

Designing a Programming Workshop for Girls

Rebecca A. Fiebrink and Tyler R. Alcott
The Ohio State University
Department of Computer and Information Science
Columbus, OH 43210
fiebrink.1@osu.edu, alcott.6@osu.edu

ABSTRACT

At Ohio State in 2003, the decision was made to design a computer programming workshop for girls of middle school and high school age. This paper will discuss the criteria necessary for a successfully run and pedagogically effective programming workshop for this type of audience. Examples will come from a discussion of Virtual Family and Alice, two software packages that have been proposed as girl-friendly learning tools, and from our experience conducting a workshop with one of these tools.

Categories and Subject Descriptors

K.3 [Computers and Education]

K.4 [Computers and Society]

K.8 [Personal Computing]: General – *games*

H.1 [Models and Principles] User/Machine Systems – *human factors*

General Terms

Human Factors

Keywords

girls, workshop, Virtual Family, Alice

1. BACKGROUND

“If we build it, they will come” goes the tantalizing dream of many would-be girls’ computer workshop creators. Participants who are given the opportunity to interact with technology in a girl-friendly environment will come to possess a richer, more positive view of the world of computing. They may even come to major in computer science in college. So goes the dream.

In reality, research does suggest that age- and gender-specific activities can be an effective tool both to counteract girls’ misgivings about technology and to spark a new interest and appreciation for computers [4, 10].

Furthermore, many computer science departments are in an ideal position to sponsor such workshops: They can be done at the

home institution with girls from the community or as a “Take a Daughter to Work Day” activity, and they can be done with relatively little funding and preparation time. But when the decision is made to plan such a workshop, as we did, the question can arise: how do we build it?

2. CRITERIA FOR SUCCESS

2.1 Consider Feasibility and Audience Appeal

Of primary concern in planning a workshop are its ease of use and appropriateness for the audience. At Ohio State, the audience included 23 girls age 12 to 17. A workshop that, like ours, uses a software tool as a foundation requires that the tool be easy to install and use, especially in a group setting. The program should reflect the capabilities of the age group and should contain qualities that appeal to girls. A workshop lacking any of these qualities can result in a negative first experience with programming, which is especially problematic in that it could reinforce girls’ preexisting anxieties about computing [5].

2.2 Consider Long-Term Impact

If a workshop is to be truly effective, it should address existing barriers to girls’ involvement with technology in a manner that can have long-term impact. Current research shows key obstacles to participation in computers by females of various age groups to include stereotypes regarding computer enthusiasts and professionals, a belief that computers are not interesting coupled with misconceptions of what computer science entails, weaker computer skills arising from less exposure to computing than boys, and a lack of confidence regarding their computing abilities [2, 3, 4, 5]. A workshop experience could not only bolster girls’ technical skills, but also counteract the many factors contributing to girls’ own problematic beliefs, regardless of whether these beliefs are already held or formed later.

A workshop can counter stereotypes of computer users by presenting female facilitators as role models. Furthermore, software tools designed with a female audience in mind can encourage girls to think of themselves and their peers as legitimate computer users. Software commonly used by girls at school may not accomplish this, as gender-neutral educational software tends to resemble software designed only for boys [8]. It is especially important in a public setting such as a workshop that girls feel the software is appropriate for their gender; girls may feel comfortable using “boy software” in private, but fear of failure with such software under the gaze of their peers can cause anxiety [8].

Software designed for females by taking into account girls’ preferences can also lead them to view computing as a fun activity. Research done by companies interested in marketing to

girls shows their interest in games involving narrative and adventure, with components of both cooperation and competition [7]. Academic studies have shown similar preferences for narrative and storytelling [5, 9]. A programming workshop for girls accomplishes even more than entertainment software, because it also introduces girls to computer science. Girls may already find some computer activities fun (online chat or e-mail, for example) but do not connect these activities to computer science or a career in computers. Instead, they may associate computing careers with more menial tasks such as word processing and data entry [3]. The benefits of a broadened understanding of what computing entails can far exceed those of the content itself learned in a few hours.

Content knowledge can also be beneficial if it provides a foundation for further learning and changes girls' perceptions of their own capabilities. If girls go on to enroll in a programming course, their workshop experience can be a useful background, especially if instruction is in a similar language or paradigm. If girls are successful in learning even the small amount of programming material presented in a workshop, this could increase confidence in their abilities and cause them to be less reluctant to try a programming course later on.

3. CHOOSING A SOFTWARE TOOL

While not numerous, there exist software packages that have been proposed as tools for teaching computer science in female-friendly or gender-neutral ways. Two tools that may particularly appeal to educators planning a girls' workshop are Virtual Family, developed at the University of British Columbia [6], and Alice, developed by the University of Virginia and now housed at Carnegie Mellon [1]. The following is a discussion of their usefulness in meeting the above criteria for workshop success and efficacy.

3.1 Storytelling with Virtual Family

The creators of Virtual Family describe it as "a gender-neutral game-based software that introduces Java programming" [6]. The program features a family of characters who have preset actions that users can initiate using drop-down selection boxes. Characters also react to each other. Users can view the Java code implementing each event, and eventually they can learn to program their own actions and design new characters.

Virtual Family is advertised as a very practical tool for a workshop environment. Its creators have conducted workshops with the software themselves and have published guidelines for others based on their experiences. Furthermore, the software is available for free download.

Virtual Family also employs several strategies mentioned above for creating long-term impact for female users. Its creators cite research on girls' preferences as a foundation for the design of the program. As a result, the game is driven by storytelling and social relationships within a familiar home environment [9]. At the same time, unlike most games designed for girls, it also demands that the user engage with technology in order for the storytelling to work. The software includes tutorials to build the skills necessary for engagement, so it is appropriate for users with no programming background.

The Java skills girls learn in Virtual Family are extensible to other programming settings; a user could pick up any piece of Java code later on and recognize methods, control structures, and similar basic entities. If girls know that these skills are currently being taught in introductory college courses, their ideas of what computer science entails could broaden. Success with these concepts could lead girls to believe that computer science is something they could someday pursue. Because of its convenience and potential for efficacy, we selected Virtual Family as the basis for our workshop.

3.2 3-D World Building with Alice

While Alice was not designed specifically for girls or for a workshop environment, it also includes several qualities that make it likely to appeal to girls and effectively change their perceptions of technology.

Alice, which has been proposed as a tool for artists as well as for teaching programming, has superb graphics and a large selection of pre-made objects and people. Presenting users with a choice between interacting with pre-assembled worlds or creating new ones from scratch, Alice can also appeal to girls' affinity for storytelling.

Like Virtual Family, users must employ programming techniques to create events in the world. Alice employs a somewhat different approach, however; instead of typing in code from scratch, the user is guided with drop-down boxes and preformatted control structures. While Alice does not provide the users with a background in a conventional programming language, it provides a different service by circumventing typos. Alice veterans who go on to study programming will see parallels between structures and logic, if not exact syntax. Alice's foolproof method of entering code can be especially helpful to girls, who are likely to blame their own inability when something goes wrong [5].

4. SOFTWARE TOOL PITFALLS

Like many software programs designed for girls, Virtual Family and Alice both contain elements that can hinder girls' true empowerment despite their promising qualities. Our experience using Virtual Family in a workshop was marred by technical problems. Both tools possess, to some degree, subtle messages that can reinforce stereotypical female roles. Such messages can arise from creators relying on research on girls' preferences without evaluating the consequences of appealing to those preferences. Or, they can result from a simple lack of attention to a game's characters. Software aimed to encourage girls can thus, according to Chuck Huff, "give with one hand and take away with the other," as it reinforces a gender-based self-concept ultimately tied to girls' traditional career values [8].

4.1 Gender in Virtual Family

The preset characters in Virtual Family provide numerous examples of how software can reinforce problematic aspects of femininity in its attempts to appeal to girls. The woman in the family is defined solely by her role as a mother; her available actions include crying, fainting, shouting, or complaining in reaction to her children, kissing her son, and assigning chores. The father possesses a more varied repertoire, including flexing

his muscles and telling dirty jokes. The children always ask the mother questions and complain to her about each other, turning to the father only when they want money. While these family dynamics may mirror some aspects of girl's own homes, they portray a girl's future as revolving around domestic matters to the exclusion of her independent goals.

The daughter of the family, a teenage girl with whom audience members are likely to identify, also fails to represent a version of femininity likely to liberate girls from traditional notions about what they should value. The daughter's actions include crying when her boyfriend dumps her, asking for phone messages, and screaming when she sees a cockroach.

Virtual Family's preset play could also alienate users who do not identify with the starkly white, nuclear family who is well-off enough to give the elementary school-age son \$50 when he asks for it. Furthermore, it sends girls who do identify with such a family the impression that minorities and other underrepresented groups are less desired or capable in computer fields. While the objective of Virtual Family is to encourage the user to edit the source code and ultimately create new characters and actions to reflect her individual ideas and tastes, the initial setup of the program misses an opportunity to encourage girls to conceive of themselves and their societal roles differently, and it may alienate girls from the game before they ever become able code writers themselves.

4.2 Technical Problems in Virtual Family

Another barrier to Virtual Family's viability in a workshop environment is its tendency toward technical problems. Our workshop was afflicted by several issues with the software. Most problematic was the discovery that running it in our lab initiated too many instances of the Java software, which resulted in failure of the program on individual workstations in a manner that made it difficult to quickly diagnose the problem.

Girls are, in general, more likely than boys to blame themselves when computers fail to function as expected [5]. Software failure in a workshop can therefore reinforce existing anxieties and inure girls to the stress of technical problems from which workshop creators hoped to liberate them. The surveys conducted at Ohio State's workshop confirmed this effect: while participants who came to the workshop possessing a positive view of their relationship to technology left with this view unchanged, participants who entered with a negative view of this relationship left with their beliefs reinforced.

4.3 Gender in Alice

Alice also contains messages reinforcing traditional gender roles in ways that may counteract more positive aspects of the software. Unlike Virtual Family, however, they might not necessarily be encountered within the scope of a workshop.

To Alice's credit, the existing worlds do not generally appeal to any gender's stereotypical preferences. There are no dollhouses or battlefields; rather, there are amusement parks, nature settings, and collections of abstract shapes.

The predefined people do include females in nontraditional roles, such as a scientist. Both females and males are visually

represented more realistically than in many other games. However, Alice generally relegates females to uninteresting or complementary roles among these characters: males are the norm, having titles like "kid," "nerd," and "jock," while females tend to have titles like "teacher," "cheerleader," or "rockette." Females often appear as accompaniments to male counterparts: the snowman is accompanied by a (pink) snowwoman, and the "Native American," a man, is accompanied by "Native Girl."

Race is more flexible in Alice than in Virtual Family. The skin color of existing or new characters can be changed using a sliding scale. However, stereotypical representations, such as those of the Native Americans mentioned above, do exist, and they can still be problematic to users of any background for the reasons mentioned earlier.

4.4 Other Problems in Alice

A barrier to girls' benefiting from Alice endemic to its approach is its lack of instruction in a recognized language. Participants with little computer science background might not be able to appreciate the fact that their knowledge can be more broadly applied. Therefore, success with the software may lack the confidence-boosting effect of learning a language like Java, and girls may not reevaluate their beliefs about computer science if they do not see Alice as teaching any standard curriculum.

While it is unclear what technical issues could arise when using Alice in a workshop, the program is apt to freeze or crash on a home PC during normal use. In a workshop, this behavior could have the same effect on participants as the technical problems of Virtual Family.

The biggest practical obstacle to using Alice in a workshop that, unlike Virtual Family, there is no available information regarding workshop ideas or potential problems. There is nothing built into the software that is explicitly conducive to a cooperative or large-group setting. Workshop creators must develop their own approach to adapting the tool for a workshop environment.

5. CONCEIVING A BETTER TOOL

An ideal software tool to support a programming workshop for girls could combine the positive qualities of Virtual Family and Alice and improve on their shortcomings.

Our experience at Ohio State suggests that one of the most important qualities of a software tool is its resistance to technical problems and resilience to user error. Stability, both on a PC and over a network, is essential. Safeguards against common novice programming errors, such as the type-free entry of Alice, may also be helpful.

The confidence-building effects of success with workshop software will be augmented if participants see their experience as having real-world relevance. Workshop instruction in an established language such as Java is one means of accomplishing this. Software that involved other aspects of computer science, such as introduction to algorithms or artificial intelligence, could have a similar effect.

A positive experience with technology will have a further-reaching effect if the experience encourages girls to fundamentally reconceptualize the relationship between their gender and technology. Tools that rely on interests such as storytelling to appeal to girls could present predefined female characters with less limited and more inspiring roles. What might a girl do with a tool that portrays her onscreen alter ego as independent and math- and tech-savvy? What might a girl do with a similar vision of herself when armed with increased confidence and knowledge provided in a workshop?

Lastly, an ideal workshop tool could take advantage of possibilities presented by a large-group environment. Such a tool could also be used in a classroom setting; in any case, it could contribute to changing girls' perceptions of computing as an asocial activity. Software designed to run smoothly in a group environment would also sidestep many of the technical issues that arise when software designed for single-computer use is taken out of that context.

6. CONCLUSION

Clearly, the benefits girls can reap from a well-designed programming workshop are numerous. The use of a software tool in implementing a workshop can both increase knowledge and promote an improved relationship between participants and computing. Virtual Family and Alice contain elements that simultaneously encourage and stymie development of such a relationship. Until a more technically and pedagogically appropriate tool is available, educators must be cognizant of both the promise and the pitfalls inherent in adopting them for workshop use.

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