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NARRATIVE INTERACTION AS MEANS FOR INTUITIVE PUBLIC INFORMATION SYSTEMS

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Abstract

We suggest narrative interaction as a design possibility for human-machine interfaces in public information systems. Because current interfaces are often very complex and do not reflect the users' everyday ways of thinking, they pose barriers for people with low technological literacy. Using storytelling and narration for the graphical presentation of information in self-service technologies enables customers to draw on their everyday experiences. Therefore, it can be described as design principle towards more intuitive public information systems. We present a case study of a train ticket purchase process with a story structure that demonstrates the concept of narrative interaction.

Keywords: self service technologies, narrative, human computer interaction, interface design, ticket vending machine

1. Introduction

Public information systems like self-service technologies gain importance as service providers reduce their operated services. For example, many railway companies have cut the number and opening hours of their ticket counters and replaced them with self-service ticket vending machines. An important challenge for the design of public information systems like these is the heterogeneity of possible users [Sundgren 2005]. Self service technologies have a particularly high impact on people with low affinity to technology; they pose a barrier to their participation in daily life, and further enlarge the digital divide in society. E.g., recent studies show that many railroad customers, especially the elderly, do not confide in their ability to operate ticket vending machines and hence prefer to buy their tickets at the counter [Schreder, Siebenhandl, Mayr and Smuc 2009, Schreder, Siebenhandl and Mayr 2009, Passenger Focus 2008].

In this case study, we present a new design approach for public information systems. We suppose that using storytelling and narration for the presentation of and interaction with information could reduce barriers for users with little computer literacy. The interface is more intuitive [Hurtienne 2009] as it allows applying prior experiences from everyday life and does not depend on knowledge about technology. Based on the benefits of narratives, we argue that many of the difficulties during interaction with public information systems could be dampened applying narrative interaction design.

In a very broad sense, narration can be defined as "a chain of events related by cause and effect occurring in time and space and involving some agency" (p. 324) [Wilkens, Hughes, Wildemuth and Marchionini 2005]. Films and novels are perhaps more likely to come to mind when thinking about narrative material than interfaces for public information systems. While films and novels easily demonstrate the entertaining narrative aspects like emotional immersion [Green, Brock and Kaufman 2004], there are more benefits of narratively structured information: For example, the temporally ordered structure provides guidance for learners [Weller 2000] and it reduces cognitive load [Zumbach and Mohraz 2008]. The reason, why narratively presented information is easy to process, is that narration is not only a mode of presentation, but "a fundamental way of organizing human experience and a tool for constructing models of reality" [Ryan 2008] in people's everyday lives.

2. The Ticket-Purchase-Narrative

In the case of operating a train ticket vending machine, the main purpose is conveying the proper information to the machine, and not being immersed in an intriguing story. As such, the system should be a graphical user interface with little text designed to minimize the user input and the time needed to buy a ticket. Accordingly, it is not possible (and would not be wise) to create an interface that meets important criteria of a true story, like dramatic tension, development of character, inner conflicts, a climax and so on. For the ticket-purchase-narrative, we focused on those aspects of the buying process which caused most user problems with current machines [Schreder, Siebenhandl, Mayr and Smuc 2009]. During the course of the narrative the user enters all relevant information on passengers, discounts and journey details.

When creating the narrative interaction for a new ticket vending machine we took into consideration the story rules by Thorndike [1977]: Important elements of a story are an agent, a setting (location, time), and a plot: The agent follows a goal in several episodes resulting in some end state. According to the ticket vending machine's

purpose, the central theme or setting is a train consisting of an engine and some wagons. It is the main agent of the story and guides the user through different episodes (screens designed as mini-stories with their own sub-tasks) in chronological order. The elements to be chosen by the user in each episode interact with the train. There is a strong causal relationship between the episodes as the modified state of the train is taken over into the next episode. The episodes structure the process that starts when the train is introduced and continues until the train leaves.

2.1. Episode: Get aboard

In an animation, the train arrives on the screen (Fig. 1). At the center of the screen a wagon with a large, empty window can be seen. Passengers (e.g., adult, child), a dog and a bicycle are positioned in front of the train. By dragging one of these characters and/or objects (or by touching it) they board the train and appear inside the wagon, (Fig. 2). Discounts for each passenger can be chosen from a pop-up window in the form of a speech balloon. After pressing a continue button the next episode starts.

It is expected that the setting which is introduced by the train arriving from the left side and coming to a halt in front of the passengers motivates users to act matching the narrative by selecting the persons or objects who board the train and for whom the tickets will be valid.

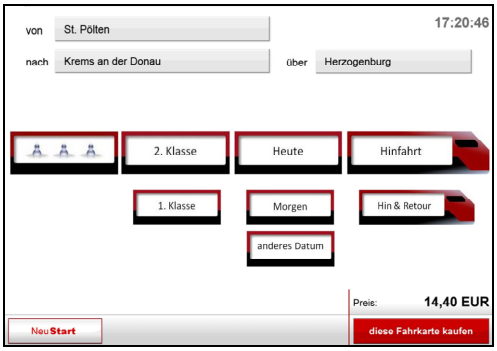
Figure 1 (left) and Figure 2 (right). The train arrives…(left) and passengers can get aboard (right).

2.2. Episode: Changing Wagons

The scenery of the second episode is established by zooming out to the total view of the train and thus, the engine and two more wagons can be seen as part of the train. The passenger wagon remains the same as in the last episode with all the persons and objects selected earlier still clearly discernible. The engine and the other wagons are equally equipped with large windows containing text elements which correspond to the possible features of the travel: ‘second class’, ‘today’ and ‘one way’. Below these wagons slightly smaller wagons are positioned including the features that can be chosen instead of the preselected ones, like ‘first class’ or ‘tomorrow’. When one of these smaller wagons is touched, it moves upward and changes place with the pre-selected wagon. A faint sound reminding of train wagons docking can be heard.

We anticipate that the users act according to the continuity of the narrative by realizing that again a small number of actions have to be set to allow the train to continue its course. Because the alternative wagons are smaller, separated and not docked to any other wagon, the scene suggests that they are placed on the siding and will not be used for the journey. By pressing a button labeled ‘buy this ticket’ the train

starts moving and leaves the screen on the right edge. The next episodes, payment and issuing of the ticket, will follow but are still work in progress.



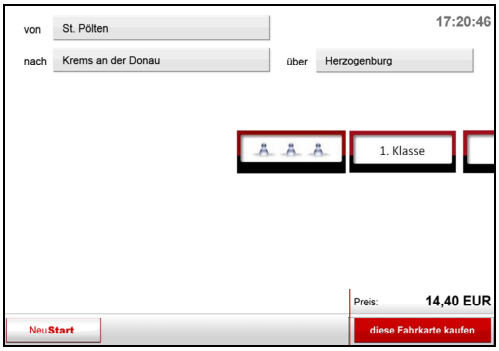


Figure 3 (left) and Figure 4 (right). The whole train can be seen (left). The journey begins (right).

3. Experiment

3.1. Method

In a 2 x 2 laboratory experiment 48 participants with differing levels of computer skill according to the results of a computer literacy scale (CL: 24 low, 24 high) and age (24 participants aged over 55 and 24 younger persons) interacted with the narrative interaction presented on a touch screen. The users received 4 fictional travel stories including tasks to buy tickets of varying complexity, measured by the minimum number of required actions (number of clicks in parentheses): task 1 - a standard ticket for a single person (8 clicks), task 2 - a special family discount ticket (12 clicks), task 3 - a ticket for a single person including return ticket (9 clicks), and task 4 - a ticket for a group of 3 persons including a return ticket (14 clicks); the time needed to solve each task was recorded as well as the number of clicks and errors. Additionally, the participants' statements were recorded and analyzed.

Based on the existing research on narratives, we hypothesized that the narrative interaction is as intuitive for users with low computer literacy as for those with high computer literacy: participants with little or no familiarity with computers should not face greater impairments than highly literate participants. Univariate test statistics were based on logarithmic values to assure normal distribution and homogeneity of variances.

3.2. Results

Time measurements (table 1) indicate the different complexities of the four tasks: overall, the participants required most time to complete task 2 (family) and least time to complete task 3 (single, return). Elder participants as well as participants with little computer experience needed more time to solve the tasks, regardless of the respective complexity (age: $F=16.883$, $p<.001$; CL: $F=11.454$, $p<.005$; no interaction).

		Trials				
	N	*1*	*2*	*3*	*4*	*all*
CL low	24	123.12 (80.22)	171.48 (130.42)	75.71 (41.4)	130.68 (87.98)	*125.25 (95.57)*
CL high	24	73.98 (43.72)	116.12 (74.17)	45.35 (15.84)	90.43 (62.04)	*81.47 (58.78)*
Age <55	24	92.78 (72.41)	98.67 (76.62)	49.57 (29.55)	80.61 (46.36)	*80.41 (61.53)*
Age 55+	24	104.32 (65.53)	188.93 (118.28)	71.49 (36.35)	140.5 (91.72)	*126.31 (93.31)*
all	*48*	*98.55 (68.56)*	*143.8 (108.62)*	*60.53 (34.59)*	*110.55 (78.01)*	*103.36 (82.12)*

Table 1. Mean (std.dev.) of duration (s)

Table 2 summarizes the average number of actions (clicks) taken per task by the participants. Similar to the speed measurements the number of actions reflects the complexity of the tasks, both measures are highly correlated ($r=.53$; $p<.001$; $N=48$). Though the number of actions is influenced by age (elder participants take more actions – especially in task 2, $F=5.952$; $p<.05$), there are no differences between participants with high and low levels of computer literacy (the observed 95% confidence interval of the difference crosses zero and is entirely contained in a 10% acceptance region).

		Trials				
	N	*1*	*2*	*3*	*4*	*all*
CL low	24	18.75 (11.29)	29.92 (19.16)	16.92 (10.24)	21.92 (8.95)	*21.88 (13.77)*
CL high	24	19.79 (14.11)	27.42 (12.56)	13.25 (5.48)	21.25 (6.56)	*20.43 (11.39)*
Age <55	24	18.25 (10.46)	22.54 (11.16)	13.29 (7.88)	19.63 (5.26)	*18.43 (9.47)*
Age 55+	24	20.29 (14.68)	34.79 (18.04)	16.88 (8.56)	23.54 (9.37)	*23.88 (14.69)*
all	*48*	*19.27 (12.65)*	*28.67 (16.08)*	*15.08 (8.34)*	*21.58 (7.77)*	*21.15 (12.62)*

Table 2. Mean (std.dev.) of no. of actions

Nearly all participants were able to correctly solve tasks 1, 3 and 4 (table 3), but only 29 participants bought the correct ticket in task 2. Neither age, nor computer literacy contributed to the success rates.

		Trials				
	N	*1*	*2*	*3*	*4*	*all*
CL low	24	19	14	23	20	*19.0*
CL high	24	22	15	19	21	*19.3*
Age <55	24	21	16	23	20	*20.0*
Age 55+	24	20	13	19	21	*18.3*
all	*48*	*41*	*29*	*42*	*41*	*38.25*

Table 3. Sum of successful participants

Interaction errors occurred predominantly during task 2: 8 participants did not see or realize that a specific family figure had to be put into the train, 4 more participants had problems finding the correct symbol and chose adults or juveniles instead, but managed to correct their input.

In general, 31 participants did not realize at first that the bigger wagons represented preselected choices and thought they had to touch these in order to select or validate them. After changing a wagon for the first time the process was clearly understood by all of them.

Regarding the moving train and graphical selection of passengers almost exclusively positive expressions were recorded: “it´s fun”, “nice, I like the train going around”, “Cool!”, “the figures are very concise”. Only one participant did not like the basic idea of the system: “That´s nonsense - I´m not a child playing with toys.”

4. Discussion

Self service technologies have a high impact on people who have a low affinity to technology, they pose a barrier to their participation in daily life, and further enlarge the digital divide in society. Access barriers often result from insufficient knowledge of how to use the electronic systems (ticket vending machines) that are becoming increasingly common at railway stations and of the complexity of these systems. We presented a new design possibility for human-machine interaction that by using storytelling and narration for the way of presenting information should reduce barriers for users with little computer literacy.

The first user test provided evidence that the narrative interaction is a rather intuitive system as it is not necessary to have prior computer knowledge: Though the analysis of the few interaction errors revealed that some improvements are still necessary (especially in the second episode), users with low levels of computer literacy encountered the same amount of interaction problems, needed the same number of clicks and solved the tasks as successful as users with a high level of computer literacy. The only effect of computer literacy found in the experiment concerned the time measurements indicating some uncertainties of inexperienced users. It would be interesting to see whether this effect diminishes with prolonged use and gathered experience with the system.

Another advantage of the narrative interaction is the possibility to facilitate communication about the interface, which might be positive both for professional and informal support. It seems quite probable that graphical anchor points make it easier to identify the individual steps of the process while using an everyday language

without any technical vocabulary (e.g. “When you’re at the point where you put the people on the train...”).

Of course, we acknowledge that not all complexities of a self-service terminal are potentially solved (or can be solved) by narratively structuring the users’ interaction with the machine. Nevertheless, narrative interfaces build on everyday experiences instead of computer logic and thereby directly tie in with many different users’ prior knowledge – an important quality of public information systems.

References

Green, M. C., Brock, T. C. and Kaufman, G. F. 2004. Understanding media enjoyment: The role of transportation into narrative worlds. *Communication Theory 14(4)*, pp. 311-327.

Hurtienne, J. 2009. *Image Schemas and Design for Intuitive Use*. http://opus.kobv.de/tuberlin/volltexte/2011/2970/

Passenger Focus 2008. *Buying a Ticket at the Station, Research on Ticket Machine Use*. Technical report. http://www.passengerfocus.org.uk

Ryan, M.-L. 2008. Narrative. In Herman, D., Jahn. M. and Ryan, M.-L. (eds.) *Routledge encyclopedia of narrative theory*, Routledge, pp. 344-348.

Schreder, G., Siebenhandl, K. and Mayr, E. 2009. E-inclusion in public transport: The role of self-efficacy. In Holzinger, A. and Miesenberger, K. (eds.) *HCI and Usability for e-Inclusion*, 5th Symposium of the Workgroup Human-Computer Interaction and Usability Engineering of the Austrian Computer Society, USAB 2009, Proceedings. Springer. pp. 301-311.

Schreder, G., Siebenhandl, K., Mayr, E. and Smuc, M. 2009. The ticket machine challenge? Social inclusion by barrier-free ticket vending machines. In Sapio, B., Haddon, L., Mante-Meijer, E., Fortunati, L., Turk, T. and Loss, E. (eds.) *The good, the bad and the challenging: The user and the future of information and communication technologies*, Koper. pp. 780-790.

Sundgren, B. 2005. What is a public information system? *International Journal of Public Information Systems 1(1)*, pp. 81-99.

Thorndyke, P.W. 1977. Cognitive structures in comprehension and memory of narrative discourse. *Cognitive Psychology 9(1),* pp. 77-110.

Weller, M. 2000. The use of narrative to provide a cohesive structure for a web based computing course. *Journal of Interactive Media in Education 1.* www-jime.open.ac.uk/00/1

Wilkens, T., Hughes, A., Wildemuth, B. M. and Marchionini, G. 2005. The role of narrative in understanding digital video: An exploratory analysis. *Proceedings of the American Society for Information Science and Technology 40(1)*, pp. 323-329.

Zumbach, J. and Mohraz, M. 2008. Cognitive load in hypermedia reading comprehension: influence of text type and linearity. *Computers in Human Behavior 24*, pp. 875-887.