collaborate with other Pro-Ams to put knowledge to work to fulfill their intellectual and social passions

We do not know how pervasive this Pro-Am phenomenon is among less privileged young people, though many community programs are seeking to offer less privileged kids the opportunity to engage with digital communities of practice. What we do know is that this is a promising space where we can work to involve more and more young people in ways that will lead to 21st-century skills (Gee & Hayes, in press).

Let me give one specific example of what I am talking about: A young rural girl, quite unaffiliated with school, is in an out-of-school program to encourage girls' interest in technology (Hayes, in press). In the program she has learned that she can use Photo Shop to turn real clothes into fashions for her Sims in the game *The Sims*, though this is something of a technical feat. Nonetheless, this is something she wants badly to do. She has learned that she can do it, but not how to do it. This she has to learn on her own—actually not on her own, since there is much help available on the Internet—since the people who run the program do not themselves know how to do it.

After much effort, the girl eventually designs virtual clothes from real cloths for her friends (her status in her peer group goes way up) and then discovers she can upload her clothes on the Internet so that people across the world can see them and use them.

Soon hundreds of people are using her designs and heaping her with praise (she now has "global" status).

This girl originally did not sell her clothes, but gave them away. But soon she opened a shop in *Second Life* (a virtual world built by its own "players"), a shop which she constructed herself. She started selling her clothes there for Linden dollars, which can be traded for real money. She has become a classic example of what the Tofflers (Toffler & Toffler, 2006) call a "prosumer," a consumer who produces and transforms and does not just passively consume.

Such prosumers produce originally for off-market status and as part of a community of like-minded experts. But, as the Tofflers point out, such prosumer activity often impacts on markets when people like this little girl eventually sell their goods or services. In fact, the Tofflers believe such activity, though unmeasured by economists, is a big part of the global economy and will be a yet bigger part in the future.

This young girl is engaged in Actual Environment Learning. She has actually joined several Pro-Am communities or what we could also call "passion communities"—non age-graded social groups that mentor and police domains dealing with things like designing clothes for *the Sims* or designing and selling in *Second Life* (Gee & Hayes, in press) The standards are high here. Others in these passion communities have mentored her, but they hold her to very high standards if she is to be accepted as an "insider".

I like this example and not just because of how it shows so clearly the connections among identity, skills, and domains with their conventions and standards. It also shows some of the limitations of current so-called "liberal" approaches to education. Many educators confronted with this example would say how horrible it was to entice this girl to be interested in fashion, since this is such a gendered stereotype (many of these educators are the same people who say, however, that we need to bridge to minority students' interests).

However, when this girl was asked how this experience had made her think differently about her future, she said—not that she wanted to become a clothes designer—but, rather, that she wanted to "work with computers," because she had seen that they are source of "power." She saw working with computers, too, as a source of

innovation and creation. We do not know what identity transformations are happening to people as they engage with real standards in real domains unless we ask.

In designing and selling her clothes, the girl has learned some important 21st century skills, ones taught more commonly today out of school than in. She has learned how to use a technologically sophisticated product like Adobe PhotoShop; how to think about the visual system (e.g., color, hue, texture), a mainstay of research in cognitive science; how to design clothes; how to upload her clothes to the Internet; how to build her own website; how to communicate with people across the world about her designs; how to use *Second Life*'s building tools to design a store; how to manage the store and become an entrepreneur; and how to be a member of and move across various passion communities and, in the act, "transfer" her learning and knowledge from one place (domain, institution) to another (an important sense of "transfer").

However difficult it might be for schools to engage with Actual Environment Learning in some domains (say, nuclear physics)—and here Sim Environment Learning should be available—there is no reason why schools could not engage young people in Actual Environment Learning in regard to "Pro-Am communities" ("passion communities) that incorporate important 21st century skills. This would mean helping young people actually to join and become "Pro Ams" in such communities. Of course, this would require wholesale reform in school attitudes and practices (otherwise kids will know they are being duped into "doing school").

21st Century Skills

There is lots of talk today—and lots of lists—devoted to 21st century skills, that is, skills important for success in our high-tech, high-risk, global world (Jenkins, Clinton, Purushotma, Robison, & Weigel 2006). I don't intend of offer another list here. Rather, I want to make two claims about 21st century skills.

First, we should not ask about skills first and foremost. Rather, we should ask first about domains. We should ask what domains in our 21st century world are worth learning. And "learning" here means gaining an appreciation for these domains'

appreciative systems. We should debate domains first. Then we can talk about the skills these domains impart.

Why talk about domains first? Because skills are only meaningful—and really only acquired well and retained long—when they are connected to the goals, norms, values, and conventions of a domain.

Second, the ever present question of transfer (does a given skill learned in one area—e.g., *Yu-Gi-Oh* math or fan fiction writing—transfer to another area—e.g., school math or writing in school?) needs to be changed. First of all, who cares whether a skill learned in the real world (say in a Pro-Am community) transfers to school if school is only about "doing school" and does not itself transfer to the real world? But, second of all: here, too, we need to talk about domains first and skills later.

The crucial transfer question is this: once we have settled on what domains we think are worth learning in the 21st century, we should then ask which domains are particularly good preparation for future learning of other domains (Bransford & Schwartz 1999), domains we value equally or more. What is a good trajectory of domains (say for science) such that each domain in the trajectory creates good preparation for learning in later domains (and not all the domains in this trajectory need to be "science" domains)? After all, after school, all real learning is centered in domains and, in our fast changing global world, people have to be good at learning new domains throughout their lives.

Andy diSessa (2000) has argued, for example, that tinkering with things like quartz radios as a kid was good preparation for learning physics later on. This was not because he actually learned a lot of physics facts while tinkering, but because such tinkering gave him an identity that prepared him to be unafraid and undeterred in learning a technical domain like physics later on.

Pokémon is a great domain to prepare one to learn in *Yu-Gi-Oh* and *Yu-Gi-Oh* is a great domain to prepare one to learn in *Magic the Gathering*. All of them are great preparation for leaning *Dungeons and Dragons*, which is really a rather different domain. And *Dungeons and Dragons* is great preparation for learning creative writing in a variety of domains, though my 13 year old used this trajectory to prepare himself for learning to be an actor in Shakespeare plays (fantasy, strange language, face-to-face role playing all combined) in a Young Shakespeare theater (though of course he did not know he was on

that trajectory when he began). Different kids take different trajectories and it is time we studied these pathways in and out of school.

Let me close this section by making it very clear that a person goes not have to learn skills, facts, or tools identified with a given domain only via that domain. So, for example, if people build (design) virtual places and objects in *Second Life*, using *Second Life's* building tools, they use tools and ways of thinking from geometry, but not directly by being in the domain of geometry, but, rather, by being in the domain of being a *Second Life* builder (designer).

Such learning in *Second Life* is a good preparation for future learning in the domain of geometry, as well as in other domains that use tools from geometry. One does not have to learn "geometry" (skills, facts, tools) in "geometry" (the domain), so to speak. But one has to learn geometrical skills, facts, and tools in some domain whose appreciative system makes them meaningful and tells the learner how to "go on" in using them for action and problem solving (as *Second Life* building does for some geometrical skills, facts, and tools). Otherwise, we just have Generic Environment Learning. Learning "geometry" in *Second Life* is Actual Environment Learning, since one is actually joining the domain of *Second Life* builders (designers)—a rather demanding lot, by the way.

Formalizing Assessment Beyond the Basic Circuit of Human Action and Social Groups that Form People's Appreciative Systems

We have seen that social groups "in charge" of various domains lift assessment out of the basic circuit of human action (its natural home) and "formalize" it in terms of mentoring and policing practices. We have argued that we ought to study these practices in various domains (including Pro-Am domains).

We as a society have, going one step further, lifted assessment out of these social groups themselves and formalized it yet further. We have set up practices and institutions whose goal is to assess facts, skills, and knowledge—such as in reading, geometry, or science—outside the indigenous workings of the domains that use these facts, skills, and knowledge in particular ways.

However, I argue that our formal standardized assessments of facts, skills, and knowledge are, in a sense, backwards. Such tests are interested in what learners have learned "in general" from their education. For example, such tests do not want to assess the geometry embedded in building in *Second Life* or in any other specific application of geometry in given school project using geometry. They want to know whether students can generalize their knowledge of geometry beyond specific applications.

There are two problems with this approach. First, such tests of general knowledge do not necessarily show that learners can actually apply their knowledge—of geometry, say—to specific problem solving applications. And, second, knowledge grows ground up from specific applications and generalizes only after people have had deep experience with a number of different applications. Generalized formal assessments often cannot distinguish between students who have earned their more abstract general knowledge through lots of experience with applications and those who have memorized facts and procedures, but not learned them on the ground of problem solving applications.

Andy diSessa's (2000) work in science education is very illuminating on this issue. DiSessa has successfully taught children in sixth grade and beyond the algebra behind Galileo's principles of motion by teaching them a specific computer programming language called Boxer.

The students write into the computer a set of discrete steps in the programming language. For example, the first command in a little program meant to represent uniform motion might tell the computer to set the speed of a moving object at one meter per second. The second step might tell the computer to move the object. And a third step might tell the computer to repeat the second step over and over again. Once the program starts running, the student will see a graphical object move one meter each second repeatedly, a form of uniform motion.

Now the student can elaborate the model in various ways. For example, the student might add a fourth step that tells the computer to add a value *a* to the speed of the moving object after each movement the object has taken (let us just say, for convenience, that *a* adds one more meter per second at each step). So now, after the first movement on the screen (when the object has moved at the speed of one meter per second), the computer will set the speed of the object at two meters per second (adding one meter),

and, then, on the next movement, the object will move at the speed of two meters per second. After this, the computer will add another meter per second to the speed and on the next movement the object will move at the speed of three meters per second. And so forth forever, unless the student has added a step that tells the computer when to stop repeating the movements. This process is obviously modeling the concept of acceleration. And, course, you can set *a* to be a negative number instead of a positive one, and watch what happens to the moving object over time instead.

The student can keep elaborating the program and watch what happens at every stage. In this process, the student, with the guidance of a good teacher, can discover a good deal about Galileo's principles of motion through his or her actions in writing the program, watching what happens, and changing the program. What the student is doing here is seeing in an embodied way, tied to action, how a representational system that is less abstract than algebra or calculus (namely, the computer programming language, which is actually composed of a set of boxes) "cashes out" in terms of motion in a virtual world on the computer screen.

An algebraic representation of Galileo's principles is more general than what diSessa's students have been exposed to, basically it is a set of numbers and variables that do not directly tie to actions or movements as material things. As diSessa points out, algebra doesn't distinguish effectively "among motion ($d = rt$), converting meters to inches ($i = 39.37 \times m$), defining coordinates of a straight line ($y = mx$) or a host of other conceptually varied situations". They all just look alike. He goes on to point out that "[d]istinguishing these contexts is critical in learning, although it is probably nearly irrelevant in fluid, routine work for experts," who, of course, have already had many embodied experiences in using algebra for a variety of different purposes of their own.

Once learners have experienced the meanings of Galileo's principles about motion in a situated and embodied way, they have understood one of the situated meanings for the algebraic equations that capture these principles at a more abstract level. Now these equations are beginning to take on a real meaning in terms of embodied understandings. As learners see algebra spelled out in more such specific material situations, they will come to master it in an active and critical way, not just as a set of symbols to be repeated in a passive and rote manner on tests.

At an institutional level we need more authentic assessments in the sense that such assessments tell us both where and how people can apply knowledge and when and how far they can generalize it based on those applications. Such authentic assessments should, on my view, be focused on learners' appreciative systems. They would tell us whether learners, faced with a complex problem, know how "to go on", how to probe, reflect, assess, and re-probe on a trajectory of action to a goal. Such assessments would mean that we would have to be sure, before we assessed individuals, that they had had the opportunity to engage in domain-centered learning in ways that have given them an emerging appreciative system.

Such assessments would assess how well learners' actions and reflections express the conventions of the domain. They would assess, as well, whether learners can articulate their knowledge of these conventions and articulate, as well, how these conventions guide their probes, reflections, and goals. It should be kept in mind, however, that not all knowledge can be articulate and such assessments would have to honor tacit knowledge, as well, where appropriate.

Such assessments would also assess the extent to which learners can transfer their knowledge to new problem solving applications. They would assess, as well, whether learners can innovate in a domain, that is engage in actions that both reflect conventions in the domain and vary from them in ways that are both acceptable and creative.

Finally, such assessments should always be clearly related to a developmental trajectory through a domain. In any rich domain—academic or Pro-Am—there are various and different trajectories to mastery. These are often recognized by insiders to the domain and can be researched (in part through the copious moment-by-moment data digital media make possible). An assessor should know on which trajectory a learner's performance resides, how this trajectory relates to other trajectories through the domain, and even know if this particular trajectory is one that leads to the capacity for innovation in the domain. Assessments should let a learner and other stakeholders in the learner's learning know on which trajectory to mastery his or her performance resides, how this compares to other trajectories, including innovative ones, and how the learner can be helped to proceed further on this trajectory or on another one.

So I am arguing that more authentic assessments—ones that go beyond assessing facts, skills, and knowledge apart from domains and applications—should be centered on appreciative systems and developmental trajectories. Such a system of formal assessment has, perhaps, not been practical on large scale in the past, but digital tools and virtual worlds will make it more practical in the future.

There is another role for formal assessment, one that sometimes, maybe often, can replace its role in regard to assessing individuals altogether. To see this other role, let us ask this question: Do we need to assess the girl making clothes for *the Sims* and selling clothes in *Second Life*, the girl we discussed above as an emerging Pro-Am? Can't we just accept the judgments of the Pro-Am or passion communities she has been part of? They have, after all, held her to high standards. Members of these communities have clear viewpoints on how she stands in the community in regard to these standards. They have given her (a multifaceted) "grade" that is, however, always in progress as she continues to grow.

If we did want to accept the indigenous judgments of such Pro-Am communities for more public credentialing purposes, then our more formal systems of assessment would need only to serve a validating role. We would use assessments to check that the group's judgments aligned with the standards we wanted to apply. If they did, we could leave off assessing individuals and let the group do its work and make its judgments. Achieving a certain standing in the group would itself earn a "credential".

The same principle would apply if we wanted to create such communities ourselves, in or out of school—communities organized like Pro-Am communities—but devoted to more "academic" concerns. We would need to get them up and running with social mentoring and policing; internally and mutually defended standards; clearly transmitted appreciative systems; and interactions with the ensemble and ensemble assessments (or mangle assessments or dance assessments, whatever we want to call them). We would then want to validate that they worked to the standards we desired. And then we would need to get out of the way.

On this approach, as we set up Environment 1 (Actual) and Environment 3 (Sim) learning, assessment would be seen not as something that is "judging" individuals, but as something that is validating that a certain social organization of learning works for

certain purposes. The social organization then would make judgments internally that we would stand by externally as well. There would be no need for any "final exam" or one shot "big test".

Let me be clear what I am saying here: on a good "fan fiction" site, for example, no one needs to give each writer a formal test (Black 2008). Thanks to the social organization of the site—its ways of coaching, mentoring, reviewing, and giving feedback, as well as determining members' reputations and standing in the community—everyone knows where everyone else stands.

Of course, there are subtleties, negotiations, and even differing judgments about such matters. So the "assessments" here are multifaceted with multiple "scores" and they are ongoing and in progress in terms of members' trajectories of learning. But that is as it should be. A single decontextualized "score" is meaningless against such nuances. We can organize academic learning we care about in such ways as well.

The validating role of assessment here would apply to transfer as well. Instead of giving each individual some test of transfer, we would use assessment instruments to validate that some domain—organized in some way—is, in general, good preparation for learning for specific future domains we care about. Then we would let the indigenous workings of the social group do its work.

All this is to say that one of the jobs of 21st century assessment ought to be validating social organizations of learning. The job of 21st century educators ought to designing such social organization and then letting them run. As they run, members themselves may well find new ways to enhance learning and judgments about learning. We can, in turn, validate these as they arise.

Of course, formal institutionalized systems of assessment thrive on schools, since schools so rarely call on or create the sorts of indigenous domain-centered forms of mentoring and policing we have discussed above. And, indeed, formal institutionalized forms of assessment seem required if we are to assess Generic Environment Learning, since there appear to be no "natural" practices to draw on here.

Conclusion

I have argued, then, that 21st century assessment needs, to be centered on appreciative systems both when we assess individuals and when we validate learning communities. This means, at a minimum, the following:

1. We need to study the indigenous mentoring and policing practices (the learning and assessment practices) embedded in domains and the social groups that operate them, especially ones that young people can actually become members of (such as Pro-Am communities). Our studies here may tell us, as assessors, that we need to leave things alone and trust the indigenous assessment practices. Or they may tell us that we need—if we are to use these domains for educational purposes (broadly speaking)—to tweak things a bit, but from the inside, so to speak, as an improvement and extension of their own indigenous practices. Either way, once we have "officially" validated the indigenous practices (tweaked or not), we can just let things run.

2. We need to study Pro-Am communities and academically relevant domains, as well as Sim versions of them, to see how they prepare (or can be best made to prepare) learners for future learning in other domains. We then need to pick Pro-Am communities and academically relevant domains that are highly fruitful not just for the skills they give learners, but for the future trajectory of learning on which they can set the learner in terms of other Pro-Am communities and domains.

3. We need to create educationally relevant (again, broadly speaking) Pro-Am communities in schools and other educational settings and design their mentoring and policing systems along the lines of the best practices we have found in such communities out in the world with whatever improvements (again from the inside) we can make.

4. We need to use digital media (and other approaches) to engage in learning in schools, and in out-of-school programs, with educational goals. This means bringing real domains or Sim versions of them to school—for example, chemistry as a domain modeled or simulated as well as *SWAT4* does for SWAT. Assessment in regard to much learning

needs to be developed in terms of seeing that learners have developed appropriate appreciative systems and are developing them on a trajectory towards mastery (i.e., making and revising probes in more and more "appropriate" and "good" ways by the standards of the domain or the Sim version we have introduced). We should be assessing how learners reflect on probes and how they make judgments about how to "go on" and how they can discuss and argue over this. This is what people do in a real domain.

5. To accomplish 4 above we need to know for any domain we have introduced into education what are the trajectories to "mastery" (there are almost always more than one). These trajectories will be ones successful learners and members have taken through the domain (or Sim versions of it). Assessment of any individual—beyond the validating role have discussed above—should always have one major purpose: tell the learner and other stakeholders in the learner's learning where in one of these trajectories he or she is and how he or she can develop further along that trajectory or another fruitful one.

6. For 21st century learning, we need to know for any domain we have introduced into education what are some of the innovative ways to move along a trajectory to mastery—what have turned out to be innovative solutions to problems and techniques for innovation in the domain. Assessments should tell the learner and other stakeholders in the learner's learning how he or she is developing in terms of not just a trajectory to mastery, but one that involves some degree of innovation (and, perhaps, this is done on a second or subsequent "play through"—curricula, like good video games, should be re-playable).

7. Finally, all assessments that assess the Generic Environment Learning should have to validate that when people pass them it does indeed mean that later on they can recruit the assessed skills in a real or Sim domain. This means demanding that all Generic learning assessments be validated in terms of "preparation for future learning" (Bransford & Schwartz 1999). Otherwise they are pointless, other than as an assessment of "doing school".

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