

The reader creates a personal meaning: A comparative study of scenarios and human-centered stories

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Different types of written textual descriptions are often used in interaction design. This paper describes an empirical study of how conventional scenarios and stories with emotional and dramatic elements may contribute to software developers' understanding of interfaces, of contexts and situations of use. The results show first, that software developers create a personal understanding of written descriptions by combining parts of them with their personal experiences. Second, that both scenarios and stories improve their understanding of technical information. Third, that stories with emotions and dramatic elements improve their understanding of contexts and situations of use substantially more than conventional scenarios. Fourth, that software developers may find it comparatively easy to write stories with emotional and dramatic elements.

Keywords: Stories, human-centered stories, scenarios, software development, emotions, requirements, conceptual design

1 Written texts are an important medium in industrial software development

In most cases it is not possible for software developers to be in continuous contact with users or customers who can describe their situations of use and what they need. In addition most software development is so complex that it is necessary in advance to describe and agree on what is going to be developed. My own experience indicates that mainly is done through the use of written verbal descriptions; in particular in the first phases of a software project where major decisions are taken. Written verbal descriptions are used to communicate the context of use and requirements from customers, usability or marketing people to the software developers, and they are used to communicate the suggested goals of the development back to customers and users.

Rosson and Carrol [2002] describe how conventional scenarios can be used in software development and Hertzum [2003] and Nielsen [2004] describe empirically and in details how scenarios can be used and improve the communication during software development. However, it is almost impossible from such studies to determine whether descriptions with different characteristics, for instance scenarios with deeper and better descriptions of the motivations of the users, may be more useful. In particular when preceding events in a project and the status and position of the writer influence how and when a written description is used in a development project.

Another problem is that each of the present studies focus on the use of just one textual genre. Within a specific genre it is only possible to express a certain range of thoughts and emotions. Because of these limitations, it is recommendable to use a range of genres in industrial software development. It is therefore necessary to do comparative studies that can reveal which genres that are most suitable for specific purposes.

Scenarios is one of the genres that can be used to describe the interaction with and context of use of an interface. Some proponents of scenarios indicate that scenarios and stories are almost synonymous [Erickson 1995 & Rosson & Carroll 2002] but an empirical study of actual scenarios reveal that scenarios are a much more restricted genre than stories in general. Conventional scenarios are driven by the interface, their plots focus on demonstrating different functions in it, their descriptions of the characters are superficial compared to stories in fiction literature, and they describe no serious conflicts [Strom 2003b]. Some scenarios consist only of lists of seemingly unrelated events, they are not narrative or proper stories at all (as defined by White [1981]).

In contrast, a fiction short story normally includes at least one serious conflict, the emotions of the characters in it are shown through dialogue and through specific descriptions of their actions, and the plot is driven by the characters' efforts to succeed in conflicts or to overcome obstacles [Knight 1985]. In contrast to conventional scenarios, such stories tend to involve and engage the emotions of the reader.

Clausen [2000] argues that stories using methods from fiction writing are better than technical descriptions when system developers shall communicate with users,

and he found that they could be written and used by computer science students in software design projects. Stories similar to fiction writing can in particular be used to describe how people use a computer system [Clausen 2000]; they are Human-centered, in contrast to scenarios that primarily are driven by the interface [Strom 2003a].

The following is an introduction from a conventional scenario:

Marissa was not satisfied with her class today on gravitation and planetary motion. She is not certain whether smaller planets always move faster, or how a larger or denser sun would alter the possibilities for solar systems. [Rosson & Carroll 2002]

The introduction describes clearly what the designers want to include in the interface. In contrast, there is nothing about the motivations of the main character: Nothing that indicates why she wants to learn more about the topic, why she will use the interface described in the scenario to learn more, or how she will use it to get more information. In contrast, a human-centered story may describe a user of a similar interface like this:

When Marissa was small she used to watch television with her older brother and ask him “Why don’t the moon fall down?” or “What would happen if we lived on the sun?” She is now in high school. She is interested in astrophysics, but she is afraid to be considered a brainy girl and to become unpopular. (inspired by Carl Sagan [1985, 1996])

The quotes or pieces of dialogue show the emotions and thoughts of the main character, such that it is possible to become engaged in the conflict she is caught in and to imagine why and how she will use a web-based interface to get in contact with other students who share her interests.

It is necessary to distinguish between fiction and the use of methods from fiction writing. It is possible to describe a real, non-fiction, situation of use by using dialogue and other methods from fiction writing, and to show how the emotions and motivations of the participants drive the events. In contrast, even though a requirement specification is written without any methods from fiction writing, and even when it is based on careful studies of users and their needs, it is normally a work of fiction: It describes something that does not exist, and that indeed may never come into existence.

In addition to scenarios or other types of stories it is necessary to use technical descriptions of the functions and interfaces of the software to be produced. Such descriptions can give a more complete and compact information, and they can be organised more systematically, which make them easier to use as references.

I will therefore investigate how conventional scenarios and human-centered stories affect how software developers perceive situations of use and technical information when they are read together with technical descriptions, and I will try to identify some aspects that affect the perception.

2 Method

In 2003 and 2004 I taught courses in the use of different textual descriptions in software development to computer science students. The first study was done during these courses (the participation was voluntary). It consisted of an analysis of 30 conventional scenarios and 28 human-centered stories written in the course.

The participants appeared to have above average technical writing skills, but none of them had any previous fiction writing training or skills. Even though they were not selected in a manner that favoured readers of fiction literature, 18 out of 26 participants replied that they had read fiction literature within the last two months.

During the course each participant wrote first a scenario and then a human-centered story describing a situation when an application for processing digital images were used. The participants were given identical written instructions for the writing of the scenario and the human-centered story.

As part of the course I did an evaluation of the human-centered stories. It was based on what I had learned in a creative writing course where I had participated in the evaluation of about fifty stories and on what might be considered the goal of fiction writing: That the characters and dialogues in the story are believable, that words and rhythms of the language are consistent through the story, that there is an apparently plausible plot that progress through the story until it reaches a conclusion, and that all these elements contribute to a consistent reader experience (Based on [Knight 1985] and Sharples [1999]).

When the courses were completed, I counted the number of new ideas that were mentioned in the scenarios and human-centered stories. I defined a new idea as a function or a usage problem where the solution was obvious, and where the usage problem or function was not mentioned in the written instructions for the assignments.

The second study was conducted in 2003-2004. Eight software developers with a programming or computer science background and five with an engineering background participated in the study. Even though they were not selected in a manner that favoured readers of fiction literature, seven of the 13 participants told that they had read fiction literature within the last two months.

The participants told that they had spent from half an hour to three hours on reading the texts. They had on average spent about four minutes reading each page. There was no relation between the types of texts they had read and the time they had spent reading them.

The texts were assigned randomly to the participants; the scenarios and human-centered stories were not mixed because the participants’ opinions about one type of text then might influence their evaluation of another:

- Three of the participants read only technical descriptions of four different applications.
- Five read both technical descriptions and conventional scenarios that described the same four applications.
- Five read technical descriptions together with human-centered stories that described the same four applications.

The texts described applications of the following types: Project management software, PDA based time-registration for social assistants, a call-center system and a mobile phone with built-in camera.

I had written the technical descriptions myself and used them in an earlier study [Strom 2003a]. They were based on applications I was familiar with and similar to good technical descriptions I had seen when working in private companies.

I had also written the human-centered stories and used them in the earlier study [Strom 2003a]. Some of them had been evaluated in the creative writing course in which I participated, and based on the feedback I had received they can be described as of an almost publishable standard.

The scenarios were based on the human-centered stories. That was done in order to ensure that they described exactly the same events as the human-centered stories. (Otherwise it would be almost impossible to make a valid comparison). They were similar to good scenarios from private companies and public sources that I had evaluated in an earlier study [Strom 2003b].

In conclusion, the technical descriptions, stories and scenarios were of a uniform quality, with only minor defects, but not of an outstanding or superior quality.

The technical descriptions equalled on average 4 typewritten pages. That is similar to a technical summary but smaller than a normal design specification. The scenarios each had a length on about 1 page, which is slightly more than most scenarios I have seen, whereas the human-centered stories had an average length on about 4 pages, which is close to the normal minimal length of fiction short stories [Knight 1985]. (It is difficult to engage the reader and resolve a conflict in a story that is much shorter.)

In the second study I used a combination of quantitative and qualitative methods with a concurrent triangulation strategy [Creswell 2003]. This means that I combined qualitative and quantitative methods in the same study, and that I collected the qualitative and quantitative information at the same time. I did that in order to capture as much information as possible within the time spent with each participant.

I conducted semi-structured interviews with standardised questions that made it possible to make quantitative comparisons between the replies of the participants. For each application the interviews included the following groups of questions:

1. Open questions where the participants were asked to describe how each described application supported one specific function, which benefits the application offered and possible problems during its use.
2. Two questions about the usability or usefulness of the application. The participants were asked to select a value on a 1-5 scale that included a verbal description of each value, and encouraged to argue for their choice.
3. One question about how good an impression the technical description gave of how the application would function during actual use, and one question about the credibility of the scenario or story (for those participants who had read one of those). The participants were asked to rate the texts on a 1-5 scale that included a verbal description of each value, and encouraged to argue for their choices.

The interviews were recorded and transcribed. In order to identify the multitude of different aspects that might occur in the interpretation of a written text, it was

necessary to extract qualitative information. Using principles based on Kvale [1997] I identified recurrent themes in the transcripts, collected and evaluated the parts in different interviews that might be related to each theme, interpreted the parts and in some cases selected a single or a few quotes to illustrate it.

In order to do a reliable comparison between scenarios and stories, it was necessary to extract additional quantitative information from the interviews. The descriptions of how each application supported one specific function (from the first group of questions) were ranked from the one that gave the most correct information and most precisely expressed information about the function, to the one that gave the least correct and least precise information. The ranking was used instead of a grading according to preset criteria, because such a grading could not reliably take into account any correct information that was not expected when the grading was made, or how precisely the information was described in the reply.

The quantitative results from the questions in the second and third groups could be directly tabulated. The number of different aspects in the participants' interpretation of the texts, for instance the number of misunderstandings made, was determined by first making a set of definitions of the different aspects, and then by using these to identify their occurrences in transcripts of the interviews. I calculated both normal averages and weighted averages where the different backgrounds of the participants were taken into account (the difference was minimal), and I identified statistical significant differences by testing in the normal distribution.

The quantitative and qualitative results were finally triangulated. This means that they were compared and that the conclusions were based on a combination of them.

3 Computer science students are capable of using methods from fiction writing

It is almost impossible to find a fiction writer who can fit into a development team, who knows interaction design and who quickly can acquire the required domain knowledge. It is therefore only feasible to use human-centered stories in software development, if they can be written by people who already participate in and know about such projects.

The first study shows that computer science students after a single lesson in fiction writing could write human-centered stories, in some cases of an almost publishable standard. They were capable of writing realistic dialogue, they described convincing characters, and they were capable of writing a consistent language that fitted the style and the topics of their stories. The largest problem was that a significant proportion of the stories included dramatic plots with infidelity, serious crime or other events that moved the focus away from the interaction with the interface. However, when the students were made aware of that problem, it was fairly easy for them to solve.

4 Writing human-centered stories create new ideas

When designing interfaces it is often difficult to identify new needs and to invent features that fulfil them. Therefore it is valuable if the writing of human-centered stories can facilitate both.

The first study shows that the human-centered stories compared to the scenarios described substantially more new ideas for the interface. The writing of a scenario resulted on average in 1.5 new ideas, whereas the writing of a story on average resulted in 2.1 new ideas ($p = 0.05$). In addition, when the lower number of stories is taken into account, the writing of stories resulted in 60 % more different ideas.

There were only a few cases where the same participant had included the same idea in a scenario and a story. This indicates that the writing of the stories and the ideas generated during it were independent of the writing of the scenarios.

In contrast to the scenarios, the stories described the characters' emotional relations to the use of different functions, for instance that they could express anger through the use of a function or hesitate before deleting an item. These relations cannot be explored through conventional scenarios, and they are important when designing an emotionally satisfying interface.

When a scenario is driven by the interface, it is easy to exclude anything that is difficult to implement or not already part of the interface. In contrast, when a story describes a situation where a user has a realistic need of accomplishing a specific result, the writer is almost forced to describe how it can be done. In order to progress with the story, he or she must invent something that overcomes the problems.

5 The reader creates his or her own personal understanding of the topics of the texts

Successful software development requires that the developers understand what they are supposed to develop. This requires that their understanding of the written descriptions their work is based on is consistent with the understanding of the people who have written and approved them.

The second study revealed large differences in how the same text was understood; in some cases the understanding contradicted parts of the text. This was not because the participants did not understand the words of the texts. It was because each participant created his or her personal understanding by combining parts of the text with his or her personal experiences. When doing that the participant often discarded parts of the text that did not fit his or her personal experiences.

One of the participants had earlier worked at a help-desk, and he had read a description of a general system for a call-center (as with the other excerpts from interviews, this is translated by the author from Danish):

Q.: What are the advantages of the call-center system?

A.: You get registered what comes in. You can see what each person is doing, if any tasks are hanging, if there is something that does not get solved.

The participant creates a situation of use based on his own experiences, even though it does not fit parts of the text. The interview continues:

Q.: How is it possible for the same operator to handle calls to different companies?

A.: He shall give a customer number or something like that. And the number will indicate whether it is company A, B and C.

This fits the help-desk experienced by the participant, but not the call-center described in the text. The text describes how the company is identified automatically based on the number that is called, and how the system then provides the operator with the necessary information to handle the call. The text does not mention any customer number. Later in the interview the same participant is asked:

Q.: What are the consequences of operators being warned before angry calls...? [Calls from a number where a previous caller has been abusive.]

A.: It depends on the number of calls. A call-center as TDC [Danish Telecom] with thousands of calls, there the customers are impersonal. The centre I thought about had maybe fifty customers that you knew and who came back.

The present situation, the question that is asked, changes the understanding that the participant has created. Instead of talking about a help-desk and a small call-center, he is now talking about a large general call-center. The new understanding is confirmed in the following:

Q.: What are the consequences for the operator, when he or she shall play different roles, for instance ... handle calls to a travel agency or a complaint because of a missing newspaper.

A.: I have all the time thought about a specific IT-system. But it is right, as you say, that they might as well handle travel agencies, car reservations or others. So it requires a large flexibility ... it is different worlds ... they will probably feel stressed.

The participant has now totally changed the understanding he has created of the topics of the text and the situation of use.

The errors in the understanding are not consequences of an insufficient or superficial reading of the texts. They appeared in particular to occur when participants actively thought about the text and made an effort to create an understanding of it. This indicates that reading can be almost as active a process as writing, and that the participants create their personal understandings based on:

- Parts of the texts; their understanding may contradict other parts of it.
- Parts of their knowledge and personal experiences that best fit the text.
- Aspects of the situations in which they create their own understanding.

The process is similar to the blending of different objects that is described by Fauconnier and Turner [2002]. It seems that the reader places impressions or mental images generated by parts of the text on top of different personal experiences, accepting these that fit together and discarding those that do not. The process is similar to a design-process as described by Boden [1990] and to Schachter's [1996] description of how memories are re-created when recalled, and it appears to be a common aspect of human thinking.

The results show only eight cases (out of more than 150 comments) where a participant expressed that he or she was conscious about the personal experiences

The reader creates a personal meaning... 9
that were used to create an understanding and how they influenced his or her interpretation of the text. One said (about the project management application):

I have been brainwashed with Microsoft Project, so it is possible it is the basis [of my evaluation].

There were no cases among the more than 150 comments where a participant mentioned alternative or multiple interpretations of the same piece of text. It was as if the participants in each moment felt compelled to choose only one interpretation.

6 Readers create an evaluation of the usability

It is not uncommon that readers try to evaluate the usability or other aspects of the use of an interface based on a description of it. It is of course important that the evaluation is as reliable as possible. In addition it is important that the basis of it is known: Otherwise it is difficult to determine how reliable it is.

None of the participants in the second study evaluated the interface and possible problems by going through the description in a systematic manner. Some commented on general aspects as this reader of a human-centered story:

...because it must be so flexible, it must also be complex ... when you have learned it, it is easy, but it takes time to learn and get used to ...

Some based their evaluation on the manner in which the interaction was described, as this reader who concluded that the software was difficult to use, because the story gave an extended description of the operation:

The text indicates it is not that easy. There are many things, many menus to navigate. You shall skim different places, then go back in another menu and maybe enter something.

Other participants created an evaluation of the usability by blending the description with a known interface as in this example:

... [Sending multimedia messages] appears to be very easy. Like writing an SMS or an e-mail. I know it, because I have a heavy Nokia – 9210 – which can transmit such stuff.

Some participants evaluated the usability by blending the described interface with a specific user, as this reader of a technical description:

It is possible that a social helper who lack routine need time to become familiar with it ... social helpers have different educations, some can use it directly, others are – PC-imbeciles.

None of the participants evaluated the usability by blending the description with a specific situation of use; none of them considered how the usability was dependent on the situation of use.

When the participants were asked about other issues than usability, they sometimes blended the description with a specific situation of use, as with this reader of a scenario who blended it with his personal experiences when asked how useful a project management tool was for the software developers:

... project management tools are for project managers, not developers. For developers it is not important that the figures are right. You do not ask the project manager to make changes in your editor. You are doing two different tasks.

10 *Georg Strom*
The blendings were often critical towards the texts, and the contents of the texts were questioned as shown by this reader who compared a technical description and a human-centered story:

It is described in the story as if it is very difficult, but in the specification it appears that he uses only two or three menus, and it appears to be logical with the information he shall enter.

Another said:

This is a sunshine story. But in real life, people make mistakes.

7 Both conventional scenarios and human-centered stories improve the understanding of technical information

The participants in the second study were asked to describe how each application supported one specific function. The replies were ranked with 1 as the best and 13 as the lowest ranking, and the results showed a substantially better understanding when the participants read a scenario or a story together with a technical description: average rankings of 7.0 and 5.6 versus 10.8 ($p = 0.05$ between technical descriptions only and technical descriptions read together with scenarios).

The results also show that those who had read a scenario or a story substantially more often during the interview referred to the technical description (it appears they were more aware of its contents): On average 1.6 times (for scenarios and stories), versus 0.7 times ($p = 0.05$ between technical descriptions only and technical descriptions with scenarios). See table 1.

It was not possible to identify any relation between the time each participant reported to have spent reading the texts and his or her understanding of them.

An earlier study [Strom 2003a] shows that stories read without technical descriptions does not give a better understanding than technical descriptions. It appears that it is the combination of technical descriptions and scenarios or stories that gives a better understanding.

8 Human-centered stories give a better understanding of a situation of use

When decision makers shall decide whether a feature shall be included in the requirements, and when the software developers shall decide how it shall be implemented, it is important that they understand its purpose and the expected situations of use. In addition, it is likely that the designers are more motivated and take more care if they are aware of when and how a feature shall be used.

The second study shows that reading of human-centered stories substantially reduced the number of misunderstandings of the situation of use, both compared to when only a technical text was read, and when a technical text was read together with a conventional scenario. There were no misunderstandings among the readers of stories, whereas the participants in the two other groups on average had 2.2 misunderstandings ($p = 0.05$ between scenarios and stories). See table 1. (Misunderstandings are here defined as personal misunderstandings that contradict at least one part of the text.)

It is possible that readers of stories use the descriptions of the emotions and motivations of the participants as an additional reference that helps them to understand how the interface is used. They blend their understanding of the interaction with an interface with the descriptions of the users' emotions and motivations and their own knowledge about human motivations and emotions.

Some misunderstandings can be attributed to a lack of background information in the scenarios. One participant concluded that a young man in one of the scenarios was paedophile. The scenario mentioned that he took a picture of two girls, but did not mention that they were approximately his own age. (The interpretation was made even though the following part of the scenario made it unlikely that he was a paedophile.)

	Read only technical description	Read also scenarios	Read also human-centered stories
Referred explicitly to the technical description	0.7	1.6	1.6
Misunderstandings	2.3	2.2	0.0
Referred to an imaginary user or situation of use	2.2	2.2	0.7
Referred to an existing user	2.7	0.6	1.0
Referred to own experiences	1.0	0.8	0.5
Referred to known interface	1.7	1.6	1.0

Table 1: Different aspects in the interpretation of the texts: Averages for each group of participants. Statistically significant differences ($p = 0.05$) are highlighted.

Other misunderstandings can be attributed to the fact that readers of only technical texts or of scenarios substantially more often indicated that they made their own story with imaginary users or situations of use and used it to create their personal understanding ($p = 0.05$ between scenarios and stories). See table 1. The following is from a participant who had read a technical description of how a social helper used a PDA:

.. this means, if Mrs. Jensen for some reason is not at home, what shall I do then? You may get the services recorded, I can imagine that you have a handful of standard services, and that you put a mark in the proper box.

If the developers do not have any personal experience with the domain, their personal stories may have little to do with the actual users or situations of use. In addition, when different members of a project group base their understanding of

the users and context of use on personal stories that are not known by other members of the group, it may easily lead to misunderstandings.

Participants who had only read technical descriptions referred substantially more often to how they expected that an existing user would use the interface. See table 1. In some cases themselves; in other cases people they had met:

Some of the call-center workers I have met have been of such a type that this could not work.

There were no significant differences between how often readers only of technical descriptions, of scenarios and of human-centered stories referred to their personal experiences. See table 1. It is possible that the personal experiences are so vivid and strong that their use when creating an understanding is not affected by the reading of a single scenario or story.

The second study shows that scenarios contribute to the understanding of the interaction with an interface and the situation of use, but that human-centered stories can contribute substantially more.

10 Software developers want emotions and dramatic elements in the stories

A number of participants in the second study made precise comments about how the texts were written. They clearly noticed the style and other characteristics of the texts they read.

Both readers of scenarios and human-centered stories expressed most often that they wanted stories with more dramatic elements (compared to that they wanted stories with less): On average 1.9 times versus 0.7 times ($p = 0.05$). They expressed that stories with emotions and dramatic elements seemed more real:

When you make some drama when you tell, it makes you believe that this product exists and is in use.

An analysis of the comments shows that the participants wanted emotions and dramatic elements, but that they reacted when the dramatic elements were so strong that they moved focus away from the use of the interface.

Scenarios and human-centered stories were rated as equally credible: 2.2 versus 2.3 on a 1-5 scale. This indicates that stories with emotions, conflicts and dramatic elements, and even with humour, are not regarded as less serious than scenarios without such elements.

11 Discussion

Every evaluation of a story and probably also of a non-fiction article include some subjective elements. However, even when that is taken into account the results of the first study demonstrates that computer science students are capable of writing human-centered stories that may be used in software development.

In the first study there have been a training effect from the beginning of the course to the writing of scenarios. However, the scenarios and stories were both written later in the course, reducing the training effect between them. The results

also show that even though the stories were written after the scenarios, they were not based on them.

The results indicate that it is common that computer science students and software developers in Denmark read fiction literature. However, that may not be the case in other countries. Computer science students and software developers in other countries may be less familiar with fiction literature and therefore find it more difficult to read and write stories with methods from fiction writing.

The technical descriptions, scenarios and stories used in the second study were of a similar good quality, they were not outstanding, and they had only minor defects that did not affect the results. Comments made by the participants indicate that this is in agreement with their evaluations of the texts.

The human-centered stories were substantially longer than the scenarios used in the study. However, both scenarios and stories described the same events, it is normally easier to get an overview through a shorter text, and comments I have received to descriptions of interactions in other stories indicate that longer conventional scenarios may be tedious and difficult to read. This suggests that the benefits of human-centered stories shown in the second study are in spite of them being longer than the scenarios; the benefits must be attributed to how the stories include conflicts and show motivations, emotions and settings of the events.

The comparison was made between technical descriptions alone, scenarios read together with technical descriptions and human-centered stories read together with technical descriptions. These are probably the most common situations in software development; it is unlikely that software developers only will be given a scenario or a story without some sort of structured technical description.

The qualitative and quantitative results were extracted from the transcripts in a consistent manner; the quantitative and qualitative results and the theoretical model lead to the same conclusion, which confirm the reliability of the results.

However, the study probably underestimates the amount of misunderstandings and reading problems that may occur in actual software development.

The technical descriptions were substantially shorter than many used in system development (on average 4 pages, whereas texts on more than 30 pages are common in industrial software development). It was therefore easier for the participants to get an overview of each technical description. It is also likely that most of those who volunteered to participate had above average reading skills, and that they read the texts more carefully because they knew they would be asked questions about them.

It shall be taken into account that the scenarios were based on the human-centered stories, so the actions described in them were plausible given the emotions and motivations of the characters. If scenarios are written without such a realistic background, it is more likely that their plots are perceived as implausible [Strom 2003b]. This means that the reported differences between scenarios and human-centered stories probably are smaller than what can be expected when scenarios without such a realistic background are used.

The participants in the second study had not contributed to the writing of the texts used in the study. If, as in the development project described by Nielsen [2004], the developers had spend time discussing what the contents of the scenarios or stories should be and participated in the writing, it is possible that the

advantages of human-centered stories as compared to conventional scenarios would be smaller. As long as the participants remember the background and motivations of the characters from their discussions, they can imagine their emotions in specific situations and may therefore need only brief descriptions of the specific events to support their memory.

Conclusion

The two studies give a valid and reliable description of how scenarios and human-centered stories (stories that are driven by the emotions and motivations of the characters in them) may contribute to software developers understanding of interfaces and the contexts they are used in.

The results of the first study demonstrate that computer science students can learn to write human-centered stories of a quality that is sufficient for use in industrial software development, in particular if they attend one of the numerous short courses in fiction writing (or creative writing).

Compared to the writing of conventional scenarios, the writing of human-centered stories generated substantially more new ideas for the interface. They gave a more realistic description of the situation experienced by the user, and the built-in conflicts stimulated the identification of new needs and functions.

The second study demonstrates that reading is an active process; the reader does not absorb the contents of a text, but creates his or her own understanding based on his or her personal experiences together with parts of the text. This means that the reader's understanding may contradict other major parts of the text. This has nothing to do with a lack of comprehension or reading skills; in contrast, it appears to be an essential part of reading, and it is a process that is similar to and almost as creative as the process of writing.

One particular problem is that readers tend to select the first understanding that fits part of a text. They may avoid some mistakes by accepting that different understandings of a text are possible and by discussing them openly.

The reader uses his or her personal experiences and imagination to create what cannot be found in the text. The reader may imagine situations where an interface is used, and based on them create an understanding of the interface and how it is used. In addition, it appears that the reader often is unaware of how he or she uses personal experiences to create an understanding, and it is likely that other persons do not know the specific experiences that the reader uses to create his or her understanding.

This may lead to misunderstandings in software development. In order to ensure that the members of a development group have a similar understanding of an interface and the possible situations of use, it is therefore advisable that they take time to discuss what they have read, and to share the experiences and stories they have imagined and used to create their understanding of what they have read.

The participants created understandings of the usability and of other aspects of an interface by blending the description of the interface with their own experiences, for instance with an interface of the same type. They assumed for instance that a described mobile phone in general was as easy or difficult to use as

other mobile phones they had encountered. In daily life that is an effective and sensible method: It gives a good indication of whether an interface can be used by a particular user or in a particular situation of use.

However, this method may be misleading if the goal is to evaluate the usability of an interface compared to other interfaces of the same type or to identify specific problems in it. In such cases it is important that the readers are aware of and discuss which examples of interfaces they use as comparison and which differences they notice.

Compared to a technical description, a combination of technical descriptions and scenarios or human-centered stories gave a better understanding of the structure of a system and the specific elements in the interface. This confirms the value of scenarios in software development.

The results indicate that the use of human-centered stories gave a better understanding of situations of use, both compared to technical descriptions alone and to technical descriptions combined with conventional scenarios. It appears that the readers use the emotions and motivations in the human-centered stories as an additional reference when they create their understanding of the situation of use. That will probably also be the case for users and other stakeholders. It is therefore likely that their understanding also will benefit from the emotions and background described in the stories.

Stories with emotions and dramatic elements are more readable, making it more likely that they actually are read (not only by software developers, but probably also by user representatives and other stakeholders). In addition, software developers in general prefer stories with emotions and dramatic elements. However, they complained if the events in the story were so dramatic that focus moved away from the interaction with the interface. This means that stories that are based on everyday problems or conflicts are the most useful and acceptable in software development.

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