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SAGE Storytellers: Learning about Identity, Language and Technology

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Introduction

Storytelling is an ancient art that allows us to share experiences, thoughts and values. In the oral tradition, stories were told in a conversational way by the elders in order to give indirect advice and communicate morals. Each culture or community has its repertoire of inspirational stories or "literature of the spirit" (Campbell, 1988) that serves similar pedagogical functions as myths. They indirectly transmit how to live a human life and are not intended to perfectly match the addressed situation: time, characters, historical period and plot vary from the listener's situation. The power of this kind of storytelling lies in enabling the listeners to learn more about themselves by constructing personal meaning and interpretation. It is believed that in the very act of finding relevance the listener will find answers.

This paper emphasizes the counseling and self-awareness possibilities of storytelling by presenting a new type of computational storytelling authoring environment, SAGE (Storytelling Agent Generation Environment), that allows children to design their own sage storyteller agents, create their own data-bases of inspirational stories and interact with them. Many new technological tools enable people to learn about the outer world. SAGE explicitly aims to enable children to explore their inner world, developing a better sense of who they are and a set of values for constructing their role in the world. On one hand, by constructing their own storyteller agents children start to explore the dynamics of storytelling and the complexity of meaning and interpretation in communication. On the other hand, the need for formalizing in the computer the flow of the conversational interaction and the turn-taking rules, allows them to play with powerful computational ideas.

Background Work and Motivation

Research on learning has argued that new technologies may help children become builders of their own knowledge. Extensive work has been done within the constructionism educational philosophy on creating tools to help children think in different ways about sciences and mathematics (Harel and Papert, 1993, Resnick, 1994), but little work has yet been done on how to design technological tools that help children learn about themselves, cultural values, narrative and language. Constructionism asserts that learners are likely to create new ideas when they are actively engaged in making external artifacts that they can reflect upon and share with others (Papert, 1980). In the light of this approach, SAGE's research focuses on building narratives and sage storytellers as "evocative objects" (Turkle, 1984) that invite reflection about identity and communication issues. When children start looking at their own culture in order to detect communication patterns and specific vocabulary in conversations, they behave as young ethnographers in search of data.

Learning about the self and the inner world is not an easy task. Narrative seems to serve at least three vital functions. A cognitive function: personal stories are fundamental constituents of human memory and new experiences are interpreted in terms of old stories (Schank, 1995). A social function: conversational personal stories have an important role in the social construction of the self from early childhood (Miller, 1990) and in the creation of coherent life stories (Linde, 1993). An emotional function: storytelling has been used in very different forms of psychotherapy. The value of tales has been explored by the work of Milton Erickson in hypnotherapy (Rosen, 1982) and in fairy tales by (Bettelheim, 1976). A good overview of different uses of narrative in therapeutic experiences can be found in (Wigren, 1994).

Some work on artificial intelligence has approached narrative with the vision that computers should re-create the cognitive processes that people use to understand stories. In this direction, research has been done on

reproducing models of the world that contain particular knowledge organized around standard situations, scripts, or cases (Schank, 1981; Domeshek, 1992). This research in AI aims to shift the design of expert-systems from rule-based to case-based reasoning. The work presented in this paper is conceived within a behavioral based approach to AI that emphasizes behaviors in the real world rather than knowledge representation structures (Maes, 1993, Thórisson, 1994). The sage storytellers in SAGE behave by having a conversation with the user. Meaning is constructed through the actions taken by conversants. This approach of *saying is doing* focuses on "doing things with words" (Austin, 1962) and employs collections of behavior-producing modules along with static knowledge structures. These modules can be thought of as a society of simple task-oriented agents behaving in "the mind" of a more complex agent (Minsky, 1985).

The sage storyteller can be defined as an agent because it meets (Foner, 1993) demarcation criteria: autonomy, personalizability, discourse abilities, risk and trust, limited domain of interaction, graceful degradation, cooperation, anthropomorphism and fulfillment of user's expectations. The notion of the sage storyteller as an agent resonates with research on the creation of believable and emotional agents in drama narratives (Bates et al, 1995). SAGE approaches storytelling by focusing on conversational personal stories and in the social role played by sage storytellers (Benjamin, 1968) who, in the oral tradition, were the elder with more experiences and therefore, more stories to tell (Stone, 1988).

The present research goes a step further within a genre initiated by Eliza in the 1960's (Weizenbaum, 1976), defined by (Murray, 1991) as a parodic interactive character whose computational rigidities model recognizably predictable human types. SAGE borrows from Eliza, Parry (Colby, 1975) and Julia (Mauldin, 1994) the notion of a simple conversational system but, first, extends the domain to the world of narrative; second, allows character construction and not only interaction.

Implementation

SAGE is an authoring tool that allows children to design their own sage storytellers. It offers children two levels of engagement with storytelling. The first level, "Interacting", allows them to play with previously programmed sage storytellers. The second level, "Authoring", allows them to write new scripts for the sage, to program the flow of the conversational interaction and to create a data-base of hand-annotated stories.

The conversational flow is built on top of seven phases of a script-based interaction with a sage in a counseling through storytelling session (see Figure 1). These phases are: 1) Greetings, 2) Introduction -- the sage shares some of his background and requests user's background, 3) Personal telling --the sage asks for user's personal story, 4) Restatement --the sage makes sure of understanding, 5) Counsel --the sage offers an inspirational story, 6) Confirmation --the sage asks for connections between the inspirational story and user's story in order to offer another story, 7) Farewell --the sage offers a final blessing.

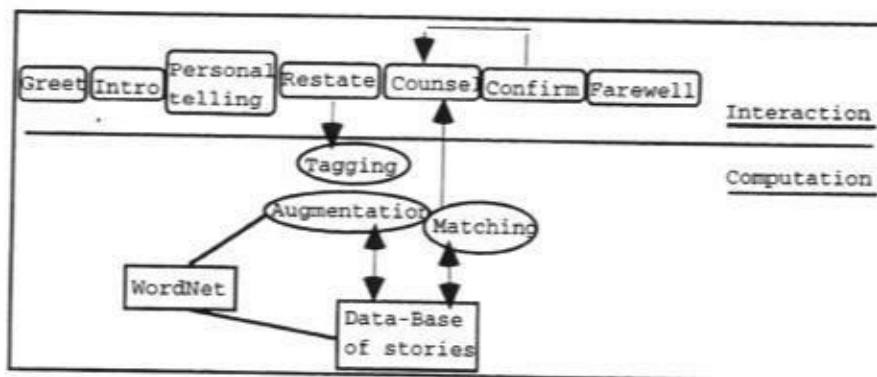


Figure 1: Phases of interaction with a sage and the underlying computation.

Each of the seven phases of the interaction is a finite state machine with several actions or speech acts that occur between Sage and User. The biggest feedback loop exists between the confirmation and the counsel phase, in which the system needs to make sure that it has gathered the right data to match an inspirational story. Kids can

design their own conversational flow by creating a new finite state machine and adding states and actions. For example, Figure 2 shows the finite state machine created for the phase "Greetings".

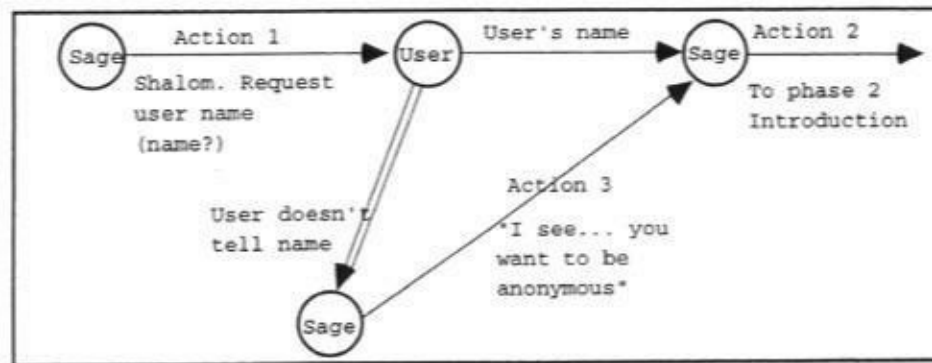


Figure 2: "Greetings" finite state machine with two states (Sage and User) and three actions.

The system parses user discourse (personal narratives) by using a part-of-speech tagger. It checks for nouns and verbs that describe the point being made by user's story. In each turn it assigns higher scores to the most repeated words. The system augments the keywords with synonyms, hyponyms and hypernyms found through WordNet, an on-line lexical reference system (Miller et al, 1993). This augmentation is done in order to match user's personal story with an inspirational story stored in the data-base.

Each inspirational story is indexed with three descriptors: "Commandments", "Nouns" and "Verbs". The decision to annotate the stories by hand instead of automatically responds to the educational goal of SAGE. To annotate a story requires people to think about the point being made by that story. The descriptor "Commandments" is weighted more heavily because it sets up the story domain according to one of the universal values that can be inferred from the Ten Commandments. In the Bible, the Ten Commandments are written in a negative form, however, when they are inverted to a positive form, they talk about respect for different life domains: God or a superior entity, self-awareness, traditions, life cycles, family members, nature, commitment, things or objects, social justice and people.

The system is implemented on top of DISSCO, a programming language that models directed, interactive, scripted storytelling conversations. It allows users to design the conversational flow, the script and the indexed data-base, without worrying about the low-level computation. SAGE works by the combination of three DISSCO files that are sent to an interpreter developed in Macintosh Common Lisp: a "code" file which directs the flow of the conversation by specifying the actions in the finite state machine, a "script" file containing the utterances that the sage might say in each turn, and a "story-index" file that provides the interpreter with the annotated inspirational stories.

"Rabbi" and "Tao": two examples

"Rabbi" and "Tao" are two examples of sage storyteller agents built with SAGE. "Rabbi" simulates an old rabbi that always has a Hasidic story at hand related to a user's problems. He uses Yiddish words, signals the turn-taking with "Nu" and uses traditional Jewish ways to avoid answering precise questions. For example, as presenting himself as an old rabbi who is becoming deaf, he maintains the suspension of disbelief when the parser fails to parse user's personal story. "Tao" simulates a Taoist sage that responds to user's concerns by offering teachings of "The Tao". He uses a language that can be recognized as coming from a Chinese sage and a stereotyped way of handling stories related to truth.

The construction of emotional and believable characters is requisite to maintain the contract between storyteller and listener. Users need to identify the conversational situation with an experience to which they can relate to. To do so, they need to have a sense of the socio-cultural role of the sage storytellers in counseling situations. To construct a believable character children become ethnographers in their own culture and benefit from the anthropological experience that (Geertz, 1973) calls "being there".

Both "Rabbi" and "Tao" construct their "persona" through the different conversational turns in order to set a socio-cultural context without limiting the interaction. The rules of thumb for modeling the conversation according to the real world are the following:

- Sage storytellers can find in every story a central point that addresses at least one of the values stated in the modified Ten Commandments.
- Sage storytellers first listen to personal stories without interrupting to ask questions.
- Sage storytellers aren't verbose. Rather, they listen and rephrase stories in order to help the teller re-tell his/her story.
- Once the tellers finish their story, Sage storytellers ask questions to get the point that needs to be addressed with an inspirational story.
- Sage storytellers do not always need or want to understand the complex situation of the tellers to offer them an inspirational story as counsel.
- Sage storytellers assume that there is not a perfect match between inspirational stories and personal stories, but they know that people will attribute meaning and interpret them according to their personal situations.

Owen is a 20 year old Chinese-American student. He is very much in touch with the traditions of ancient China from an intellectual perspective, but his beliefs are centered around Christianity. This is a conversation that he had with "Tao":

SAGE: Nin hau, what is your name ?

USER: Owen

SAGE: Owen, I am Chuan-Tzu, the Taoist sage of the cyberspace who seeks freedom from labeling things right or wrong. What is your age, Owen ?

USER: 20

SAGE: I am 80 years older than you... I am older than the mountains and the seas, while you, Owen are still young. What brings you to my solitary place ?

USER: Well if you think there is nothing right or wrong, I don't see how you can help me.

SAGE: I need more details...

USER: You see, with your philosophy there is only escape, never fulfillment of the true good.

SAGE: Keep talking, Owen.

USER: Of course you might disagree with me, but according to you, I can not be wrong. You see the problem?

SAGE: I see, but you are not alone in your quest for the Way. Owen, let me tell you... The Sage accumulates nothing. Having used what he had for others, he has even more. Having given what he had to others, what he has is even greater. Have you grasped the meaning ?

The Taoist story matched in the data-base was indexed under the Commandment "Justice" and the verb "help". Bellow is shown part of the run-time augmentation the system made in order to search for a good story in the data-base:

matched aid (4): SYNONYM of help (2) with SYNONYM of help (2)

matched assist (1): HYPONYM of help (1) with HYPONYM of help (1)

matched judge (6): HYPERNYM of think (1) with SYNONYM of justice (6)

matched propose (2): SYNONYM of think (2) with HYPERNYM of offer (1)

Interactions and Reflections

More than eighty people have interacted with "Rabbi" and "Tao". Some opened up while others only wanted to understand how the system worked. A few of them, especially women not familiar with technology, repeated the same scene that Weizenbaum observed many years ago and asked to be left alone while talking with the Sages. People need to tell personal stories and are willing to give details about their experiences. However, the role of a sage storyteller in a counseling situation is not clear for everyone, especially for kids. For example, Abraham, a 14 year old from New Jersey that goes to a Jewish school and is very used to talking with rabbis, said that he wanted to build a sage basketball player because that is the person he admires. However, he enjoyed listening to the Hasidic stories and even asked for a print out of the stories to share with his younger sister. This is the conversation he had with "Rabbi":

SAGE: Shalom... oy vey...I can't remember your name, you are ?

USER: Abraham

SAGE: You seem a little shy , Abraham . I also was shy to tell stories, but since my father and my grandfather were Hasidic Rabbis I knew I had to become one. That is the way it is. Nu, Abraham, how old are you ?

USER: 14

SAGE: Oy vey, I am 76 years older than you.
 SAGE: You know Abraham , a story is more than a story...a story has power. Nu, what is your story ? what is in your mind ?
 USER: Once I was learning gemarah and I could never understand the lines.
 SAGE: Oy vey... go on, Abraham.
 USER: I kept on trying and trying, but no matter how much I studied I could not get it.
 SAGE: I see Abraham ... what else do you have to share with this old rabbi ?
 USER: I have the same problem with chumash, dinim and all other subjects.
 SAGE: Oy va voy, Abraham let me see if this rabbi understands. Once you were learning gemarah and you could never understand the lines. You kept on trying and trying, but no matter how much you studied you could not get it. You have the same problem with chumash, dinim and all other subjects. Is this right ?
 USER: yes
 SAGE: Your situation reminds me of a story. Remember,there is power on the stories. The Gerer Rabbi said: "Exile contains redemption within itself, as seed contains the fruit. Right work and real diligence will bring out the hidden reward. Abraham, do you see the point of this story related to your own story ?
 USER: yes, so now I see that I just have to keep on trying no matter what.
 SAGE: I hope it was helpful. Zie gezunt, be well. May the Lord, Source of Life, bless you Abraham with peace, and may you find your inner peace. Amen.

The Hasidic story selected by SAGE was indexed in the data base with the commandment or value "Commitment", the noun "work" and the verb "travel". Abraham used the verbs "learn" and "study" in his personal story. The system augmented them through WordNet and found the shared hypernym "work". This verb established the story domain or value as "Commitment" and matched the corresponding Hasidic story.

Despite the simple matching method used by the system, most of the subjects found that the inspirational stories were relevant for their situation. Martin, a student that played with "Rabbi" expressed:

"First I thought that the story didn't make sense because I was trying to fit myself into the characters of the story. But then I realized that those characters were referring to me in an indirect way. The story was not telling me how to act, but it was giving me a different way of looking at my problem."

Martin had the following conversation with "Rabbi":

USER: All the best girls are already taken.
 SAGE: Oy vey, all the best girls are taken. Nu ?
 USER: Yeah, the only girls I want to go out with already have boyfriends or are married!
 SAGE: Ahhaaa, but do you think you are the first one in this situation.? This reminds me of a story...
 "A couple unable to have children came to see Rabbi Shimon bar Yohai, asking to be divorced. The rabbi suggested that the couple celebrate their divorce with a feast in the same way that they celebrated their wedding. The event was sad considering the situation, and during the feast, the husband announced that he would like to offer a toast to his wife. He said, "For ten years we have lived very peace full and happy lives. The only reason for our separation is that we have no children. To show my affection for you, please take any object you wish in the house". That night, as the husband slept, the wife asked their servants to carry him to her father's house. The husband awoke in the morning, and asked how he had gotten there. "You are here because of your own request," his wife answered. You asked me to choose any object I wished, and I chose you as the object most precious to me." The couple remained together. They had their first child the following year." Do you get the point of this story related to you, Martin?
 USER: Hmm...you mean there is no point waiting for married couples to get divorced?
 SAGE: Go on, keep talking
 USER: I see, you are telling me that married couples consider each other the most precious things in the world, so I should not waste my time hoping that one day they will break up so I can claim the bride.

It is extremely hard to predict which inspirational story is going to be selected since the keyword augmentation produced by WordNet works in many different hierarchical levels. Another problem is the search time. Sometimes a personal story with many relevant keywords (around 20) can take as long as 60 seconds to be augmented and make the story matching. However, results of people interacting with both "Rabbi" and "Tao" confirmed that an approach to storytelling focused on a communicational model taken from oral tradition, conversational personal stories and counseling is successful. Results showed that in a storytelling system of this kind, where the goal is to get the user to tell a personal story and to construct meaning and personal relevance, a complex matching and indexing system is not always needed.

Future work

Current work involves re implementing DISSCO as a more friendly programming environment so kids can easily create their own sage storytellers. In that direction, research is being done on visual programming languages. On the narrative interest, the focus is on what kind of discourse structures the system should parse in order to abstract the point made by a personal story and show a smarter linguistic behavior. Such a "tool to tell with", which only manipulates language structures but doesn't understand them, could help children start thinking about the complexity of meaning and interpretation in communication. By playing with language and storytelling, children can get an early access to the world of narrative. Finally, work is being done on embodying the storytellers in a physical object. The natural children's tendency to establish intimate relationships with their stuffed animals is leveraged by adding computational abilities (speech synthesis, speech recognition, sensors, etc.) so the toy can give feedback and allow interesting multimodal interaction.

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