

Human Cognition and Social Agent Technology

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offprint

Advances in Consciousness Research

This is an offprint from:

Kerstin Dautehahn (ed.)

Human Cognition and Social Agent Technology

John Benjamins Publishing Company

Amsterdam/Philadelphia

2000

(Published as Vol. 19 of the series

ADVANCES IN CONSCIOUSNESS RESEARCH, ISSN 1381-589X)

ISBN 90 272 5139 8 (Eur.) / 1 55619 435 8 (US)

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CHAPTER THREE

Children as Designers of Interactive Storytellers

“Let me tell you a story about myself...”¹

Marina Umashi Bers and Justine Cassell

1. Introduction

In everyday life, conversational personal story telling is a communicative experience in which story listening is as important as story telling in order to construct a sense of identity. When people communicate they often do it through telling stories about their experiences and by finding personal relevance in other people's stories. New technologies have the potential to encourage people to share their personal stories, thus exploring their identity, as well as to learn about the nature of story telling interactions.

SAGE (Story telling Agent Generation Environment) is an authoring environment that encourages story telling and story making as well as provides a framework for children to design and program their own interactive storytellers. The latter supports changes in the way children think about themselves, and about story telling as a communicative activity.

Thus, SAGE supports two modes of interaction. In the first — story telling interaction — children are invited to share what is going on in their lives with a wise old sage, who “listens” and then offers a relevant traditional tale in response. In the second — storyteller authoring interaction — children are invited to add to the library of wise old sages by designing their own storyteller for themselves and other children to interact with. In order to support children as designers as well as users of the storytellers, we imple-

and traditional tales provide a sense of continuity between generations as well as models for human behavior (Campbell 1988). Conversational personal stories play an important role in the social construction of the self from early childhood (Miller et al. 1990). Adults tell and retell life stories according to certain conventions and in many different contexts as a way of establishing coherence in their lives (Linde 1993).

3. *An emotional function.* Story telling has been used in very different forms of psychotherapy (Wigren 1994). In fact, one view of psychotherapy is that it leads us to be able to tell coherent life stories (Polkinghorne 1988). The emotional value of tales has been explored by Erickson in hypnotherapy (Rosen 1982) and in fairy tales by Bettelheim (1976). As Anna Freud (1965), Erik Erikson (1950) and others have shown, through the verbal-play experience of story telling, children can find not only recreation but also self-cure.

From cognitive, social and emotional standpoints it is important for children and adults to have a place to tell their story. But it is also important to provide a space for them to explore what is narrative and how conversational story telling works. SAGE was conceived to support both story telling and story making. While story telling helps children to "play out" what is happening in their lives, story making supports learning about narrative by interacting with and designing meaningful storytellers. Taken together, these two activities allow users to construct and express their narrative voice (Cassell 1998) as well as their identity.

2.2 *Story telling systems: beyond story writing*

To date most of the research on computers and story telling has focused on interactive games, mystery simulations, and interactive fiction (although see Don 1990 and Laurel 1993). Interactive games and mystery simulations present a plot by way of short descriptions of characters and places, and they allow users to navigate through the spaces and find out more about the characters. Unlike narratives about the self, these are "forms of narrative that privilege space over characterization or plot development. [They are] part of an alternative tradition of 'spatial stories,' a different way of organizing narratives that must be examined and evaluated according to their own cultural logic" (Fuller & Jenkins 1995).

Interactive fiction presents a short story or novel in a hypertext format,

towards machine understanding with broad applicability. For example, there is extensive research on producing models of the world that contain particular knowledge organized around standard situations, scripts or cases (Schunk & Riesbeck 1981). This story understanding research depends on a theory of narrative as primarily constituted by goals and actions in the context of plans. A different tradition within AI, drawing from anthropology and ethnomethodology instead of cognitive science, has proposed a theory of situated action as complementary to the traditional planning approach (Suchman 1987). The emphasis is not on mental processes but on social relations produced through the actions people take in the world. The integration of social and cognitive approaches has been proposed by understanding how meaning involves a social as well as a mental dimension (Winograd & Flores 1986). These theories are compatible with SAGE's notion of stories as social as well as cognitive artifacts.

In SAGE, a strong sense of context and a shared assumption about the socio-cultural role of the storyteller allow the user (1) to believe in the abilities of the system, despite minimal natural language understanding, and (2) to find coherence between his or her personal stories and the response stories retrieved by the system. This is achieved by enabling children to design storytellers with strong stereotypical characteristics and well-defined domains that set up certain behavioral expectations (Foner 1998).

2.3 *Learning by designing*

SAGE was specifically designed as a computational construction kit (Resnick et al. 1996) to help children learn in an active and hands-on way. Its educational philosophy is based on constructionism (Papert 1980) which asserts that learners are likely to have access to different kinds of new ideas when they are building artifacts that they can reflect upon and share with others in their learning community. SAGE is a construction kit that supports two types of connections required by constructionism to bootstrap learning:

- personal connections — children can program their interactive embodied storytellers according to their interests,
- epistemological connections — new ways of thinking about story telling, identity and technology are encouraged.

In the light of this approach, SAGE focuses on the building of stories and sage storytellers as "evocative objects" (Turkle 1984 & Turkle 1995) that invite

In interaction mode, children can watch the stuffed animal move its ears, shake its body and blink its eyes to indicate attentiveness as they converse with it. In design mode, children can program the toy's communicative behaviors by specifying an action that the toy would perform at each turn in the conversation. They can also create the different personalities and conversational styles that the toy might demonstrate.

Stuffed animals are objects whose emotional affordances can be exploited in building computational interfaces for children (Drain 1987; Umachi 1997a; Glos 1997). For example, Microsoft has developed an interactive toy called Barney. The toy communicates with the PC wirelessly, reacts to CD-ROM games and watches television with the child (Alexander & Strommen 1998). The psychologist Winnicott (1971) introduced the term "transitional object" to refer to the first "not-me" infant's possession — often a stuffed animal. The favorite toy, as described by Winnicott, "must seem to the infant to give warmth, or to move, or to have texture, or to do something that seems to show it has vitality or reality of its own."

Research on human-computer interaction has taken on challenge to unite the digital with the physical world so as to integrate the power of computing seamlessly into toys. This area is moving from graphical user interfaces (GUI) to tangible user interfaces (TUI) — from a mouse and keyboard to ubiquitous computing and tangible media (Ishii & Uhlmer 1997). An example in the domain of technology for children is Dr. LegoHead (Borovoy 1996). In this system physical Lego blocks have been augmented with digital information, allowing children to build creatures out of high level Lego brick parts such as eyes and mouths, thus exploring ideas about the nature of metaphor and function. Following this line and in order to support emotional engagement, SAGE offers the possibility to embed the wise storyteller's assistant into a programmable stuffed animal with basic motor functions.

SAGE takes the challenge of designing tangible user interfaces and leverages from the fact that children establish intimate communicative relationships with their stuffed toys (Dyl & Wapner 1996). On one hand, the natural tendency to communicate at a deep level with soft objects can be leveraged by adding computational abilities so toys can give feedback. On the other hand, children can program the toy's communicative behaviors, thus exploring powerful ideas about the nature of communication. The result is computationally-augmented soft toys for story telling.

3.2 The authoring language module

The SAGE authoring language has a graphical user interface that allows children both to design storytellers to interact with and also to model different types of story telling situations. The environment supports children's creation of interactive storytellers by providing three design windows that can be chosen from a menu: the character's creation window, the conversational structure window and the database of stories window.

In the character's creation window (see Figure 2) children describe different facts about the lives of the sage storyteller and an optional storyteller's assistant — the interactive toy. These facts will determine how the storyteller (and assistant) interact with the user. This window is also used to load pictures of the storyteller who lives on the screen (scanned photos or sketches done in a drawing program).

In the conversational structure window children design the conversational flow between user and storyteller (or the storyteller's intermediary, the toy assistant) by selecting and arranging objects of three different types from a palette — turn-taking states, communicative actions, and parts of conversation. These objects are placed by the user in the conversational structure window in order to model the conversational story telling interaction (see Figure 3). Once these objects have been selected, the scripts that instantiate

The figure shows a graphical user interface window titled "Storyteller" with a subtitle "Information about the characters". It is divided into two main sections for character design:

- SAGE Character Design:**
 - A "Load Picture" button.
 - A text area labeled "Facts about their life:".
 - A "Name" field containing "L.A. Lakers".
 - A "Team" field.
- ASSISTANT Character Design:**
 - A "Load Picture" button.
 - A text area labeled "Facts about their life:".
 - A "Name" field containing "Bunny".

Figure 2. Window to design character's personality

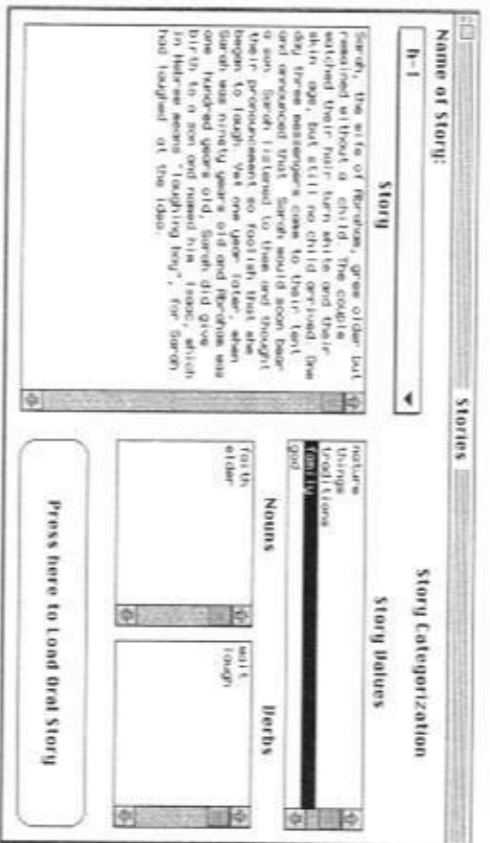


Figure 4. The database of stories and its descriptors

In the database of stories users can write or scan in response stories — the comforting stories that will be offered by the sage. They can also record them in their own voice or ask someone else to do it. Children categorize or annotate the stories with story values, nouns and verbs that they consider good descriptors of the main story points (see Figure 4). The hand annotation process is an important educational feature that helps children to read over a story and try to understand its underlying meaning. Nouns are verbs chosen as keywords represent some of the story's basic concepts. The values can either be keywords or sentences in the form of a short moral. The computational module takes all the keywords and augments them. This augmentation determines which response story is a best match with the user's input story.

The SAGE authoring language allows children to quickly get going with their projects and to create an interactive storyteller. However, it only allows the user to create directed conversational story telling situations. The nature of the conversational system is always machine-controlled (mixed-initiative is not readily an option), ensuring that the persona created is more likely to be believable and to interact successfully.

4. Empirical Research

In the introduction we claimed that the SAGE story telling system is an example of how technology can be used to encourage children to reflect about their inner life, and to support their learning about narrative and communication. In this section we describe empirical research that supports these claims. We show that children's interactions with SAGE did indeed lead them to reflect on thoughts, feelings, and interpersonal communication, and also expanded their knowledge about personal story telling as a communicative activity. The following sections present the methodology used in the empirical research, and then address these claims.

4.1 Description of workshops

We conducted several pilot studies to examine children's interactions with the sage storytellers, and their ability to build their own meaningful characters. Our earliest research showed that children were in fact quite ready to engage deeply with sages that we had designed (Umashi 1996). They opened up willingly to tell personal problems to the characters that we had designed, a Hasidic Rabbi and a Buddhist scholar. Here is an early sample of a conversation that a thirteen-year old had with the Hasidic Rabbi:

- SAGE: You seem a little shy, Leo. I also was shy to tell stories, but since my father and my grandfather were Hasidic Rabbits I knew I had to become one. That is the way it is. Nu, Leo how old are you?
- USER: 13
- SAGE: Oy vey, I am 77 years older than you. You know Leo, a story is more than a story...a story has power. Nu, what is your story?
- USER: I had my first day at school today and everybody was making fun of me because I did not know the Gaemarah(sig)
- SAGE: Oy vey... go on, Leo.
- USER: so they started to beat me up because I was so stupid
- SAGE: I understand — what more can you tell me Leo?
- USER: and everyday when I come home from school I cry for a long time
- SAGE: Nu, do you think you are the first one in this situation? Leo let me tell you a story: When Rabbi Wolf Zbarazer was on a journey, he would not permit the driver to beat his horses, saying to him: "You have no need even to scold them, if you understand how to address them properly." Can you find a connection with your own story?

The nature of children's engagement was no different whether they under-

SAGE does to children. In the following sections we look at examples of wise storytellers created by children. Each example is a case study that illustrates a phenomenon also found more generally during the workshops.

4.2 *The presentation of the self*

When interacting with one of the sages that we had designed, children revealed aspects of their inner lives and the problems they face everyday. In building a sage, children designed that person to whom they wished they could turn with their problems. But it is essential to note that the sages they designed were also aspects of the inner life of the child designer. That is, since the children were creating their own characters and databases of stories, they were also playing with different notions of self, and creating or imitating the narrative voices they wanted or needed to hear. Children created storytellers as projections of fears, feelings, interests, and role models. These projections allowed the presentation of the self to themselves as well as to others.

Out of a total of eight storytellers built during the workshops, three were based on humans or fictional media characters: Doug, a cartoon character; Tera Randof, based on a mixture of a real sports figure and family members of the child designer; and Shaquille O'Neil, a well-known basketball player. The other five characters were fictional, although two of them, Spot and the Big Orange Fox, clearly tell stories based on the designer's personal experiences.

Abi is a bilingual fourth-grader whose parents come from Russia. When he grows up he wants to be a physicist because he likes computers, math and science. Unlike all the other children who participated in the workshop, he said that he had never heard the word identity before, and after we explained its meaning he concluded: "it is what is inside me, like being Jewish and American and having my relatives in Russia."

During the workshop Abi created The Big Orange Fox that would explicitly ask the user if she or he has specific problems. If the user responded positively, The Big Orange Fox would tell an appropriate story indexed in the database under different types of problems. For example, below is a story written by Abi and told by his character, The Big Orange Fox. Abi indexed this story as religion problem.

There was once a boy who did not like his religion so he followed his family religion but when he was alone he secretly followed his religion but when his parents spotted him they cut off his finger and put him into a tiny dark box with spikes on all the sides but the bottom and left him there for 24 hours.

SAGE : I have a lot of problems like wondering if my team is going to win the big game or if I will mess it up for everyone. Please tell me a problem you have.

USER : I am sad because my parents told me that we can't take my dog on vacations with us, so I will miss him.

SAGE : Your problem reminded me of this story. Kerri is my best friend. Kerri knows everything about me and I know everything about her. Every Friday we sleep over each other houses. Switching houses each week. This week it was at my house. I got the usual snacks: popcorn, pizza, chips, soda, and candy. A few hours later Kerri came by with her sleeping bag. You could tell she was in a bad mood. I asked her to lighten up, and she snapped, "Fine" and left. I was stunned. What was her problem? I waited the few minutes that it took for her to walk home then called her. Her mom answered. I asked to talk to Kerri. Her mom said Kerri doesn't feel like talking to you right now. Kerri didn't talk to me in school for a month. Then I got the horrible news: my mom got a great job in L.A. so we were moving there! Kerri didn't even come over to say good-bye. I have never seen or talked to her since. Maybe she wasn't really my best friend. Did you like that story? Did you understand the moral of it? Please tell me what you think that story meant.

USER : You didn't see your friend ever again, but I will see my dog when we come back from vacation. I guess that is not that bad.

Tracy is only one of the many cases in which we observed, by analyzing the logs of the interactions, that a deep knowledge of how the system works does not affect emotional engagement and sharing of a personal problem. Both Abi's and Tracy's case studies show that SAGE was effectively used by children to explore identity, according to their personal needs at the time.

4.3 *Powerful ideas about communication*

Children's knowledge of how SAGE works allowed them to reflect about the nature of sharing problems in a deeper way and compare it with their intuitions about how people and machines communicate with each other. Tracy said:

A person already knows how to react to a question, but the computer does not. You have to feed in information about what to say and that is like creating a mind and a personality [. . .] When people communicate they take an experience they had or think of something that the other person might want to hear, a same sort of problem, something familiar or similar, and they just tell it.

Mischa, created Mother Nature and designed a complex conversational structure that has two parallel branches, one for people who like to be in nature and one for people who do not. In the post-interview, reflecting on her authoring experience, Mischa said,

similar problems when their parents interacted with their characters. In general, the conversational structures designed were very linear, without branches to take into account different kinds of user input. Only after observing others' interactions with their sages did the children realize that they had to contemplate the possibility of responses other than their own. This discovery was facilitated by the iterative design process, meaning the loop of working on the computer and immediately debugging or trying results in the real world in an iterative process.

5. Conclusions

In this chapter we discussed the importance of technological tools specifically designed to encourage children's exploration of identity and communication. We proposed personal story telling as a way to access the inner world as well as to explore notions of communication. Constructionism informed the educational philosophy of our work.

We presented the design and implementation of such a technological tool: SAGE, an authoring environment for creating embodied interactive storytellers with whom one can converse. We described children's interactions with the SAGE tool, concentrating on case studies.

Contributions of this research are the themes that emerged from the analysis of the children's learning experiences:

- The continuum between the interacting and the authoring mode: From the self-reflection perspective, both experiences were successful. However, the authoring mode seemed to support deeper explorations of identity and communication as well as a bigger sense of empowerment and control over the learning experience.
- The creation of storytellers as projections of fears, feelings, interests and role models: These projections allow the presentation of the self to ourselves as well as to others.
- The exploration of notions of communication while observing breakdowns: The iterative design experience supported this type of exploration by providing children with the opportunity to decenter and debug their system's conversational structures after observing other people's interactions with them.

Acknowledgments

Thanks to the members of the Gesture and Narrative Language group and the Epistemology and Learning group at the MIT Media Laboratory. We are thankful to Prof. Mitchell Resnick, Prof. Sherry Turkle, Prof. Seymour Papert and Edith Ackermann for insightful discussions. We also thank Dr. Fred Martin and Rick Borovoy for providing support with the handy-board, and Warren Sack for introducing us to WordNet. Special thanks to the Interval Research Corporation for supporting part of this research and to Lee Felsenstein and his team for building the interactive rabbit. We are also grateful to the crew of talented undergraduates, Ien Cheng, Adrian Barnard, Peter Davis, Anthony Young-Garner, Andy Buttner and Yaron Koren who worked on different aspects of the implementation of SAGE. Big thanks to Josh Bers for reading and correcting many versions of this manuscript.

Notes

1. An extended version of this article, "Interactive Storytelling Systems for Children: Using Technology to Explore Language and Identity", was published by AACE in the *Journal of Interactive Learning Research*, volume 9 (2), copyright 1998.

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