Digital art-making as a representational process

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Abstract: In this paper, I take a distributed cognition framework to analyze the tasks of artistic production in terms of the external representations produced. Using data collected through case studies with four youth media arts organizations (YMAOs), I ask how the digital art-making process can be understood in terms of the construction of external representations and what function these representations serve in art-making. I analyze data on the process of making digital art in terms of the macro and micro tasks performed (Spillane, Halverson, & Diamond, 2001) in order to highlight external representation construction across organizations. Then I describe one micro task in depth to unpack the role the representations created serve in sensemaking. I find that digital art-making as structured in YMAOs seems to provide a robust, authentic environment for the construction of process-based external representations which has implications for content domains that value representation as a learning goal.

Introduction

> I think that's what artists do. They struggle with their pieces, with what their pieces are about. They struggle with who they are and how they're going to show themselves (Street Level participant, 09.08).

Producing external representations that demonstrate mastery of a topic is often the desired outcome of participation in a constructivist-oriented curriculum. Performance-based assessment is predicated on the idea that the products of a learning process accurately represent what learners know and can do. While curriculum and assessment designers often struggle to construct tasks that afford learners the opportunity to engage in authentic production, art-making is fundamentally a representational task (Eisner, 2002; Langer, 1953). In producing art, we always strive to represent an idea, a feeling, a story to an audience using the tools of artistic media. In this paper, I describe how structured artistic production experiences provide adolescents with the opportunity to engage in a series of complex representational tasks. These representational tasks are consistent with a broad framework demonstrating the importance of external representations in sensemaking (Cox, 1999; Reisberg, 1987) as well as our understanding of the role of representation in creativity (Hasirici & Demirkan, 2007) and the artistic production process (Eisner, 2002).

The use of external representations for sensemaking in the context of schooling has thus far been situated in research on mathematics (e.g. Zhang & Norman, 1994) and science (e.g. Puntambekar & Goldstein, 2007). Philosophers of art (Langer, 1953) and scholars who describe the arts and cognition (Gardner, 1973; Eisner, 2002) take engagement with complex external representations to be a core part of artistic production. Despite a common emphasis on creating external representations as a method for students to demonstrate mastery, there is virtually no connection across research on artistic production activities and core subject areas. One reason for this may be the lack of common language for describing the value of representation for sensemaking in classroom-based academic tasks and in artistic production. The ability to evaluate and construct representations in physics, for example, is considered a high-level skill, and one that is essential for students to master. The arts, on the other hand, are often considered "extra" activities that, despite their direct parallels with scientific investigation (Gardner, 1973), do not warrant the same prestige. Understanding the role external representations play in artistic production processes can demonstrate the ways learning art and learning science are alike, breaking down the artificial separation between core and "extra" academic subject areas.

In order to understand the role of external representations in artistic production, I take a distributed cognition framework to analyze the tasks of the art-making process in terms of the external representations produced. Using data collected through case studies with four youth media arts organizations (YMAOs), I ask how the digital art-making process can be understood in terms of the construction of external representations and what function these representations serve in art-making. I analyze data on the process of making digital art in terms of the macro and micro tasks performed (Spillane, Halverson, & Diamond, 2001) in order to highlight external representation construction and use across organizations. Then I describe one micro task in depth to unpack the role the representations created serve in sensemaking. I conclude with reflections on the important role digital art production can serve in student learning and development with implications for content domains that value representation as a learning goal.

The Role of External Representation in Sensemaking

Understanding the role of external representation in sensemaking begins with a distributed cognition perspective on thinking and learning (Hutchins, 1995; Salomon, 1993). Distributed cognition shifts the "locus of knowledge" from inside the individual to within and among actor-tool-activity networks (Salomon, 1993).

Understanding how people interpret and construct external representations using available tools over the course of systemic activity is a core task of research on distributed cognition (Cox, 1999; Zhang & Norman, 1994). Hutchins (1995) describes this research as, "the examination of the role of material media in which representations are embodied and in the physical properties that propagate representations across media" (p. 266).

In a distributed cognitive system, external representations function both as tools to think with (Norman, 1993; Zhang & Norman, 1994) and as tools for expressing complex ideas (Norman, 1983). Cox (1999) distinguishes between external representations that are provided for learners to assist in their understanding (presented or pre-fabricated) and the representations that learners construct to demonstrate their own understanding or to assist their own learning (self-constructed). While much of the research on the role of external representations in distributed cognitive systems has focused on learners' use of presented representations, Cox (1999) argues that constructing representations are of vital importance to understanding learning: "This activity represents more than a simple translation, for as Vygotsky observed, when signs (language, diagrams, etc.) are included in an action, they do more than facilitate manoeuvres that are impossible in the absence of the sign system. They fundamentally transform action" (p. 347). Reisberg (1987) described external representations as both *aides memoires* – expressions of understanding that extend human cognition – and *aides pensées* – tools with which to develop new understanding. In both cases, "one can learn by turning one's [internal] representations into stimuli – i.e. by externalizing them" (p. 288). How learners construct external representations of complex ideas and the value of this activity in building robust understanding is of great interest to educators and researchers who value a constructivist approach to learning.

External Representation and the Arts

Artistic production provides a rich context for understanding distributed cognition and the role of external representation (Eisner, 2002; Gardner, 1973). Eisner (2002) describes artistic production as, "[the] transformation of a material to a medium. Materials *become* media when they mediate…[and] to convert a material into a medium is an achievement" (p. 80). Like any representational domain such as mathematics or writing, "getting smart" in the context of producing art, "means coming to know the potential of the materials in relation to the aims of a project or problem" (Eisner, 2002, p. 72). Art-making is fundamentally a creative process, and creativity is intimately tied to the production of external representations (Csikszentmihalyi, 1996). Hasirci and Demirkan (2007) describe mental images and external representations as "essential in investigations of creativity" (p. 262). Hayes (1989) describes the capacity to build the right representation in the right situation as a marker of creative expertise. There are strong parallels between the role external representations play in creative acts in art and in science. In both domains, creativity requires convergent and divergent thinking; the ability to construct representations that are both unique and recognizable is the marker of an accomplished artist and scientist (Gardner, 1973).

Artistic production is about the creation of representations. Creating art mindfully, that is learning how to construct and critically evaluate these representations, requires scaffolded instruction. In youth arts organizations, participants are engaged in authentic artistic production tasks, yet they are guided in these authentic tasks by explicit pedagogical practices. Eisner (2002) describes student artists in the context of formal instruction as, "work[ing] meaningfully on the creation of images" (p. xii). Research on artistic production in youth arts organizations has demonstrated that youth are highly invested in the meaningful construction of images with explicit attention to how these products will be received by a public audience (Heath, 2000; Soep, 2006). In my research, I am interested in how youth learn to engage with and create external representations over time. I follow this process in youth arts organizations because they offer youth explicit instruction (much like schools) toward the goal of the public sharing of art (much like professional artists). It is in this context of these organizations that I take up questions of external representations and artistic production.

Research Methods

Broadly, I am interested in the role self-constructed external representations play in learning, particularly in the arts. While seminal research on arts-based learning has broadly considered the importance of representations in art-making (Eisner, 2002; Gardner, 1989), this research has not taken an explicitly distributed cognition perspective on the art-making process in order to understand how representations are constructed and the functions they serve. To initiate this research trajectory, I posed the following research questions: (a) What are the representational tasks involved in producing autobiographical digital art? (b) What function do those representational tasks serve emerging art-makers in youth media arts organizations as they create products to share with a public audience?

Data Collection

To address these questions, my research team conducted four instrumental case studies (Stake, 2000) with YMAOs across the United States. Youth arts organizations work in a variety of media including live theatre,

radio, digital story, film, and spoken word poetry. While all of these media afford youth the opportunity to engage in the representation of self through art, we chose YMAOs that work in the digital media arts, with a focus on film. This allowed us to hold the representational medium constant as we explored how youth constructed and used external representations. Table One briefly describes the four organizations.

Table 1: Four case study organizations.

	Location	Production cycle length	Type of program	Time of data collection	# of youth participants
Appalachian Media Institute	Whitesburg, KY	3 months	Summer internship	Summer 2008	12
In Progress	St. Paul, MN (headquarters)	Varied	Ongoing	Summer 2007	10
Reel Works Teen Filmmaking	New York, NY	6 months	Semester	Fall 2007 – Spring 2008	12
Street Level Youth Media	Chicago, IL	3 months	Summer internship	Summer 2008	12

At each organization, we traced one production cycle – from participants' initial entry into the organization to the final presentation of their work. In identifying a production cycle as the frame for our cases, we created further consistency in our data collection not by the amount of time we spent with each organization but by the organizational structure provided for participants to produce their digital art (Table 1). In order to capture the production cycle at every organization we collected a variety of qualitative data:

- *Documentation of the process in action*. Most of this documentation was in the form of ethnographic observation, though we also obtained video documentation at various points across the production cycle.
- *Artifact collection*. We collected all artifacts youth created around the digital production process including application essays, journals, group brainstorming sheets, worksheets, edited/unedited video footage, and blog entries. We also collected curricular materials used by organizational leaders and individual workshop facilitators.
- *Interviews* with participants, organizational leaders, facilitators, and mentors.

Data collection was iterative; we employed a constant comparative method across our case studies (Glaser & Strauss, 1967). We began with two open-ended case studies (*Reel Works* and *In Progress*) and then returned to the field a year later to conduct two more directed case studies (*AM*I and *Street Level*) based on our initial interpretations. In our open-ended case studies, we participated in as much of the production cycle as we could, and collected all artifacts that seemed relevant. While we did not initially conduct a full analysis of all representations produced, we did identify when and where opportunities for construction occurred to inform the design of our second round of case studies. In this second round, we directed our efforts towards capturing youths' representation construction – both the process of constructing and their use of these representations in the context of the production cycle. We also asked organizational leaders more pointed questions about the relationship between identity and representation in our second round of interviews.

Data Analysis

In a distributed cognitive system, the way actors make sense of their work can be analyzed in terms of the tasks they must complete and the artifacts generated in the completion of these tasks. In this analysis, I employ Spillane et al.'s (2001) analytic method for understanding distributed cognitive tasks, breaking down the digital art-making process into macro and micro tasks. In my previous work, I have documented autobiographical artistic production as a "dramaturgical process" – the telling, adapting, and performing of narratives of personal experience (Author, 2007, in press). Using an open-ended coding process (Corbin & Strauss, 2008) of observational data, interviews and artifacts created during the production cycle across all four case studies, I coded all the representational tasks we captured as one of three macro tasks: (a) Telling stories and/or figuring out what story to tell; (b) Adapting stories into filmic representations or; (c) Presenting products to an outside audience.

Once I classified all data that concerned the building of an external representation into these three categories, I conducted a second round of grounded coding where I assigned the data to a "micro task" within one of these macro tasks. Since tasks demonstrate the distributed interrelationships among actors and artifacts in sensemaking (Spillane et al., 2001), I considered an activity a micro task if participants had to create a unique external representation as an integral part of the activity. Having identified these micro tasks, I explored them further in analysis by identifying relevant properties and dimensions (Corbin & Strauss, 2008) of these micro

tasks across organizations and by building theoretical conceptual matrices that highlighted analytic points of interest across the data.

Findings: Representational micro tasks in digital art-making

Given the central role artifacts play in analyzing distributed cognitive tasks, my analysis affords opportunities to see these cognitive processes as representational tasks and to understand the tasks at a level of depth previously unexplored in cognitive analyses of artistic production. In this section, I first describe the representational tasks youth engage in as they created digital art at the four YMAOs. Table 2 provides a summary of all the micro tasks and their prevalence across organizations. In the narrative sections below, I reference the names of tasks by an individual data citation (field note, interview, journal entry, worksheet) though multiple forms of data demonstrated the prevalence of these tasks and their relevant artifacts. I then describe one representational task in depth: the pitch. In doing so, I analyze the role this task and accompanying external representations serve in sensemaking.

Table 2: Micro tasks in the process of digital art production.

Type of task	Format(s)	AMI	IP	RW	SL
Macro task: Telling stories					
Application essay	Written text	√		√	√
Application interview	Oral conversation		√	√	
Warm-up ideas	Written text; Multimodal	√	√	√	√
Pitch	Oral presentation PowerPoint or other supplementary text	√	√	√	√
First treatment/shooting script/shot list	Written text	√	√	√	√
Macro task: Adapting stories					
Prose script	Written text	√		√	
Rough cut(s)	Multimodal	√	√	√	√
Macro task: Presenting final products					
Final video	Multimodal	√	√	√	√
Artist statement	Written text				√
Public showing	Multimodal; Oral conversation; Written text	√	√	√	√

Telling Stories

In the context of producing digital videos, "telling stories" as a macro task is accomplished when filmmakers are ready to begin shooting footage for their films. Across all four organizations, there were five different micro tasks that youth participated in.

The application essay. In three of the four organizations youth were required to submit a written application. Applicants were given a series of guiding questions to respond to, including questions about what stories they might like to tell with film, as well as reasons for wanting to join the program.

The application interview. Two of the four organizations required youth to participate in one-on-one interviews with the program's directors prior to beginning the process. At Reel Works, youth had also written applications so the interviews were supplementary. At In Progress, interviews were the director's opportunity to talk with youth prior to their beginning the process about their goals and film ideas.

Warm-up ideas. While some youth came to the organizations having already decided what film they want to make, many had not. Youth produced a variety of artifacts that were "warm-ups" for their final product including short essays in response to questions such as, "Why do you like art and making stories? What are you going to do this year" (IP FN 07.31.07) or writing prompts such as, "I really miss…" and "My greatest passion in life [is]…" (RW Journals Fall 2008). Participants also produced more focused representations based on guided worksheets. Alternately, youth produced mini-films in a short production cycle such as "community-based interviews" (AMI FN 06.08) or "past assignments" (SL FN 07.01.08). The resulting artifacts were multi-modal, video-based projects that were accomplished in a short period of time and are given feedback by the adult facilitators.

Pitch. Across organizations youth were required to "pitch" their ideas to a critical group, either within their community or to some outside group. Youth produced a wide variety of artifacts during the pitch, depending on the nature of the task as structured by the organization. The pitch is described in greater depth below.

First treatment. Before participants began shooting their films, they created a representation of their plan – referred to as a "first treatment," (RW FN 07.20.07) "shot list," (SL Journals 07.08) "essays," (IP FN

08.01.07) and "proposals" that include who they will interview, shot list, b-roll footage, why they want to make the film and its importance (AMI Interview 04.08).

Adapting Stories

To distinguish between the "telling stories" macro task and the "adapting stories" macro task, I divided the work by representations that were created before and after footage for the final product was shot. In some cases youth used footage they created in their "warm-ups" for their final product, blurring the line between the two macro tasks. Additionally, films that were heavily interview-based had a clearer distinction between pre-/post-shooting artifacts since none of the dialogue was crafted in advance. For films with narrative elements, some of the adaptation work was accomplished in advance of shooting. Despite this messiness, there were two micro tasks unique to the adaptation function.

Prose script. Participants at *Reel Works* generated scripts for their films after they shot the majority of their footage, giving them a roadmap for how to edit their films and a broad sense of how the final product would look. *AMI* had their participants create "paper edits…where you write down what you think your video will look like and what each part's going to be like. Like some people do it minute-by-minute or just in minute chunks…like what scenes are going to look like and what each character's going to bring" (AMI Interview 07.16.08).

Rough cut. Participants produced one or more "rough cuts" before they presented a final product. Typically, these rough cuts were used in critique sessions with peers and/or mentors. Rough cuts are multimodal since they represent the film to that point – they may be missing certain key modes (such as soundtrack) or they may contain all modes in basic form.

Presenting Products

A core component of any performance-arts production process is the final presentation to an outside audience. Since audience is a critical component of artistic production, all of the micro tasks in the presentation function focused on creating a sharable product that can be communicated to outsiders. Three unique representational tasks emerged.

Final video. All participants produced a video, either alone or with a group. The final video is the ultimate external representation – the permanent instantiation of how an individual or group of youth chose to share their story with an audience. In other work I describe how these final products can be analyzed as standalone multimodal representations (Halverson, in press).

Artist statement. At *Street Level* youth created "artist statements", written text that accompanied their videos describing who they are and what their piece is about.

Public showing. In addition to completing a video as a standalone piece of work, youth participate in a variety of public events where they have an opportunity to engage in a discussion about their work with audience members, either in the form of a gallery opening (Street Level) or a screening with a post-show "talk back" (other three organizations).

One Micro Task In-Depth: The Pitch

While the above description outlines the representational tasks involved in producing digital art, I am also interested in the role these representations serve in helping youth to understand the art-making process. In order to explore the role representations serve art-makers, I chose one task and its accompanying representations to analyze in further depth. Table 3 provides a more detailed breakdown of "the pitch" at each organization.

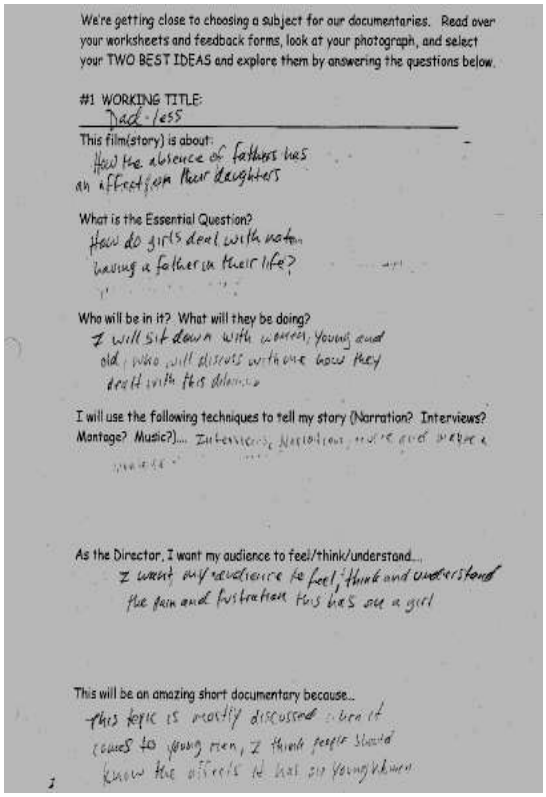
Table 3: Pitch micro task across organizations.

	Micro-task	Artifacts produced	People involved
AMI	Brainstorming session	Ideas on butcher block paper Oral presentation List of ideas to vote on Vote tally for project ideas	Participants Instructors Mentors
In Progress	One-on-one meeting	Journal notes	Participants Director
Reel Works	Formal story pitch	Pitch worksheet Oral presentation	Participants Instructors Mentors External experts
Street Level	Group presentation	PowerPoint Oral presentation	Participants Instructors

The artifacts generated for these pitch sessions provide opportunities for youth to engage with their film ideas by a) expressing textually and orally what story they want to tell and why and b) engaging with experts and peers through reflective critique. The differences in task and artifacts created are isomorphic representations that are implementations of the same abstract goal (Zhang & Norman, 1994).

The *Reel Works* pitch process is the most traditional example of "pitching" movie ideas to sell to outsiders. Youth participants traveled to Time-Warner studios in New York City to share their ideas with their peers, mentors, and directors, and a panel of professional producers. Youth were instructed to treat this meeting as if they were selling their movie ideas to producers, providing a context for their presentations. In addition, they were given a worksheet to guide their thinking about the development of their ideas (Figure 1). Some youth used the worksheet directly, filling in responses to worksheet questions and using these responses to give their pitches. Others used the questions on the worksheet as guidelines for the construction of a narrative description that they created in a journal. Youth used these artifacts to read from as their delivered their pitches, though they also answered questions from the audience extemporaneously.

The worksheet provided space to reflect the content of the story – e.g. "*This film(story) is about*: The life of my grandfather; Through good times and bad. How I handled the ups and downs." It also provided space to think about the representational medium of film – e.g. "In this film, I would be the narrator. I will also interview my parents and other artists who appreciate the art of photography like I do. There will definitely be music in the beginning of this film." Finally, participants reflected on the meaning of their film: "*As the Director, I want my audience to feel/think/understand*…where I'm from, try and put theirselves [sic] in my situation, be inspired at the end of my film. I want people to go out and change their situations, my film should be influencial [sic]." The questions posed on the worksheets encourage youth to think about the content of their film, their use of film as a medium, and why their film is important. This explicit attention to content, structure, and impact resulted in external representations, in the form of written statements on their ideas, how they will be carried out and the functions they may serve.



We're getting close to choosing a subject for our documentaries. Read over your worksheets and feedback forms, look at your photograph, and select your TWO BEST IDEAS and explore them by answering the questions below.

#1 WORKING TITLE:
Dad-less

This film(story) is about:
How the absence of fathers has an effect from their daughters

What is the Essential Question?
How do girls deal with not having a father in their life?

Who will be in it? What will they be doing?
I will sit down with women, young and old, who will discuss with me how they dealt with this dilemma

I will use the following techniques to tell my story (Narration? Interviews? Montage? Music?)... Interviews, Narration, music and images

As the Director, I want my audience to feel/think/understand...
I want my audience to feel, think and understand the pain and frustration this has on a girl

This will be an amazing short documentary because...
this topic is mostly discussed about it comes to young men, I think people should know the effects it has on young women

Figure 1. *Reel Works* pitch worksheet.

The oral presentation afforded youth the opportunity to engage in reflective critique that pushes these ideas further. These critique sessions focused on both practical issues of filmmaking and about the function of film as a medium in communicating a complex idea. For example, in pitching *Rupture,* the film about absentee fathers referenced in Figure 1, the filmmaker, instructor, mentor, and an external expert have an extended exchange about how to construct this piece so that it shows certain universal themes yet maintains her individual experience. As the instructor describes: "your story is one that many, many people have experienced but when

you bring us through the story through your eyes, of walking through those doors, of what you were thinking and then of what your mother was thinking as you came through those doors" (RW pitch meeting, 03.08).

In contrast, at AMI, the focus of the pitch is for youth to sell their ideas to one another. Since films are made in groups, the pitch session serves as an opportunity to select three ideas they will choose to make. Youth engage in an extended brainstorm session where they generate their film ideas and try to draw connections across ideas (Figure 2). Every person has a chance to contribute their ideas, to describe the idea they contributed to the brainstorming session, and to indicate which of the ideas are their favorites. The butcher block paper is used to generate ideas and to draw connections across stories.

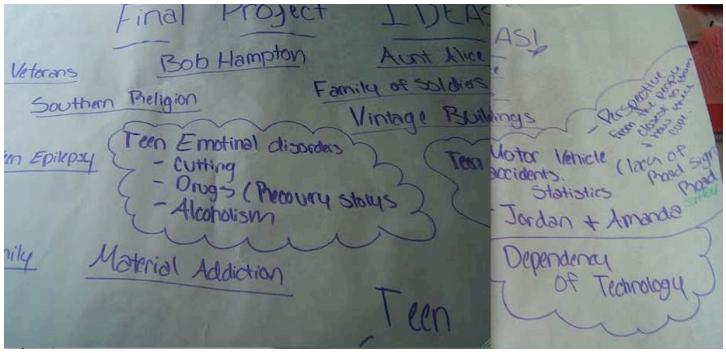


Figure 2. Final project brainstorm at *AMI.*

Once three ideas have been selected through a blind voting process, and youth are assigned to groups based on their own interests and mentors' construction of productive teams, these new groups devise a "proposal" for their film. The proposal consists of basic structural ideas, whom they will interview, a preliminary shot list, and a description of the film, as well as an assessment of who the audience for the film will be. Similar to Reel Works, AMI participants are given a series of questions to answer about their prospective film; they use "sample proposals" as models to construct their own (AMI FN, 06.27.08).

While the content of the pitches are constructed representations of participants' ideas, the structure for the representations is created by the organizations. By prompting youth with questions to answer, models to follow, and formats to fit ideas into, the organizations provide a structural scaffold within which participants can craft representations of their ideas. The pitch happens relatively early in the process, usually about one third of the way through the production cycle. At this point, youth are likely still struggling with core questions around why their ideas matter and whom these ideas may reach. Structuring the representational task in this way facilitates youth engagement with these questions and requires that they construct external representations, in the form of text and oral presentations that describe their emerging understanding of the value of their ideas and how these ideas can be communicated to outsiders. Across the pitch meetings, instructors and mentors used participants' pitches to help youth think in depth about the generalizability of their individual narrative ideas.

Discussion: External representations in art-making and beyond

Analyzing the micro tasks embedded in the telling, adapting, and performing of narratives of personal experience demonstrates that learning to make art in the context of YMAOs is fundamentally a distributed, representational endeavor. YMAOs structure opportunities throughout the process for participants to create artifacts - written, oral, and multimodal – that demonstrate youths' evolving understanding of the story they want to tell and how the medium of film affords them the opportunity to represent this idea. Building these representations provides opportunities for sensemaking and reflection both in the representations themselves and in the discourse generated around these representations. Each microtask results in an external representation that affords the opportunity to explore the relationship between the idea and how the medium of film can express this core idea. The films themselves are multimodal representations of sophisticated ideas (Halverson, in press); seeing the microtasks from initial conception to final product allows us to understand how the final representation comes to be and whether and how youth are mindful of what their artistic representation conveys.

This type of distributed, representational system is not limited to digital art-making. Artistic production is a representational act, and learning to create art in an organizational context allows emerging artists to understand how representation affords reflection on art and meaning. The representational tasks scaffold the art-making process for youth to become reflective artists also look a lot like the representational process we want our students of science and mathematics to engage in.

Educational Significance

Understanding artistic production in terms of external representational tasks is significant to researchers, practitioners, and designers who are interested in constructivist, project-based learning environments, especially

those that engage learners with 21st Century skills. A decade ago, Cox (1999) described the growing importance of representation construction in progressive learning environments: "As educational technology becomes more and more integrated into the curriculum and as the variety and sophistication of data visualization and external representation techniques proliferate, the issue of training students to use ERs effectively is likely to increase in importance" (p. 360). Digital art-making as structured in YMAOs seems to provide a robust, authentic environment for the construction of process-based external representations.

Constructing external representations of process over time is a crucial component of YMAOs as designed environments. Despite this, research on the design of learning spaces that promote the development of complex external representations has been left to the sciences particularly physics, engineering, and the biological sciences. My analysis confirms Eisner's assertion that we need to allow artistic production to enter the conversation around external representations, complex cognition and the design of learning environments: "the tasks that the arts put forward – such as noticing subtleties among qualitative relationships, conceiving of imaginative possibilities, interpreting metaphorical meanings the work displays, exploiting unanticipated opportunities in the course of one's work - require complex cognitive modes of thought" (Eisner, 2002, p. 35).

Finally, narrative media such as digital art-making may be especially potent for adolescents and emerging adults who are involved in a psychosocial identity development process. Identity development has been described as the negotiation of a relationship between cultural and personal narratives (Hammack, 2008) – explicit engagement with these narratives through the dramaturgical process could facilitate positive developmental outcomes for participants. Artistic production that focuses on autobiographical experiences opens up opportunities for the representational process to engage youth in identity exploration. Future work will focus on how constructing external representations over time is intricately connected to identity development.

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