Hybrid Shmybrid: Using Collaborative Structure to Understand the Relationship Between Virtual and Tangible Elements of a Computational Craft

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Abstract: In this paper we use a case of students' collaborative models to reflect back on the relationship between computational and tangible elements in a design project. The dual nature of the computational craft rather than being interdependent was dichotomized, allowing students to use their prior interests to dictate participation.

Background

In recent years the DIY (Do-It-Yourself) movement has provided exciting new opportunities to open computing to broader audiences by integrating programming with new media production (Kafai & Peppler, 2011). Computational crafts, a hybrid of tangible art and virtual computation, provide young people with new ways to relate to computing through interests and hobbies (Eisenberg, 2003). Studies show these hybrid design technologies can engage young people in multiple disciplines, like art and computer programming or circuit design, especially young people who might not otherwise be interested in or exposed to these disciplines (Rusk et al., 2008). Although studies investigate the benefits of designing with computational crafts, relatively few examine the relationship between collaborative structures and the media themselves. Here we suggest that the way students managed tasks in a collaborative design project highlights potential discrepancies in the fusion of tangible and digital media.

In this study, students' division of roles in collaborative group models demonstrates how compelling it was to pull apart computational and tangible elements of the multi-modal design project. Rather than providing multiple means of entry into design, for instance engaging in programming through a prior interest in crafting, the multi-modality allowed for division of labor that separated these elements. In this poster we suggest that collaborative structures influenced students' participation, or lack thereof, during a computational craft design project, presenting a representative case where student design teams segregated tasks amongst themselves and worked in isolation. We look at the relationship between students' division of labor to reflect on the hybridity (or lack thereof) of the computational craft media and consider implications for learning.

Context & Methods

In this study alternative high school students designed tangible/digital pets over the course of 12 workshops. Students at the alternative high school have failed so many classes at the traditional high school they need intensive remediation to graduate. This project targeted those students in hopes of drawing them into interesting areas of design and computation. During the study we collected surveys, field notes, video recordings, and student interviews, focusing on collaboration in three design groups. We drew on activity theory (e.g. Cole, 1996) to analyze the relationship between students' division of labor in their collaborative groups and the nature of the design project (the tool). We began by identifying and comparing episodes of collaborative interaction (an exchange of three or more turns) and potential collaborative interaction (i.e. one student asking a question of another related to the project). We focused on what students attended to during each episode then corroborated these episodes with specific utterances in student interviews. Here we present the case of one group, Tegan, Rocky & Ted, a junior girl and two senior boys, who worked as a team using Scratch (a media-rich programming environment) and PicoBoards (an external logic board) to develop a whimsical interactive physical creature. Their pet, a monkey, resembled recently popular children's toys like Zhu Zhu Pets and Webkinz with both physical (a fluffy real-world body) and virtual (an interactive avatar) elements. Tegan, Rocky & Ted programmed the monkey's interactions on the screen via inputs from sensors, buttons, and sliders embedded on the PicoBoard within the pet's body.

Findings

Our analyses draw on three groups of students, all of whom divided roles amongst themselves and in turn reified existing interests and expertise. For the sake of space, in this poster we focus on Tegan, Rocky & Ted's collaborative group, but the findings reflect the relationship between division of labor and lack of integration in the computational craft across all groups. The full poster will illustrate activities of the other groups as well.

One of the first steps that Tegan, Rocky & Ted took was dividing the design task into separate parts: programming the virtual pet, crafting the physical pet, and planning the interface between them. After this decision they rarely exchanged ideas during the design task. For instance, on two important days of the

workshop (days 7 and 10), the group interacted together regarding their design for only 14 of 80 minutes of workshop time. Tegan claimed ownership of the physical pet design, leaving her partners to do the computer programming. As Rocky said, "Tegan pretty much made the pet and me and Ted pretty much programmed." Not only this, but Tegan became so attached to her physical pet design that she refused to let her partners collaborate with her on the design. At one point, when Ted tried to assist Tegan with a specific bit of construction, she forcefully took the pet away from him saying his contribution was, "Not perfect". Rocky admitted, "She would get mad at us if we tried touching her pet". The nature of the work was individual and illustrates how divided the tasks were: the monkey was "her pet" not "our pet."

By disassociating herself from other elements of the project, Tegan prevented her group's project from being as successful as it could have been. In an interview, Tegan admitted she let her partners "do whatever they wanted" with the computer program. In fact, once the craft materials arrived, Tegan did no further programming and rarely looked at the computer. Thus the effect of compartmentalization; Tegan was at once fanatical about her physical design and cavalier about the virtual counterpart. This disparity had ramifications for the students' final product. For example, on the last day of the project, before students demonstrated their pets to invited guests in a design exhibit, Ted expressed concern that their monkey looked different on screen versus real life. For instance, the physical pet wore a scarf and mittens while the virtual pet had prominent freckles and no accessories. Ted argued that this was a fundamental problem with their design project in that people would not be able to tell the two elements went together. Tegan rebuffed his argument, saying the pets looked the same and continued making changes to the physical monkey, widening the gap between tangible and virtual design. Not only did Tegan refuse to address her partner's concern, she was disinclined to engage in other parts of the project even in situations where the amalgamation of the overall design might reflect poorly on her efforts.

Perceived expertise influenced students' participation within their groups. For instance, when asked why the group broke up responsibilities, Tegan replied, "Well, cause they're (Rocky and Ted) not really crafty and also they'd just mess it up because I had an idea in my head." The perception that the boys were not crafty, shared by the boys, resulted in the boys' lack of opportunity to design with the crafts. The assumption that computational crafts provide a pathway to computation and also deliver students to engage in new disciplines does not always hold. In this case, the opposite was true, Tegan abandoned programming in pursuit of her interest in physical pet design; Rocky and Ted were not encouraged to craft and were rebuked when either one attempted to contribute. Similarly, Tegan and others in the role of crafter rarely accessed the computer and did little to no programming. As observed elsewhere, division of labor has the potential to aggravate rather than ameliorate changes in expertise in often-stratified classrooms (Abraham & Wilensky, 2005).

In light of students' divided collaboration, we suggest the need for a framework considering the actual hybridity of these media. As hoped, the tangible/digital pet design project provided multiple entry points for students with different interests, some in crafting and others in programming. However, rather than being interdependent, the craft and computational media were dichotomized by students, allowing prior interests and expertise to dictate participation. Students divided tasks and attended to different parts of the design, which has potential implications for the development of new interests and learning. This need not be the case, but it provides a word of caution to educators and researchers excited about the potential in the Maker movement. Rather than assuming that tangible/digital crafts are promising simply because they combine approaches, we need to develop models that see hybridity on a continuum and research effects of these media on learning and interest development.

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