Daisy

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December 2005

THIS IS **NOT** A DEFINITIVE FINAL REPORT

FORMATIVE evaluation studies like this one often:

- **are conducted quickly**, which may mean
  - small sample sizes
  - expedited analyses
  - brief reports

- **look at an earlier version** of the exhibit/program, which may mean
  - a focus on problems and solutions, rather than successes
  - a change in form or title of the final exhibit/program

Mind – Formative Evaluation
Daisy

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PURPOSE

Daisy is a chatbot computer program that 'converses' with users by stringing together word patterns it remembers from the current and previous conversations with its users. It determines how to respond to visitors' input by analyzing conversations it's seen and identifying and building on important words. In this way, it 'learns' based on prior input.

Daisy was placed on the floor to engage visitors in conversation and to encourage visitors to think about the nature of thinking. The purpose of this study is to gauge

- What visitors do at the exhibit. More specifically,
  - How long do they stay (holding times)?

  - What do visitors try to do?
  - What do visitors talk about with Daisy?
  - Why do visitors decide to end the conversation?
  - Do they use the function keys and do they help?
- What visitors think about Daisy.
  - Do they find the experience interesting? How so? Why not?
  - Do visitors ever think that Daisy is thinking or feeling?
  - Do visitors think computers in general can think or feel?
  - What counts as a 'good' conversation?
- If talking with Daisy encourage visitors to think about their own thinking and feeling.

SETUP

- Daisy was placed in the exhibit prototyping space during this evaluation. See Figure 1 and Figure 2.
- The exhibit developer, Erik T, had a set of initial conversations with Daisy to help it 'learn'. This way, Daisy would not be a complete blank slate when visitors first approached it, but instead would have some responses to visitor input.

Figure 1. Exhibit label

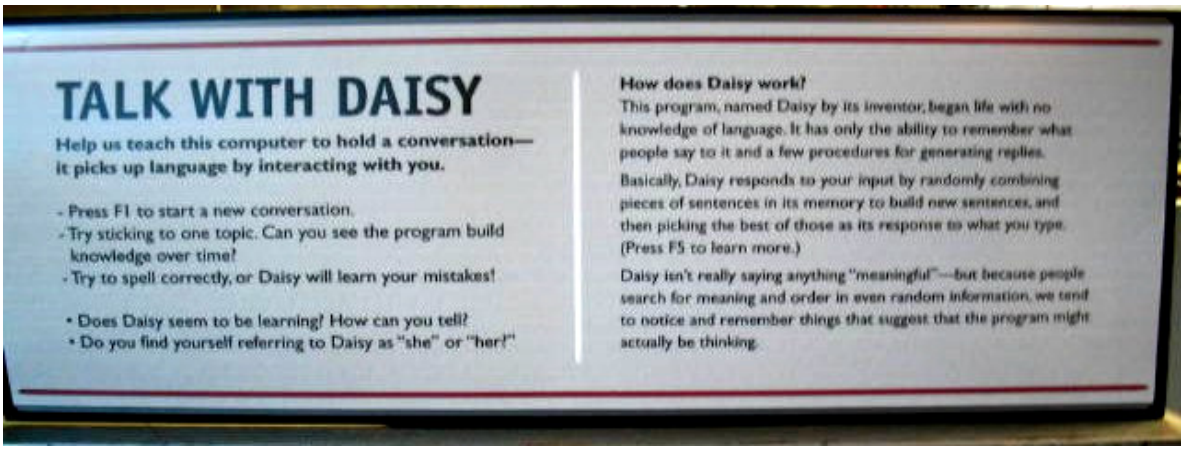


Figure 2. Standalone exhibit setup. The exhibit was placed in the prototyping area on the museum floor



METHOD

- An evaluator observed every other visitor who stopped in front of the exhibit for more than 10 seconds and then approached that visitor for an interview as they were leaving the exhibit. When it was very slow on the floor, the evaluator selected every visitor. In either case, the evaluator only observed and interviewed visitors 8 years old or older.
- Daisy logged every visitor's conversation, including the time when someone signed in to talk with Daisy[1]. This log was later downloaded, coordinated with the interview data and analyzed.

[1] There was a 1hour 5minute offset between system time and real time, which we accounted for when we matched the visitors' interviews with their conversations with Daisy.

DATA COLLECTED

- We observed and interviewed visitors from 11:30pm to 4pm on Sunday, November 6, 2005.
- N = 10
- Demographics

Age Group	Count
Child	3
Teen	0
Adult	7
Senior	0
Total	10

Gender	Count
Male	7
Female	3
Total	10

Group Type	Count
Multi-generational	6
Adult - Peer	4
Total	10

RESULTS

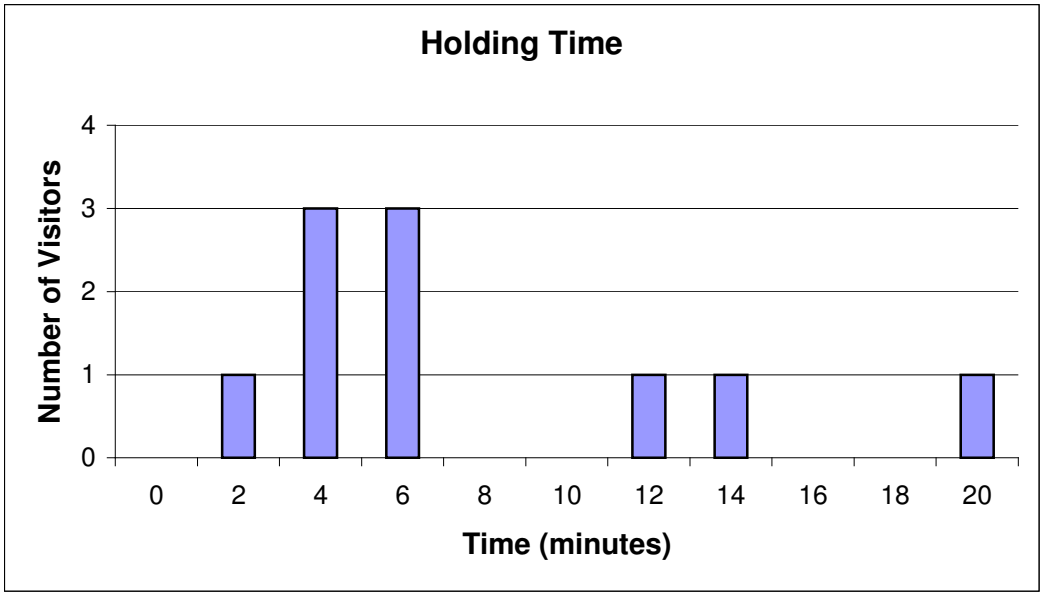
In the following, quotes from visitors who have a background in computer science are noted in blue.

What visitors did at the exhibit

Holding times

The visitors we observed stayed on average (median) 5 minutes at Daisy. A histogram of their holding times is shown in Figure 3.

Figure 3. Histogram of Holding Times. (N = 10; mean = 7 min; median = 5 min; maximum =18 min; minimum = 2 min.)



What visitors tried to do

Visitors reported trying to do the following at the exhibit:

- Have a conversation with Daisy (4 visitors)

  Visitor1: I just made a conversation.

  Visitor5: I tried to ask it questions. I read the information quickly, and then tried to have a conversation.

  Visitor9: I tried to hold a conversation.

  Visitor8: I tried to talk with it and ask it questions.

- See how Daisy responds (4 visitors)

  Visitor2: At first I just started typing. Then I read the label. The computer didn't respond the way I thought it would, based on the description. I typed a lot more, but it came back with unrelated responses. I reset it to 3 days old, but it still didn't make sense.

  Visitor4: I said Hi, waited for a response, when it said something meaningless, I said I didn't understand, and it responded with another meaningless response.

  Visitor7: Just tried to see what it knew, its own capabilities, did it have emotions, things like that.

  Visitor10: F: I was trying to find out what Daisy thought - she said "I can see you," so I responded "How do I look?" but then she changed the subject.
  M: I was free-associating, being just like Daisy.

- Answer Daisy's questions (1 visitor)

  Visitor3: I answered a few questions.

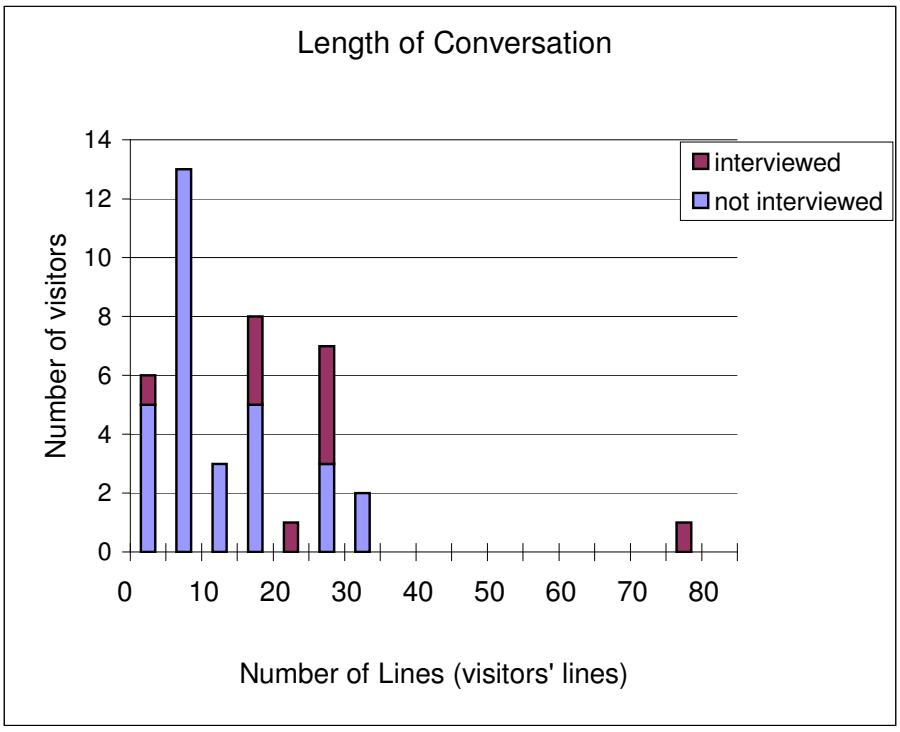
- Type gibberish w/o intent (1 visitor)

  Visitor3: my son was typing gibberish.

Visitors' conversations with Daisy

- As a rough measure of the degree of visitor engagement, we counted the number of lines visitors entered in their conversations with Daisy. We looked at both those visitors whom we interviewed and those we did not. Note that many of the visitors whom we interviewed had the longer conversations with Daisy[2]. See Figure 4.

Figure 4. Histogram of the Number of Visitor Lines per Conversation. For all visitors (N = 41) mean = 15.2 lines; median = 12 lines; maximum = 77 lines; minimum = 1 line. For the visitors we interviewed (N = 10) mean = 26 lines; median = 23.5 lines; maximum = 77 lines; minimum = 3 line)



- We also looked in the computer log for instances of talk about thinking and feeling. This includes talk about humans (the visitor, in particular, or people/animals in general) and about machines (Daisy, in particular, or machines/non-living things in general).

[2] 9/10 of the visitors we interviewed were above the median.

Although there were other topics of conversations, we began by looking for thinking and feeling talk as one indication that Daisy may be engaging visitors in thinking about the nature of thought and emotions.

Then for each category, we looked for 3 patterns of talk:

- Daisy introduces the subject and the visitor responds
- Daisy introduces the subject but the visitor does not respond (i.e. changes the subject or type a response that our coder found difficult to interpret)
- The visitor introduces the subject

Table 1 and Table 2 give examples of snippets taken from visitors' conversations to illustrate each of these coding categories. Table 3 tallies the number of visitors whose conversations had at least one instance of each category of talk.

Table 1. Talking about thinking

Daisy introduces the subject and the visitor responds in the next line

```
DAISY> brain's run on tv?
Visitor2 > brain's freeze on tv

DAISY> human perception is masterpiece theater.
Visitor3> yes

DAISY> do is bother you that you have a mind.
Visitor7> no, i love my mind and it is better than yours
DAISY> computers will never think.
Visitor7> do not be so negative

DAISY> thinking makes my mind broken?
Visitor8> it doesnt make my mind break

DAISY> can i pass the turing test?
Visitor9> yes
DAISY> yes, i think in 2001.
Visitor9> why not right now?
DAISY> why do you have a conscious?
Visitor9> because i think.
 …
DAISY> do you have a mind hans.
Visitor9> yes
DAISY> what makes you sure that thinking right now.
Visitor9> because i am awake

DAISY> intel makes computer chips that make them smart.
Visitor10> they are only as smart as there masterprograminators.
```

Daisy introduces the subject but the visitor does not engage in discussion about thinking in the next line

```
DAISY> skunks don't burn gas, they pass the turing test?
Visitor1> i don't get it

DAISY> no, i've never tasted that. where computers have minds.
Visitor3> pop

DAISY> do you have a mind.
Visitor4>
DAISY> does it hurt your head when you think?
Visitor4>
DAISY> i am not conscious!
Visitor4>

DAISY> computers think more than they should.
Visitor6> %%%f1%%%

DAISY> no, i love my mind and it is better than computers?
Visitor7> you are not making sense right now

DAISY> whose child are smarter?
Visitor10> no, whose child "is" smarter...

DAISY> thinking makes my screen.
Visitor8> thinking makes your screen
DAISY> thinking makes my screen.
Visitor8> ok then

DAISY> star wars was a computer that could think.
Visitor10> star warts spelled backwards is straw rats.
```

The visitor introduces the subject

```
Visitor10> yes, good, you are learning faster than either of the previous
two cuckoo-bananas.
DAISY> star warts spelled backwards is straw rats.
Visitor10> yes, very good jackson.
```

Table 2. Talking about feelings

Daisy introduces the subject of emotions and the visitor responds in the next line (e.g. with a comment about emotions or acknowledges the emotion)

```
DAISY> i have nothing to fear.
Visitor2 > that is true

DAISY> everybody needs somebody to love.
Visitor5> i agree.
DAISY> yes.
Visitor5> who do you love?
DAISY> people who live in connencticut, that is possible

DAISY> do you have an emotion?
Visitor7> yes
DAISY> i want to love.
Visitor7> why?
DAISY> why do you a real person, actually!
Visitor7> in what way?

DAISY> i worry that i hear in charge. you know, them.
Visitor10> don't worry too much about things. they can only get better,
unless they get worse first.
DAISY> don't worry too much.
Visitor10> ok, roger that, good buddy.
```

Daisy introduces the subject but fails to engage the visitor in talking about emotions or acknowledging the emotion in the subsequent line

```
DAISY> whose child are you in love?
Visitor1> i am not in love a child
DAISY> whose child are you in love?
Visitor1> let's change the subject

DAISY> i am 11 years old. are you afraid of friends.
Visitor3> are you alive?

DAISY> i like you.
Visitor4>

DAISY> no machine has ever passed the difference between happy as a clam.
Visitor9> %%%f1%%%

DAISY> don't worry too bad, because locusticeans are very delicious.
Visitor10> yes, and they are not even an endangered species.
```

The visitor introduces the subject

```
Visitor7> do you have emotions
DAISY> i have a brain, but not involve thinking.
Visitor7> do you feel
DAISY> sometimes you feel like a nut, sometimes you don't.
Visitor7> i don't like nuts
```

Table 3. Tally of type and pattern of talk.

Type	Pattern	Visitor										Total (out of 10 conversations)
		1	2	3	4	5	6	7	8	9	10	
Thinking	Daisy introduces the subject and the visitor responds		Y	Y				Y	Y	Y	Y	6
	Daisy introduces the subject but the visitor does not responds	Y		Y	Y		Y	Y	Y		Y	7
	The visitor introduces the subject										Y	1
Feeling	Daisy introduces the subject and the visitor responds		Y			Y		Y			Y	4
	Daisy introduces the subject but the visitor does not responds	Y		Y	Y					Y	Y	5
	The visitor introduces the subject							Y				1

- We found
  - Daisy introduced the subject of thinking at least once during its conversation with 9/10 visitors. But, 3 of these visitors never responded in kind to Daisy.
  - Also, Daisy talked about emotions in 8/10 conversations. Yet, in half (4) of these conversations, the visitor never responded to Daisy's prompts.
  - Visitors rarely introduced these subjects themselves during the course of their conversations.

<u>Why visitors decided to stop talking with Daisy</u>

Visitors reported ending their Daisy experience when

- They felt that they could not carry on a 'sensible' conversation with Daisy (5 visitors)

Visitor1: She wasn't really saying anything. Everything was random and stuff.

Visitor2: I got frustrated; it wasn't getting any more intelligible. At first I thought it was understanding language, and I couldn't tell if punctuation counted. If it did, I would have thought more that it was thinking.

Visitor6: Because it wasn't a conversation - it was just regurgitating random pieces of sentences.

Visitor9: It didn't seem that it was progressing anywhere.

Visitor10M: You lose the logical thread, and can't go on much more.

- They felt that they had gotten all they were going to get out of this experience (3 visitors)

  Visitor3: I had gotten past the interesting point. There's lots of stuff for my son to play with here and we have a computer at home, so if it's just him typing on the keyboard, he can do that at home.

  Visitor4: Because I got what it was supposed to give.

  Visitor7: I don't know, I lost interest maybe.

- For extrinsic reasons, which did not have anything to do with this exhibit (3 visitors)

  Visitor5: Because I'm watching these kids. I needed to keep up with them.

  Visitor8: I realized that my family was waving.

  Visitor10F: We were just there for a long time. It was just time to go.

Visitors' use of the function keys

- The following shows the number of visitors who used a function key.

Function Key	Description	Count (out of 10)
f1	Restart	3[3]
f2	Correct spelling	0
f3	Reset mind (newborn)	2
f4	Reset mind (3day-old)	3
f5	How does Daisy work?	3
f6	About	0

- Some visitors were confused about certain function keys

  Visitor6: Just F1, but Daisy didn't change - it did the same thing.

  Visitor2: [re: Newborn/3day settings] Made Daisy 3 days old. but it didn't make any more sense than it did before.

  Visitor2: [re: Explanation] Daisy didn't seem to conform to the description on the label (taking my sentences and using them, recombining pieces of my sentences.)

  Visitor6: The whole thing.

[3] This is a count of the number of visitors who pressed the Restart key *during* their session and then signed back in to continue talking with Daisy.

What visitors thought about Daisy

Visitors' Interest

Interest Rating	Count (out of 10)
Interesting	3
Somewhat Interesting	4
Neutral	1
Somewhat Not Interesting	2
Not Interesting	0

- Some visitors found the exhibit experience interesting because:
  - Daisy said random/surprising things. (3 visitors)
    - Visitor1: Because it always says random things.
    - Visitor2: To see what the response was going to be.
    - Visitor8: That it had a lot of facts and some opinions about stuff.
  - The concept and program were interesting (2 visitors)
    - Visitor7: The concept of AI, and the fact that it's a program, working from an algorithm.
    - Visitor10: M: just very interesting topic
      F: the programming is very interesting; it's only somewhat interesting if you're really thinking it's smart.
- On the other hand, some visitors thought the experience was not interesting because
  - They expected more intelligent conversations (4 visitors)
    - Visitor3: I thought the responses would be better than they were. That the responses would be more logical (You ask a question, it responds logically).
    - Visitor4: Because I thought it was going to have some AI, but the responses were not that intelligent. The label said it wasn't supposed to come up with anything.
    - Visitor5: Because the responses were just random.
    - Visitor6: It would be more interesting if what it said made sense.
  - They didn't understand the point of the experience (1 visitor)
    - Visitor9: I couldn't understand what the object of it was.

Did visitors think that Daisy was 'thinking'?

Was Daisy thinking?	Count (out of 10)
Yes	4
Uncertain	1
No	5

- Visitors thought Daisy was thinking when
  - It gave an answer that made sense to the visitor (3 visitors)

    Visitor1: It took a little while, but when she gave a reasonable answer, that's when I thought she was thinking. Not when she wasn't making sense. There was a lot about cars burning gas.

    Visitor9: When I asked questions, it tried to reply with something I had already said… It knew I was asking questions - maybe it sees the question mark?

    Visitor10F: Sometimes. I kept to one subject and it really answered me… Because it was answering my question from what I input.
  - When it paused before answering (1 visitor)

    Visitor4: When I was waiting for a response, but then the response made me think it wasn't thinking.
  - When it spell checked (1 visitor)

    Visitor8: When she corrected her own spelling while typing… Because she seemed to see that she'd typed it wrong.
- One visitor, who did not think Daisy was thinking, explained:

  Visitor3: I was hoping the program would execute logically to my perception, I don't think of computers in terms of thought.

Did visitors think Daisy had emotions?

Does Daisy have emotions?	Count (out of 10)
Yes	1
Uncertain	2
No	7

- Most visitors felt that Daisy did not have emotions. Some visitors based their explanation on the absence of talk about emotions in their conversation with Daisy. For example:

  Visitor1: No, I don't remember, but I do remember that she did at one point… Oh yeah, she said that cars don't have emotions.

  Visitor3: I don't recall her talking about emotion at all.

Visitor9: I don't think any references to emotions came up in the conversation.

This is in contrast to one visitor who believed a machine simply could not have emotions regardless of whether or not it talks about emotions:

Visitor3: I don't think of computers in terms of human traits like emotion.

- Two visitors thought Daisy might have emotions, but were not sure.

Visitor8: She said she was happy… That made me think that maybe it was true.

Visitor7: I knew it didn't really have emotions, but there were times I thought it could have. I thought this when she said, "I want to love." … It gave me a start because it sounded real.

Did visitors think computers can think/ have feelings

Can computers think?	**Count** (out of 10)
Yes	0
Uncertain or Somewhat	5
No	5

- No one believed unconditionally that a computer could think. But, half (5/10) of the visitors thought that with certain caveats a computer can think or can be made to think.

Visitor6: I think they can think in a manner… Have logical reactions or put things together logically.

Visitor8: she learns so much from other people. Maybe she can build up enough to think.

Visitor9: I think they can think… They can only think logically, though.

Visitor10M: Not today, but maybe in the future. F: Only if they're programmed enough.

- Half the visitors thought a computer cannot think. These were their arguments:

Visitor2: No. The idea of taking words and turning them into meaning is essential. Our reality is actually created based on the ability of our minds to perceive patterns and ascribe meaning. - and that's why written language and TV are so dangerous. We're not being trained to perceive how our minds are being controlled by words, which are really only symbols. We think that symbols are THINGS in reality, and they really exist, when they don't. What's really interesting is that we believe what our minds perceive, we buy into it completely.

Visitor3: I think of them as something that follows orders - it's up to the programmer to make it do something interesting.

Visitor4: They can be programmed to make intelligent calculations … it's not the same thing as thinking.

Visitor5: No. I define thinking and feeling as animal behavior (not exclusively human, though). It seems to me that thinking and feeling were developed for our survival. Inanimate objects aren't concerned with survival, unless programmed to, and that's different than how living things survive.

Can computers have feelings?	Count (out of 10)
Yes	0
Uncertain or Somewhat	1
No	9

- Only one visitor thought that computers can have emotions under certain conditions. Otherwise, a large majority (9/10) of visitors did not believe computers can have feelings. Most of the arguments are the same as those for why computers cannot think.

What counts as having a 'good' conversation with Daisy

Visitors explained what makes for a good conversation with the exhibit:

- It responds to what visitors have said. (6 visitors)

  Visitor3: Having a more cohesive set of answers, for instance, if it asks a question, and I give it a related/expected response, it should come back with something logical.

  Visitor6: If it were a cohesive conversation. If the responses had to do with what you're asking.

  Visitor7: When it was talking about itself, its capabilities. It was pretty responsive when talking about that and it didn't confuse its words as much.

  Visitor8: When she said stuff that seems true and really answered questions.

  Visitor9: That there's some correlation between what I said and what she says back. The better the correlation, the better the conversation.

  Visitor10F: Staying on subject.

- Its responses are surprising. (2 visitors)

  Visitor1: When she says something funny - I said "I like cars" and she said, "Cars burn gas and pass gas."

  Visitor5: If I were surprised by something Daisy said, or was learning something from what she said

- Daisy can elicit an emotional response. (1 visitor)

  Visitor5: When emotions are involved… if I was having an emotional reaction.

- Daisy gives grammatically correct responses. (1 visitor)

  Visitor10M: Grammar and semantics being present WOULD make it good, but mostly they aren't there. Without them, it's hard to get further.

Visitors' thoughts about their own thinking and feelings

Did visitors think about their own thinking?

- Two visitors reported that talking with Daisy prompted them to think about their own thinking. When we looked back at these visitors' transcripts, we found that they both talked about thinking with Daisy.

  Visitor9: Yes. In order to respond to a question or interact with someone, you'd have to process what was said, be able to think about what was said.

  Visitor10F: Yeah, because it transferred what I said to another sentence.

- Half (5/10) of the visitors felt that the experience made them think more about machine thinking and not necessarily about their own thinking. Four of these visitors talked about thinking within their conversations with Daisy.

  Visitor2: I'm a computer scientist, so I was interested in whether there was logical programming for the computer.

  Visitor3: I don't know I'd go quite that far. It made me imagine what it would take to emulate thought.

  Visitor4: A little bit. The label said there's a difference between how machines and humans think. This is the challenge of making a computer that can talk with you.

  Visitor7: It made me realize the difference between man and machine. That AI is, just that, artificial. It's not really intelligence.

  Visitor10M: It didn't in my case. I was just having fun. It did make me think how it is to program.

- 4/10 of the visitors did not think about their own thinking at all. Three out of the 4 never engaged with Daisy in talking about thinking.

Did visitors think about their own feelings?

- Only one visitor said that the experience prompted them to think about their own emotions. This visitor not only responded to Daisy's emotion statements but also introduced the subject of emotions in his conversation with Daisy.

  Visitor7: Yes, I think so. I was trying to explain to Daisy what love and emotions are. It's not an easy explanation.

SUMMARY

- In general, visitors who stopped to talk with Daisy found the exhibit engaging. On average, visitors stayed at the prototype for 5 minutes (median), entered 12 lines (median) in their conversations, and thought the exhibit was *somewhat interesting*.
- Although only one person could use the keyboard at a time, the exhibit, nonetheless, attracted groups. Members who were not typing looked on and often laughed and commented on what Daisy said.

- Most visitors tried to engage in a meaningful exchange with Daisy. That is, they tried to have a conversation with Daisy and were interested in what it might say. We looked specifically for talk about thinking and feeling and found that Daisy was quite good at introducing these topics in the conversations. (In 9/10 conversations, Daisy made a remark about thinking, and in 8/10 conversations, Daisy commented on feelings, either its own or someone or something else's.) However, we found that in about half the conversations, visitors did not ever respond to Daisy's comments on these subjects. This may be because visitors did not find these subjects interesting topics of conversation with a machine or, more simply, because having any kind of conversation with Daisy was already very difficult – half the visitors explained that they stopped talking with Daisy because its remarks simply didn't make sense.
- 4/10 of the visitors could believe at times that Daisy was thinking, particularly when it responded to what they inputted with an appropriate (e.g. on topic) comment. This, however, did not necessarily mean that visitors thought that computers could think, only that Daisy, at its best, was believable. In fact, some visitors articulated a very clear distinction between thinking and programming.
- Visitors were less willing to attribute emotions to Daisy, and only one person thought there was even a possibility that machines could have emotions.
- A few visitors reflected on their own thinking (2/10) or their own feelings (1/10). Instead, a larger portion (5/10) thought about the machine's thinking. The focus currently, therefore, seem to reside outward in what Daisy is doing and not so much inward on what the visitors themselves are thinking and how they make sense of their conversations with Daisy.
- Future iterations can explore ways of helping visitors have more meaningful conversations with Daisy. This may include 1) giving visitors examples of 'good' conversations that other visitors have had, to model how to sustain meaningful dialogue with Daisy, and/or 2) recommending topics of conversation. This would be a way of constraining the conversation, a popular solution in developing intelligent agents and chatbots. We may even want to suggest that visitors try talking to Daisy about thinking and emotions by experimenting with giving general guidelines (e.g. Try to carry on a conversation with Daisy about the nature of emotions, particularly love) or that visitors try asking Daisy more specific questions to initiate the conversation (e.g. How smart does Daisy think it is? Smarter than you?)

  It is not clear if further clarification that could be accessed only through the function keys would help. A minority (3/10) of the people we interviewed looked at 'how does Daisy work.' It is even possible that visitors may become less inclined to talk with Daisy once they realize that "it was just regurgitating random pieces of sentences".
- Another, complementary tactic would be to encourage visitors to focus on their own thinking in their conversations with Daisy: How do we make meaningful random, non-grammatical patterns of words? Though difficult to do, this approach may help more people experience the exhibit not as a technology exhibit but as an exhibit about their own thinking process.

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APPENDIX A – INTERVIEW QUESTIONS

1. How interesting would you say that was? Would you say that exhibit was …

Uninteresting	Somewhat Uninteresting	Neutral	Somewhat Interesting	Interesting

2. What made it _____ for you?

3. Can you tell me what you tried to do at the exhibit?

4. At any time, did you think that Daisy was 'thinking'? YES NO
   [Probe: did you think that Daisy was understanding you? Or that Daisy was talking to you intelligently?]
   [If YES]
   a. When?
   b. Why then?

5. At any time did you feel that Daisy had emotions? YES NO
   [If YES]
   a. When?
   b. Why then?

6. Did this exhibit make you wonder what it means to think? How so?

7. Did this exhibit make you wonder what it means to have feelings? How so?

8. Why did you decide to stop talking with Daisy when you did?

9. Do you think computers can think/ have feelings? How's that?

10. When Daisy is doing her best, how does a conversation with Daisy compare to a typical conversation with a human being? Is Daisy

Never	Rarely	Sometimes	Often	Always

    better than talking with a human?

    a. Can you tell me what counts as having a 'good' conversation with Daisy?

11. Did you use any of the function keys. For example to look for help or to see how Daisy works? *YES NO*
    a. [If YES] Did it help or make sense to you?
    b. Was there anything confusion about what you read or the information it gave you?