Developing the 'Future Technology Workshop' method

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Abstract. A method for the design of future socio-technical systems, the Future Technology Workshop, is described. The method builds upon existing participatory design techniques to propose a way of transcending the participants' bias and preconceived notions of existing technologies and encourage them to postulate future forms and uses of technology, by emphasising equally on technologies and activities. Four pilot workshops are reported.

1 Introduction: The Future Technology Workshop (FTW) Rationale

We describe a technique that extends current participatory design methods, to explore the interactions between activity and technology, now and in the future. Its aim is to provide informed design of socio-technical systems that are useful and desirable.

There are various methods for encouraging participation in design, many stemming from Scandinavian research. In general, these approaches encourage brainstorming and storyboarding of concepts, based on current experiences. Some techniques provide people with templates for their designs (e.g., PICTIVE: Muller, 1991). Some techniques encourage role-play. For example, Nilsson et al. (2000) used objects such as pieces of wood to represent devices that workers used to 'perform' activities during a workshop.

Druin (1999a, 1999b, Druin et al. 1999) has developed methods for including children in the design process as legitimate design partners. In outline, the methods are based around participatory envisioning, contextual inquiry (Holtzblatt and Jones 1995), and lab-like observations. The children are observed in their normal environments, or in specially constructed labs that are technology rich, or are given various materials to construct a product and asked to explain how it is used.

Inkpen (1999) has explored the design of handheld devices for children. Her methods have included (a) the administration of a questionnaire, from which she gathered information on children's general requirements for handheld computers, (b) a participatory design exercise where children worked in groups of 2-4 to produce low-tech prototypes of the handheld computers they would like to have, and (c) a diary exercise where children had to report the places where they would want to use a handheld computer and the activities for which they would like to use it.

Rogers and Scaife (1999) worked with children as informants at various stages of the process of designing an educational software system for the teaching of basic ecology

concepts. The children's role was primarily concerned with refining the user interface, whereas the decision of what technology to design was suggested by the curriculum.

The methods and techniques described above focus on children constructing and acting with objects, and encourage them to lead design. However, design is grounded in current experiences, which may constrain the children's designs, with the danger of missing more radical design opportunities. As Inkpen (1999) notes, "while this activity was successful in identifying important issues for the design of handheld computers, many of the children were constrained by their preconceived notions about what constitutes a computer and the functionality it can provide". Therefore, a methodology that encourages users to postulate future uses of technology and provides a transition from current to future thinking could be beneficial for the creative design of new technologies.

The Future Technology Workshop (FTW) method is being developed to address these shortcomings. The method is intended to serve both as a process of "discount socio-cognitive engineering" (Sharples et al. forthcoming) and a means of envisioning future technologies and technology-mediated activities. The idea for the FTW is based around the interaction between activities and technology, now and in the future. The interactions can be shown as a grid (see table 1).

The aim of a series of applications of the method is to reach an informed understanding of box 4 of the grid. To avoid the constraints and preconceptions that a start in box 1 brings, each workshop begins with a session to envisage designs and activities in box 4, and then circles through 3,1 and 2 and back to 4. This process can be repeated several times (probably at least twice), so that when the participants revisit box 4, they can better appreciate the concepts of 'new activities' and 'new technologies'. Ideally, the process will lead to a 'spiral' of design ideas, with each revisit to box 4 building on and pushing forward earlier conceptions. Each session has a defined outcome, which is recorded by the facilitators who manage the session. Each workshop will make use of the design concepts and activities produced by the previous one – so that the designs progressively "solidify" (metaphorically and literally) from PlayDoh models to functional prototypes.

	CURRENT TECHNOLOGY	**FUTURE TECHNOLOGY**
CURRENT ACTIVITY	1. Everyday technology-mediated activity	2. Familiar activities supported by new technology
FUTURE ACTIVITY	3. New activities that current technology might support	4. New activities with new technologies

Table 1. Interactions between activities and technology, now and in the future

In its current form, the FTW consists of 7 sessions, with 6 participants and 2 or 3 facilitators. The workshop is carried out as a day event, with 2 hours dedicated to the first 4 sessions, a 1-hour break, and 1.5 hours for the remaining 3 sessions. We shall illustrate the description with an example where children and adults designed new activities and technologies for capturing and sharing visual events.

Session 1 – Imagineering (10-15 minutes): This session explores box 4 of the grid in table 1. The facilitator primes the group with a question concerning the design task at hand in such a way that it limits the scope of the ideas to be produced, while at the same time does not pre-empt them to think about current technologies. In our example, we asked what sorts of activities relating to the capturing and sharing of visual events and experiences they will want to be able to do in the future. We have found that even with neutral wording like this people start thinking about their current practices and objects. Therefore, prompting the participants to think as far in the future as possible might be necessary in order to obtain ideas of innovative activities.

A brainstorming based on this question follows, where the list of ideas is recorded by one of the facilitators on a flip-chart pad. It is important that the ideas put on the flip-chart are abstracted so that the group is not committed to a specific idea early on, and also that the note describes activities rather than technologies.

The purpose of the session is to set the scene and get the participants to think in terms of the future, with respect to both the technology and the needs satisfied by it. The session acts as a precursor to the modelling session. The outcome of the imagineering session is a set of new activities that people would like to be able to perform in the future. A side effect of this session is also that the participants' outlook is now set to think of the future.

Session 2 – Modelling (40-50 minutes): This session continues the exploration of box 4. The participants are divided into 2 or 3 groups and are provided with a set of low-tech prototyping materials, such as PlayDoh, coloured pencils and paper, post-it notes, sticky paper, etc. The facilitator asks the groups to select some of the ideas produced during the first session and build a model that will demonstrate how the relevant activities are performed. The groups are also asked to write a short description of their models, and at the end they are asked to present their models to the whole team. Facilitators observe each group and make notes of the issues, debates and ideas produced, together with information about who initiated them and when. The focus for this session is on future activities performed using futuristic, envisioned technology. The purpose is to set the participants to imagine the future and produce models of useful and meaningful technology. The outcomes of the modelling session are (a) the models produced by the groups and the written descriptions, (b) the observation notes during the modelling, and (c) the notes made during the groups' presentations.

Session 3 – Role Play (30 minutes): Continuing the exploration of box 4, this session asks the groups to exchange models and then plot a scenario demonstrating how the model might be used, and enact it. After a group has role-played a scenario, the group who had originally designed the model is asked whether the enactment involved the sort of activities they were thinking of. In addition, the groups who watch an enactment are asked to draw storyboards of what is happening on-stage. The storyboarding is done using A4 paper sheets that are formatted to allow 2/3 of the page for drawing, 1/6 for explanations, and 1/6 for comments. The purpose of this session is to bring the future into the present, by getting participants to "act" as if future technologies were already there to support new activities, and also to have them engaged in the future activities and make their ideas of them more tangible. The outcome of this session is a set of storyboards that show the enacted scenarios. The initial intention was to have the rest of the participants rate each model at this stage, however in order to avoid turning the rest

of the workshop into a competition between the different groups we decided to avoid rating the models. Nevertheless, some assessment of the produced concepts is necessary in order to decide which ones will be implemented. This could be done once a series of workshops is complete, by having a new group of participants assess the different models that were produced.

Session 4 – Retrofit (30 minutes): This session explores box 3 of the grid in table 1. The groups are asked to modify their scenarios so that they only use existing technologies to enact them. To facilitate their thinking about existing technologies, a range of relevant technologies is on display together with gadget catalogues. During each enactment, the rest of the participants are again asked to storyboard the scenarios using A4 paper of the same format. The purpose of this session is to bring the future into everyday life, setting the participants to think how the futuristic activities they have imagined so far might be adapted into their current lives. The outcomes of this session are a set of storyboards of the modified scenarios as well as a list of the identified technological gaps for supporting future activities.

Session 5 – Everyday (10-15 minutes): This session explores box 1 of the grid in table 1. The facilitator shows the group photos of current technologies (for example, pictures from a technology catalogue) and demonstrates existing gadgets relevant to the design task. The group is asked to discuss how the activity that was introduced in session 1 (for example, capture and share visual events) is currently carried out, with current technology. Once a list of current activities is produced, the participants are then asked to identify relevant problems and shortcomings of the existing technologies. The purpose of this session is to remind the participants of the things they currently do and the technologies they currently use, as well as to set them thinking about how existing practices could be improved. The outcome of this session is a list of current activities and a list of relevant problems.

Session 6 – Futurefit (50-60 minutes): Session 6 explores box 2 of the grid in table 1. The group is asked to look at the current activities and problems that were produced in the previous session and discuss how they think those current activities will be performed in the future. The facilitator prompts them to think in relation to the models they had built earlier. Once a list of future technologies to support current activities has been produced, the groups are asked to modify their initial models to accommodate as many of the current activities identified as possible. They are then asked to make an advert for their model and try to sell it to the other participants. The purpose of this session is to set the participants thinking about what sorts of future technologies will be used to support the activities they currently perform, as well as to obtain a list of implicit requirements for technology based on the way the models are advertised.

Session 7 – Requirements (15-20 minutes): This session relates to boxes 2 and 4 of the grid in table 1. The whole group is asked to produce a set of requirements for each model, based on their experience of the previous sessions and their needs. The group is also asked to identify the two most important requirements for each model, and are then asked to individually rate the requirements on a scale between 1 and 5, with 5 having the most importance/appeal.

3 Pilot Future Technology Workshops

The FTW method reached the format described in section 2 through a series of pilot workshops. The initial research that led to the conception of the methodology took place at a children's holiday camp at Osmington Bay, Dorset, during February 2001, at the beginning of a larger research project on digital photography. At that point, only the first two sessions were carried out. Six boys and six girls, aged approximately 11 years, participated.

Firstly, all 12 children sat in a semi-circle around a whiteboard with a facilitator (a researcher with experience of interviewing children). The facilitator began the session by asking them to pretend they were designers for Kodak and to imagine what sort of new things they could do with images. As the children made suggestions the facilitator wrote them on 'post-its' and placed them on the whiteboard, clustered by idea. This lasted around 15 minutes. The children were then split into two groups of six. Each group sat around a table with their own facilitator. The groups were asked to take one or more ideas from the first part and elaborate on them. In particular, they were invited to draw the device that would achieve the functions discussed.

The concept of a 'spy' camera was a primary theme for the boys – to be able to send the camera off by remote control to capture images without being noticed, while being able to see the images on the screen of the remote controller. For the girls, a friend-type relationship with the camera seemed important – it would be small, or embedded in an anthropomorphic object, respond to voice commands, and tell its owner if it had been stolen, or her hair needed brushing. Although these ideas were about new technologies, they did not associate the conceived technologies with everyday activities that children might want to perform with them. This appeared necessary in order to refine the design ideas and to provide the children with the context necessary for identifying more requirements for the technologies. Therefore the methodology was augmented to include sessions three to seven.

The second pilot was carried out with 6 adults, 3 engineers and 3 non-engineers, all students or staff of the University of Birmingham. Their design task related to ways of "capturing and sharing visual events and experiences in the future". All sessions except session 6 (futurefit) were carried out. The participants were divided into 3 pairs (2 engineers, 2 non-engineers, and a mixed pair) for sessions 2, 3 and 4. Among the list of ideas they produced during imagineering, was the idea of immersing into the sights, sounds and feelings of another place and/or time.

All three pairs independently chose to work on this idea and they all tended to take a "holistic" approach to experience and incorporate other senses in addition to vision. The engineers pair produced a model based around wearable computational devices, which the group thought would be used for everyday life tasks such as finding one's way or making a decision. The non-engineers pair produced a model based on computational implants, which is a more advanced technology than wearables. The group thought the model could be used to reproduce the past and alter, or even create, reality. The mixed pair produced a model based around a robot that the user could have as a "second self", collecting experiences around the world (or even the universe) and sending them back in real time. Interactions between robots are surrogates for interactions between robots' owners. In a joint session at the end the participants were asked to list the requirements for future imaging technologies. They thought that it would have to be cheap, small and

light (portable), durable, reliable and user-friendly. It would need to have the capacity to hold as much information as needed and it should have no negative health effects. It should be adaptive and transferable to different platforms (e.g. from camera to computer). It should have the power to record everything and be fast enough to capture the moment instantly and to work in real-time data transfer situations. With regard to the shortcomings of existing technology two additional (implicit) requirements were mentioned: capturing, storing and retrieval of smell and feelings as additional sensorial data, and also automatic, prompt availability of the service, without the need for turning on a computer and logging onto the internet.

The addition of sessions three to seven did indeed help the participants to put the imaginary technologies in context. For example, the mixed pair's robot was thought to be able to visit the owner's home town, interact with their friends and family, and transmit the experience back to the owner, helping them feel less "homesick".

At this point we wanted to see how a follow-up workshop, building on the outcomes of the first, would help in advancing the design ideas. Therefore the third pilot was designed to build on the outcomes of the second, and thus the design task related to ways of "immersing into the sights and sounds of another place and/or time". Several ideas of "immersive" activities were produced during imagineering. It was carried out with 7 adults, 3 engineers and 4 non-engineers, and all the sessions were completed. For the purposes of sessions 2, 3 and 4 they were divided into 2 mixed groups.

The first group produced a model that consisted of a number of devices that allowed the person to change biologically (such as "use a spray to change your gender" or "wear a cap to live as a different species"); or to change time and/or space (such as "fortune balls that you throw on the floor and step into another time and place", a "time travelling door handle that you can attach to any door and see where it takes you", and a "frog's leaping into the future"). This group interpreted immersion as a holistic, self-transformative experience.

The second group produced a model based on a room that utilises light projections (holograms) to create an environment for the user to get immersed in. The room would "enable the person to visit many different scenarios from the past, present or future. The projections may become physicals in the future". The room could be used for scenario prediction, simulations, labs, and tutoring. This group interpreted immersion as a holistic experience but not self-transformative: the person does not change to experience the world; rather, the world around them changes to offer them new experiences.

In summary, the third pilot resulted in alternative designs and ideas for immersion. The designs, however, were not any more detailed than those produced in the second pilot. Furthermore, the second and third pilots produced a list of very general, non-functional requirements rather than the list of detailed, functional requirements that would be needed for further development of the ideas. Modifications to the methodology were made therefore so that the participants would be asked in the future to list requirements specifically for the models they produce rather than generally about the capturing of visual events, and also so that a follow-up workshop builds upon a specific model from the first workshop rather than on abstract models.

We now needed to see how the modified methodology would work with children. Therefore, the fourth pilot was carried out with 6 children, 3 boys and 3 girls, aged 11-12. All the sessions were carried out and, for sessions 2, 3 and 4, the children were

divided into two groups, one for the girls and one for the boys. The design task related again to capturing and sharing visual events. As in the first pilot with children, spy cameras and independently mobile cameras were the main theme. The girls produced two models, one consisting of a spy camera operating through glasses that allow the user to secretly take pictures of anything they see, by pressing a disguised button on the glasses' frame. The second consisted of an independently mobile memory camera, that remembers objects and people and knows where to find them, and can thus be instructed to "go off and take a picture of my dog's basket". The boys produced a model of an underwater camera that has the ability to propel itself safely in deep sea and take pictures of the bottom of the sea on behalf of its owner. It is worthy of mention that after session 6 (futurefit), the boys modified their model to be an amphibian camera, so that it could be used for their current activities as well as for underwater quests, showing that the merging of current and future activities is possible.

4 Conclusions and Future Work

A method for creative design of future technologies, the Future Technology Workshop, is proposed as an alternative to existing participatory design techniques for use with children. The main advantage of the method in relation to others is that it allows focusing on the future and the participants' desires for future technologies and activities, and it leads to requirements for socio-technical systems. The method has been refined through a series of pilot workshops and has reached a satisfactory format. Although primarily aimed for use with children, the method has been tested with adults and was both valid as a design method and acceptable for the participants (although some of them have been reluctant to use PlayDoh). The activities carried out during the seven sessions of the workshop were attainable by both adults and children, with only minor modifications needed for use with children, relating mainly to the use of language and terminology appropriate for the age group.

One of our main concerns is the method's dependence on the participants' qualities: participants who tend to use up more time than others to explain their ideas can put off the rest of the group. The background of a participant may also prove to be a hindrance: being unable to detach oneself from the knowledge and experience of current technologies, combined with a strong personality, may throw the group back to "known ways". Starting the imagineering session is another difficult point: a fine balance is needed between giving enough information to inspire the participants' imaginations, and leading them into existing thinking, ideas and products.

The pilot workshops have confirmed that the method provides a coherent framework for exploring future activities and technologies to support them. Session 1 starts off by exploring potential future activities relating to the design task and the space of possibilities they offer. Building on the outcomes of session 1, session 2 allows the introduction by the participants themselves of supportive objects as parts of the activity models, as the tools that could enable those activities. Sessions 3 and 4 offer the opportunity to instantiate the possibilities and transfer the focus back to activities, making use of the models created in session 2. Session 5 reminds the participants the activities they currently perform and aids contrasting the future they had been working on until session 4 with the present. Finally, sessions 6 and 7 serve as a bridge between the activities that the participants would like to be able to perform in the future, both old and new, and the attributes of the technologies that would enable them to do so.

The method will be further explored in the context of the "Children as Photographers – Digital Study" project. We expect to finalise the current form of the workshop after another one or two further workshops with children. We then shall look into how the children's ideas can be solidified. One idea is to produce working prototypes of technology based on the common themes that are gradually emerging from the models (e.g. an independently mobile camera, or a spy camera) and allow children to explore their use and define more specific requirements.

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