Folk Computing: Revisiting Oral Tradition as a Scaffold for Co-Present Communities

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ABSTRACT
In this paper, we introduce Folk Computing: an approach for using technology to support co-present community building inspired by the concept of folklore. We also introduce a new technology, called “i-balls,” whose design helped fashion this approach. The design of the i-ball environment is explained in terms of our effort to simultaneously preserve what works about folklore while also using technology to expand its power as a medium for community building.

Keywords
Groupware, CSCW, ubiquitous computing, face-to-face, education, community, folklore, handheld, mobile computing, social computing, PDA

INTRODUCTION
We are interested in how technology can support face-to-face communication and community building. In the body of research on technology and community, work on augmenting co-present community is underrepresented. Perhaps this is because face-to-face communication is often considered the gold standard against which computer-mediated communication is measured. Also to blame may be a deep-seated belief – recently seen in the popular outcry against the use of cell phones in public spaces – that technology is somehow fundamentally hostile to intimate, interpersonal space.

We believe, however, that there are important ways that carefully designed technology can contribute to face-to-face communication. Previously, we have developed computationally-augmented nametags that could help users establish a sense of common ground, both on the level of individual conversations (Borovoy, et al., 1998a) and for the entire community (Borovoy, et al., 1998b). In this paper, we will discuss technology that helps community members reflect on their own complex patterns of interaction, while simultaneously helping them to interact in more diverse ways.

We have used folklore as an organizing metaphor in our work because current research in “folkloristics” suggests the powerful role it already plays in supporting co-present community – by encouraging diverse member interaction, and educating members about important group dynamics, for example (George, 1973). Much of this current research involves an expanded definition of folklore that may not jibe with people’s “folk” definition, however.

While Webster’s defines folklore as “traditional customs, tales, sayings, dances, or art forms preserved among a people” (see http://www.m-w.com), current folklore theorists have broadened the concept to include a wider category of things that circulate orally within a community (including things like games, jokes, and rumors) and a less constrained sense of history. No longer are folklorists solely concerned with quaint customs and stories that are holdovers from a distant, romanticized past. A more modern definition of folklore that better suits our purpose comes from the folklorist Barre Toelken: “tradition-based communicative units informally exchanged in dynamic variation through space and time.” (1979)

For our most recent research on Folk Computing, we have experimented with a rich folk unit that has special appeal to children: the folk game. These are games that travel across vast stretches of time and space solely via the word of mouth of children, spawning variations as they go, but also retaining certain identifying characteristics (Opie and Opie, 1959). Classic examples are Marbles, Four Square, “Rock Paper Scissors,” and Tag, and each of their many hundreds of variations.

As with many design metaphors, our appropriation of folklore is somewhat loose: we have taken up the entailments of folklore we found most relevant to augmenting face-to-face community building, and elided

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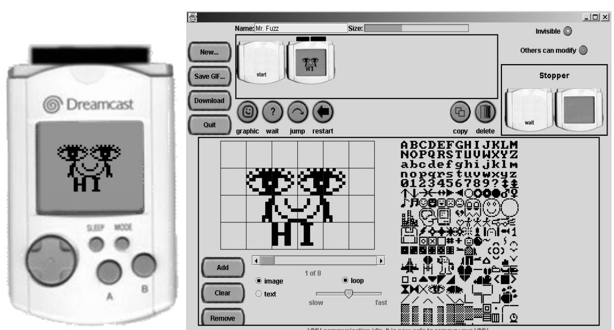
others that did not suit our purposes. That being said, we believe we have stayed true enough to the concept to warrant our use of the term "folk" in the name of our research project.

As an example of how we have worked within and around the concept of folklore, consider how Folk Computing's use of communication technology appears to contradict the centrality of pure, oral communication in folklore. In fact, traditional folklore has often had a material dimension to it. Many folk games, for example, make use of objects such as balls and paper. The key is that these materials are nearly ubiquitous and are easy to incorporate into face-to-face interaction. Therefore, in our research, we have worked to insure the technology has these qualities.

DESIGNING I-BALLS

This paper will focus on our most recent "folk computing" development: the key-chain-sized "i-ball" devices. We will explore our design and initial testing of the i-balls in terms of how they preserve and extend the features and functions of traditional folklore. It is important to note, however, that over the last five years of folk computing development, the role of folkloristic ideas in our designs has coevolved with our technology and our experience of its potential. We try to bring the prescriptions of theory, the possibilities of technology, and the practical demands of actual communities into a dialogue. Therefore, the following design discussions should not be read as linear reductions from theory to practice.



Figures 1 & 2. I-Ball and PC-based I-Ball Editor

Overview of I-Ball Design and Initial Trials

The name "i-ball" is short for "ball of information." I-balls are simple software folk objects that have some toy- and game-like qualities. People can design their own i-balls and then share with other members of community. In our prototype, i-balls exist on key-chain-sized video game devices made by SEGA and sold as part of their DreamCast video game system, as shown in Figure 1. We wrote our own software for this commercial device, and renamed it the "i-socket," to distinguish its capabilities from those of the original SEGA "Visual Memory Unit (VMU)"– designed to let kids store and recall their state in a particular DreamCast game.

People design their i-balls on a PC using a prototype graphical programming tool we developed. The most basic form of i-ball consists of a single "animation" programming block. This block allows kids to "decorate" their i-ball by composing an animation out of 128 different letters and icons in a simple "flip-book" style animation editor. Figure 2 shows the first frame of an animation a child created that depicts a face that blinks and says "hi". I-balls created on a PC can then be downloaded to an i-socket via a small "docking station".

Like the play objects they are named after, i-balls can be passed between people. Participants can give a copy of one of their i-balls to someone else, or, using "jump" blocks and "rule" blocks in authoring environment, i-balls can be programmed to "bounce" from one person's i-socket to another's, based on user-defined rules. I-ball passing can occur when two people connect their i-sockets using the ports that SEGA designed in to the hardware. Figure 3 shows two kindergarteners passing an i-ball in this manner.

Figure 3. Two Children Exchange I-Balls

We pilot tested the i-ball technology in the Fall of 1999 at a multi-generational conference on "learning through invention," where almost all of the 500 children and adults in attendance were given an i-ball device to wear around their necks. In the Spring of 2000, we did a more extensive trial over three weeks involving the entire third through eighth grades of a public K-8 school – 350 students, teachers, and staff members (including the principal, secretary, cafeteria monitor, etc.)

A few words about how this new technology was received and what kids did with it: At the first i-ball event, several people commented on the frenzy that the activity engendered. We had set up seven i-ball programming kiosks, and they were in constant use, usually with several people waiting behind each one. In a day and a half, more than 1600 i-balls were created – an average of more than three per attendee. The sight of participants passing i-balls from i-socket to i-socket was ubiquitous.

Over the course of our i-ball trials, children have created i-balls in a variety of "genres", including:

- "Hot potatoes" that must be passed according to certain rules in a certain amount of time

- “Quests”, or scavenger hunts, that send a person in search of a variety of other people who meet particular descriptions
- “Randomizers” that were used to create “Magic 8 Ball”-type fortune teller toys
- “Hitchers” that are simple autonomous software “agents” that hitch-hike around the community, invisibly jumping from one user to another
- “Secret i-balls” that would show one animation to an “insider” group (e.g. students) and another when viewed by everyone else (e.g. teachers).
- “Multi-author i-balls” that children would add their own piece of animation to and then pass on

Designing I-Balls as Folklore

The ultimate goal was to use technology to expand the capacity of folklore to build community. However, our first challenge was to ensure that the i-ball technology preserved enough of the essential characteristics of traditional folklore for it to function that way. In fact, this emphasis on both tradition and innovation is one of the hallmarks of folklore itself (Toelken, 1979). Our attempts to design the i-balls to satisfy this and other folklore requirements are the focus of this section.

Designing for Folklore Habitat

The performance and exchange of folklore, particularly children’s folk games, happens “in the wild.” (Opie and Opie, 1959). Folk games thrive in the spaces of children’s lives that still lie outside the encroaching boundaries of adult structure and supervision. We chose the SEGA VMU technology because its small size, durability, and built-in connectivity gave us confidence it would find its way into the kind of hallway and back-of-the-school-bus interactions where children’s folklore plays such an important role (see Figure 4).

Figure 4. Kids Sharing Their New I-Balls After Class

One of the highlights of the school i-ball trial came on the first day. We started the day in the computer lab introducing various classes to the i-ball authoring tool and helping them create their first i-balls. While things went quite smoothly, our team felt there was a little less enthusiasm than we expected based on the previous trial. However, as we walked past the school playground on our way to lunch, we noticed that in the midst of kids playing ball, there were a large number of children excitedly showing each other i-balls they had made or collected. When we stopped to observe, one child ran up to show one of us a particular i-ball, saying “Have you seen this one? It’s famous!”

That the i-ball activity did not take hold until kids played with it “off the grid” is a sign of its success as folklore. As the trial went on, we continued to witness and hear about i-ball interactions in the cafeteria, the teacher’s lounge, and even the bathroom, known to be a key oasis for children’s folklore in the school environment (Mergen, 1999).

One difficult trade-off: Because we wanted the i-socket to be small enough for kids to wear, it was not large enough to support an i-ball authoring tool. We had to separate the playing and passing of i-balls from their authoring. This was unfortunate, and it had consequences for meeting the requirement that folklore blend both tradition and innovation (see below).

Designing for Folklore Transmission

A key aspect of folklore is the seeming ease with which it spreads through a community via face-to-face exchange. Therefore, we designed the i-balls with ease-of-transmission in mind.

Children’s folk games often involve two levels of passing: the games themselves get passed along from one child to another, and passing can be an intrinsic part of the game. For example, different variants of the ball game “Four Square” are taught child to child, and the game itself involves the passing of a ball between children. Tag is a more abstract example, where the designation of who is “it” is passed from child to child. When a child teaches another child a game, he or she passes a copy of the game; the original child still knows how to play it. However, when a child passes something within a game, like a ball, or the condition of being “it”, the object usually moves from the giver to the receiver.

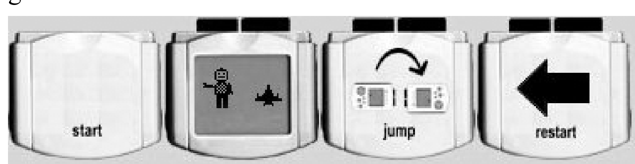


Figure 5. A Simple Jumping I-Ball Program

We designed both levels of passing into the i-balls. To pass an i-ball game, a user connects his i-socket to another’s, selects “copy” from a menu, and then selects the i-ball they want to copy. To create an i-ball game that involves passing, the user adds a “jump” block into his or her program. For example, when the i-ball program shown in Figure 5 executes, it will start at the left-most “start” block, play through the following animation block showing a character boarding a plane, and then wait for the user to connect with another i-socket. At that point, the program jumps over to the new i-socket, deletes itself from the old i-socket, and continues executing after the jump block. It immediately hits a "restart" block, causing the whole program to repeat on the new i-socket.

Computationally, "jump" is a very complex operation. Designing it as a primitive let children construct many kinds of i-ball passing games with relative ease.

Designing for Conservatism and Dynamism

Toelken calls conservatism and dynamism "the twin laws of folklore process" and says that "constant change, variation within a tradition [is] a central fact of life for folklore" (1979).

We wanted to support the kind of "variation within a tradition" that one witnesses in such folk games as Marbles or Tag. This meant that people should be able to dock their i-socket to a PC, open up an i-ball they were passed whose functionality they admired, tinker around with the program in the i-ball editor, and then save this modified version back to their i-socket. We imagined this would enable people to easily make variations of popular i-balls without having to understand their workings enough to rebuild them from scratch.

Due to a design trade-off, we were not able to get this "mutation" support implemented for the first i-ball conference trial. Communication between two connected i-sockets turned out to be fairly slow. We limited i-ball size to 512 bytes to ensure i-balls could be passed quickly enough to keep passing games lively and to keep i-ball exchanges spontaneous. The 512-byte limitation already constrained the amount of animation and behavioral complexity each i-ball could exhibit. Making an i-ball "de-compilable" – able to be uploaded from an i-socket and restored to user-editable form – would have required sacrificing more i-ball expressiveness in the service of background plumbing.

Since we could not support mutation, we offered instead a set of editable sample i-balls for people to use to get started. However, upon review of all the i-balls authored at the conference, we were unhappy with the amount of influence these somewhat arbitrarily chosen i-balls had. This risked putting us in violation of another key folklore requirement: what constitutes legitimate folklore does not get determined by some central authority (Oring, 1986).

After implementing whole new client-server architecture for the i-ball editors, we successfully added mutation capability for the second i-ball trial at the K-8 school. Now, when a student at a PC selected an i-ball on their i-socket to edit, a copy of the uncompiled source code was transparently uploaded from a central server. This meant that editable i-ball source code did not consume any of the precious i-socket to i-socket communication bandwidth.

At the school, more than one third of all i-balls created were mutations of other already-existing i-balls, suggesting that this capability was useful. Some i-balls inspired multiple generations of mutations. Figure 6 shows a visualization of how one i-ball mutated, where the original is in the center, the mutations on it are in the surrounding ring, mutations on mutations are in the next ring, and so on.

Ultimately, there were 98 different i-balls that had at least one mutation on them where someone other than the i-ball's original author used that i-ball as the basis for a new one of his or her own. These i-balls were much more numerous than the half-dozen sample i-balls people used in the initial trial, they represented a broader range of authors, and they were part of an open system where anyone at any time during the trial could create an influential i-ball on which many people made variants. This was more in keeping with the decentralized nature of folklore.

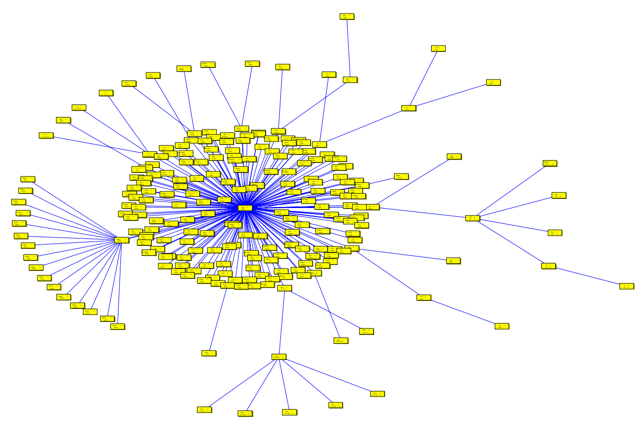


Figure 6. Mutation Visualization of an Influential I-Ball (See color plate on page 000)

Adding New Dimensions to Folklore

The previous section focused on our efforts to preserve the salient features of folklore in our i-ball design. This section focuses on two new capabilities, tracking and computational agency, which we designed into the i-balls in an effort to enhance their effectiveness as a medium for community building.

Tracking and Social X-Rays

Many folklore scholars are interested in the role folklore plays in educating members of its community, or "folk group." We are particularly interested in the role folklore can play in educating a community about the community. As Toelken says "one of the key features of a folk group will always be the extent to which its own dynamics continue to inform and educate its members and stabilize the group" (1979). We believe that, using technology, we can significantly improve the extent to which a folk group's dynamics can inform and educate its members.

Like dye that is injected into a vein in order to reveal the internal structures of one's body on an x-ray, the i-balls were designed as kind of dye that flows through a group and reveals images of its social structure, or "social network" (Scott, 1991). Each i-ball has the built-in ability to store its own path as it moves from person to person, and to report this path back to a central server every time its host i-socket comes in contact with a PC. Participants can then access this data through a suite of visualizations we designed to illuminate relevant community dynamics.

Figure 7 shows a type of visualization that reveals how a particular i-ball moved through the school population. Each node is a person, labeled with their first name and grade. The creator of the i-ball is the root node. Each link represents an exact copy of the i-ball that was given from the person above to the person below (for details on the color scheme, see below). The tool was designed so that students could pull up a visualization of this sort for any i-ball they currently had on their i-socket, or for any i-ball they created.

Students' immediate reaction to these types of diagrams was fascination. Because many of the computers at the school were quite slow at creating these images, we printed several poster-sized versions of them for popular i-balls. When a new one was put up, kids would swarm around it, first trying to locate themselves on this representation of their social terrain, and then looking to see how their friends and classmates were tied in. There was a sense of excitement around this privileged view these students were getting of a geometry they always sensed, but could never before directly apprehend. And this geometry was personal: we observed one girl become quite upset when she could not find herself on a chart for an i-ball she was sure she had received.

Some kids, on further reflection, were able to make more sophisticated interpretations of the visualizations. One sixth-grade boy carefully explained to us that you couldn't tell how cool an i-ball was just by how many people got it. Instead, you had to look at the pattern of how the i-ball moved. If the author gave the i-ball to a number of people, that was much less cool than if he gave it to a few people, and they gave it to a few people, etc. We saw in this the seeds of a more sophisticated model of that ubiquitous and problematic adolescent concept of "popularity".

We witnessed several occasions where viewing these visualizations helped students surface powerful misconceptions. For example, one girl, when viewing a list of who had gotten a copy of an i-ball she authored, exclaimed, "How did she get a copy of my i-ball? I didn't give it to her. I don't like her!" Only after viewing the i-ball movement tree did she realize that a friend of hers gave it to this other girl, and that it wasn't just about who she gave her i-ball to directly. The notion that she could be linked to an enemy through a friend was unsettling to her.

One of the most interesting "ahas" came after a third grade class viewed a visualization of how one of their favorite i-balls had spread. Someone in the class had made an i-ball version of the class mascot: a bunny named Shadow. They felt this i-ball was very popular and asked several times for a poster-sized printout of how it traveled through the school. When we brought it to their class, however, they were disappointed.

The visualization revealed that while most of the third-grade had gotten a copy of the Shadow i-ball, it had not spread much beyond that. After a long discussion, it became increasingly clear that the third grade had come to believe that because everyone in the class had seen Shadow, many in the school probably had as well. This led to some interesting conversation about the limits of generalizing what is true about your close-knit group to what is true about the larger population.

Ordinarily, of course, the mistaken beliefs of the third graders are self-sealing. People's folklore universe is determined by whom they interact with, and there is no way of getting outside this universe to test the limits of it. Phenomena like insularity are notoriously hard to see from the inside. The i-ball visualizations provide a potential way out, however. With them, kids could begin to see how the structure of their social networks informed their view of the world.

Our original version of the type of graph depicted in Figure 7 was not "colorized". Instead, students had to study the text in each node to discover the characteristics of the person it represented, and then look for patterns in how these nodes were connected. In an effort to make community interaction patterns "pop out" at the viewer, we added the colorizing functionality. For example, the visualizations in Figures 7 and 8 make gender and grade insularity easily discernable by colorizing the nodes according to these attributes. People tended to pass the "Romance" i-ball to others of the same gender and in the same grade. Interestingly, Figure 9 reveals no comparable insularity with respect to ethnicity.

Kids have a natural interest in probing the social network that binds them together. We see this in some traditional folk games that involve simpler forms of the kind of tracking we built into the i-balls. For example, kids write chain letters in hopes of receiving back postcards that signify their connection to children all over the world. Unfortunately, this feedback channel is very brittle, and the postcards almost never arrive.

In an effort to make the feedback more reliable, kids play the game of "Telephone" while sitting around a table. One person whispers something to his neighbor, who then repeats it to her neighbor, and so on until the message has gone all the way around the table. At this point, the last person and the first person say what they believe the message to be, and everybody laughs at how it was transformed by the oral process. What is Telephone if not a tabletop experiment designed by kids to explore their own oral culture? I-balls let kids move these experiments off the tabletop and into the wild, where folk culture really lives.

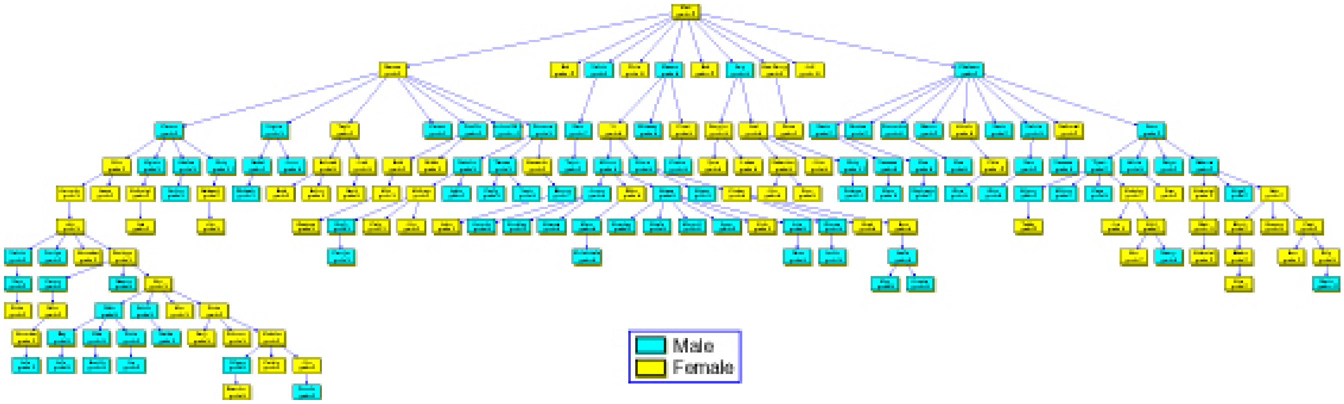


Figure 7: Visualization of How the "Romance" I-Ball Traveled, Colored by Gender (See color plate on page 000)

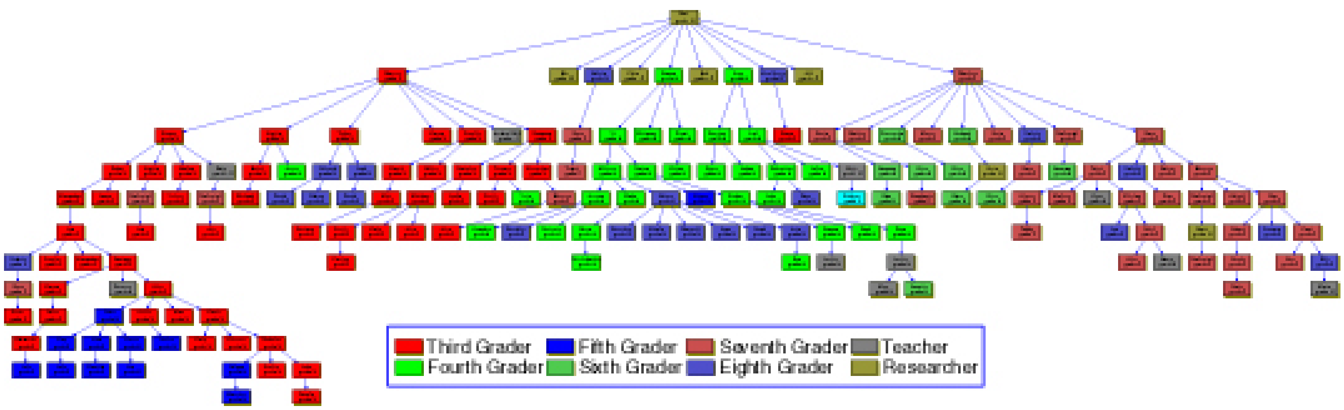


Figure 8: Visualization of How the "Romance" I-Ball Traveled, Colored by Grade (See color plate on page 000)

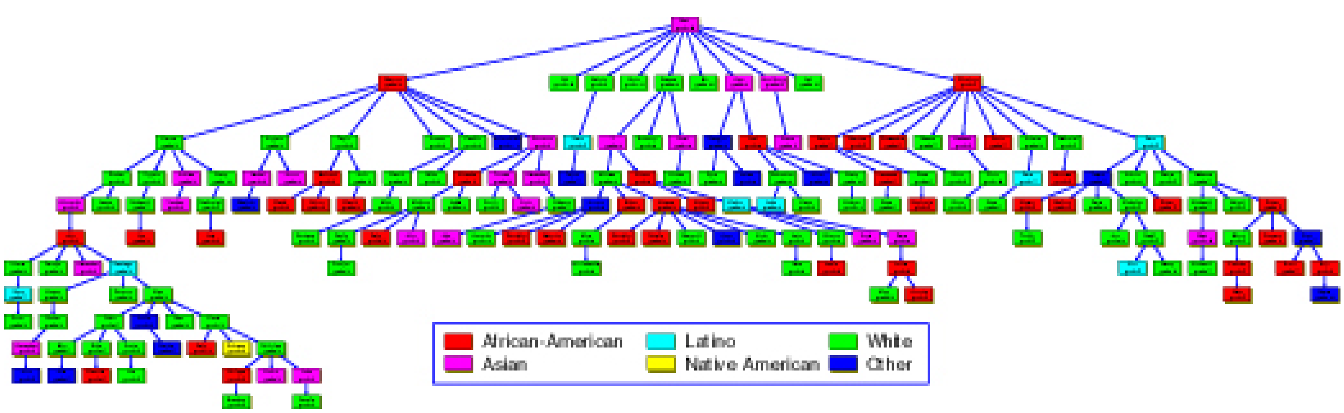


Figure 9: Visualization of How the "Romance" I-Ball Traveled, Colored by Ethnicity (See color plate on page 000)

Computational Agency and Community Integration

In both i-ball trials, we received a large amount of positive feedback for the role the i-balls played in both integrating strangers into a community, and in helping people interact beyond their usual social sphere. In the survey results from the first trial, several parents expressed their gratitude for the way the i-ball activity drew out their otherwise shy children, encouraging them to interact more with other kids and even making them comfortable interacting with other adults. At the conclusion of the school trial, one teacher discussed some difficulties that the school community experienced recently, and said she felt the i-ball activity had a very healing influence. Folklore is already understood to play this type of "integrative" role in communities (George, 1973). However, a specific capability of the i-balls made them much more effective at this task.

We believe that the computational agency inherent in the i-balls made them especially helpful for community integration. To best explain this, we need to explain the "killer app" of the i-ball activity – The Quest.

Figure 10. Part of a Quest I-Ball Program

Figure 10 shows the last several program blocks for a popular quest i-ball that was written by one of the schoolteachers. Quests work by displaying an animation – a simple text messages in the example – that instructs the player to go seek out someone else of a particular description. The program then halts at a "wait" block that contains a condition that must be met before the program continues and the next animation clue is displayed. In Figure 10, notice that the middle clue says "Find someone who likes tennis." The next block is a wait block that contains a condition requiring the person playing the quest i-ball to connect his or her i-socket to the i-socket of someone whose favorite sport is tennis.

Figure 11. I-Ball Rule Editor

Figure 11 shows how the quest author spells out this condition in the i-ball editor. Basically, a condition template is provided where each element can be altered with a pop-up list of substitutions. In the figure, the author is choosing to have the quest player search for someone who likes tennis instead of some other support. Other conditions particular to other variables can be added, and these conditions can be and'ed or or'ed together. We chose the variables in advance (age, grade, gender, favorite sport, etc), and got the data into everyone's i-socket by way of a web form they filled out before the activity started.

Quests were wildly popular. One of the signature events that was repeated over and over again at both i-ball trials was one person approaching someone else and saying something like "Do you have brown eyes and like broccoli?" The quest in Figure 10 that the teacher made spread to hundreds of people at the school, and inspired 48 different mutations.

The crucial feature of the quest was the way it invited, almost demanded, that a player interact with a variety of people. Because of the agency exhibited by the quest – it instructed you on whom to meet, it could tell when you had done it, it could control the flow of information, and it could even impose a time limit – participants seemed to feel comfortable approaching people they ordinarily wouldn't. They had an alibi: "The quest made me do it!"

Because of power quests had over people's behavior, quest authors were inclined to try design quests that brought people together in unusual ways, or ways perceived as helpful. For example, at the school, one parent and child authored a "thank you" quest that sent people to find teachers, staff, and students who the authors felt had been unrecognized for their community contributions. Of course, quest authors and quest players were the same people. Many people both designed quests and played the quests of others. Therefore, one can look at the quest as a way for a community to regulate its own patterns of interaction.

Although some of the interactions surrounding quests were superficial, there was some evidence that they laid the groundwork for more meaningful interactions. One participant at the conference commented that once one had discussed someone's favorite food with them, it was easier to talk to that person later about something more substantive. Of course, this is one of the points of folklore; although the lore itself might not be that meaningful, the connections that it maintains and the sense of group identity it forges create a context for more meaningful interaction.

PRIOR WORK

There are two major ways our research on Folk Computing devices differs from other technology to support community building: its emphasis on co-present, not distributed, communities and its emphasis on augmenting community context, not content.

The relatively small amount of work that is being done in the area of co-present community support often uses the technology to help mediate the dominant conversation, such as tools for meeting support (Stefik et al, 1987). We take another approach by supporting a kind of background communication that is larger in scale than any one focused meeting. The bits of folklore that move through this channel do not represent the main thread of any conversation, but instead help establish a shared community context.

Our work on "Meme Tags" (Borovoy, et al., 1998b), computationally augmented nametags, had several qualities in common with the i-balls. People could author their own short, textual ideas (or "memes"), trade them with their peers, and then track how they were circulating via large-screen "Community Mirrors." Some of the i-ball design grew out of our disappointment with people's lack of interest in purely textual memetic content. Memes did not spread very widely or generate much community "buzz". This was in stark contrast to the more richly structured i-balls, some of which spread through most of the school, and did indeed become "famous." The i-balls also introduced the "mutation" capability into the authoring tool and visualizations.

Tools are starting to appear that produce visualizations of the social networks of online communities by parsing their email or Usenet messages (for example, see Sack, 2000). These tools differ from the i-ball visualizations in their focus on on-line, rather than face-to-face, interaction.

People often compare our work on the i-balls to Pokemon (see http://www.pokemon.com), a hand-held video game that involves some trading of creatures back and forth between kids. Pokemon is missing two elements that are essential to the Folk Computing concept, however: authoring and tracking. Kids play very little role in the creation of the Pokemon creatures. Instead, there is a closed universe of a few hundred kinds. Also, when kids give their creatures away, they have no idea what happens to them.

Authoring, passing, and tracking are tightly integrated in the Folk Computing concept. The ability to pass on their creations motivated people to spend a lot of time designing interesting i-balls. The fact that they had authored the i-balls themselves meant they cared about where they went and who had them. Finally, the fact that they experienced what it was like to pass a single i-ball to someone else meant they had an entrée into the understanding of complex visualizations with hundreds of links. This combination is unique.

CONCLUSION

While some of our most meaningful interactions happen in face-to-face settings, technology has yet to play a large role in supporting co-present communities. We have drawn inspiration from the role folklore plays in building and sustaining these communities, and have patterned a new generation of personal devices on folkloric features and processes. In this paper, we have documented the struggle to both preserve key dimensions of traditional folklore, as well as add new computational features that extend its community-building power.

In future research, we would like to conduct a careful ethnographic study of how Folk Computing devices get used by communities. Unfortunately, there is a constant trade-off between the effort required to design, build, and maintain this technology, and the effort required for careful study of how technology gets used. We are on the lookout for the right collaborators to ease this trade-off.

ACKNOWLEDGEMENTS

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