JMP 14 (4) pp. 307–329 Intellect Limited 2013

Journal of Media Practice
Volume 14 Number 4
 doi: 10.1386/jmpr.14.4.307_1

ANTTI RAIKE, ANNA KEUNE, BJÖRN LINDHOLM AND JUSSI MUTTILAINEN
Aalto University

Concept design for a collaborative digital learning tool for film post-production

ABSTRACT

This article considers how and in what form a collaborative digital learning tool can contribute to the training of trainees in the field of film post-production. A concept design for such a tool is presented. The concept design was the product of a series of collaborative investigations, and the initial findings of these investigations are reported. The initial findings suggest that such a digital learning tool has the potential to qualitatively improve how training is offered in the complex field of film post-production. The proposed digital learning tool seeks to combine the in-depth training associated with university-based training programmes, with access to a broad range of resources contributed by expert film practitioners, as well as enabling trainees to engage directly with such expert film practitioners (an approach based on the 'T-shape' model of training). In order to become expert film practitioners, trainees have to become proficient in every aspect of the post-production process of film production. Post-production is not a routine practice that can be followed in a step-by-step manner. Experts in this field are characterized by their creativity and flexibility in being able to adapt the post-production process to the particular requirements of each film production. Such experts have an invaluable contribution to make to the training of the next generation of professional film practitioners. The concept for the collaborative digital learning tool presented in this article was designed in close collaboration with such experienced film practitioners, in order that their knowledge

KEYWORDS

post-production
film
collaboration
digital tool
learning

and experience can be made directly accessible to trainees in the field. The article identifies design challenges, discusses the applied participatory design methods and illustrates how the design challenges identified were addressed through visualization and the design concept. The article concludes with a discussion of the possible impact of the tool, and presents recommendations for the design and development of training within higher education film departments.

INTRODUCTION

The end of the use of film as the standard medium for the production of motion pictures also brought to an end the process by which such films had been produced. Film cameras, film reels and the mechanical equipment required to operate them took their place in the museums of film history, and were replaced by a number of digital formats, databases and a seemingly never-ending production of updated software programs and applications. Today even film experts have a hard time keeping pace with developments in digital film technology. In our time there has been a technological revolution in the production of motion pictures, and therefore of necessity a redefinition of how those engaged in film production are to be trained for this digital age. It follows that those engaged in the training of digital film production staff will seek to create and use digital learning tools in order to facilitate training and learning in what is, in production terms, a new industry. This article describes a concept for one such digital learning tool for use in relation to film post-production, and how such a tool could provide detailed interactive visualizations of the digital production process, a range of digital learning resources, and the opportunity to engage directly with expert film practitioners.

The post-production process in digital film production involves a range of skills in which all practitioners need to be proficient. Trainees (novices and beginners) need to acquire, in addition, the flexibility to apply these skills to the particular requirements of each project. It is this ability, above all, that characterizes the difference between experts and trainees in the field of film production. Trainees can gain an intrinsic understanding of the skills required through practice and collaboration with experienced, expert colleagues, who are in a position to act as guide and mentor, providing trainees with the opportunity to ask questions and explore ideas (Bereiter and Scardamalia 1993). However, the time available to such experts to act as mentors, advisors and collaborators is, it must be recognized, limited, constrained by the demands of their professional careers and the budgets available within university film departments to fund their participation.

Feightner and Eicholz (2004) date the use of computer technology to enhance film images in post-production as commencing in the late 1970s. In 1982, Disney's breakthrough animated movie *Tron* (Lisberger, 1982) stunned the film industry by demonstrating just how far digital technology had evolved. The entire film production process is now digitized, providing a novel set of creative tools that allow film-makers an unprecedented range of resources to control and refine the final presentation of their film images (Feightner and Eicholz 2004). In parallel with these technical advances experienced practitioners like Kottolli (2006) have identified how the global industry is developing collaborative methods of managing complex digital productions within culturally diverse teams. Krippendorff (2006) and Kuutti (2007) draw attention to an interesting development that has occurred within higher education,

namely how established disciplines are engaging with a design approach to knowledge production, increasing the range of subject areas in which design is seen as having a significant contribution to make. As a consequence, what is designed is changing, and new tools and methods of design research are needed in order to address the increasing scope, scale and complexity of film post-production (Sanders and Stappers 2008). Thus, researchers and practitioners in the field of film production need to consider models that advocate a more contextual, situated, multidisciplinary and nuanced understanding of the relationship between personal knowledge and the data-dense visualizations of digital film production. Educators and developers need to design tools that will enable more collaborative knowledge creation within university film departments and the film industry.

Task-related visualizations can compress extensive data and complicated information, which allows a range of processes to be made accessible to a wide and diverse range of practitioners. However, Tufte (1990, 2002) advocates the creation of high-density designs to allow viewers to select, narrate, recast and personalize data for their own use. Standard Gantt charts, for example, tend to be analytically thin and simple, thus lacking substantive detail (Tufte 2002). Visual clutter and confusion can be understood as failures of design. As Tufte (1990) has argued, illustrating cognitive complexity is difficult. The collaborative capacity of social media tools, such as wikis, blogs and online forums, creates the possibility for trainees and experts to participate in creating data-dense and more accurate visualizations of film production processes such as post-production. This raises the difficult question of how social media tools can be used to facilitate the learning of complex and demanding subjects and skills. However, the difficulty involved should not be used as a reason for not engaging with the issues it raises. Chen and Bryer (2013) argue that agenda-driven social networks can make a significant contribution to learner-centred learning, an approach which encourages the active participation of learners in their education. They suggest that open social media can provide students with access to a considerably greater range and quality of information and experience than can be made available within a closed teaching environment (Chen and Bryer 2013). It is recognized, however, that a lot of preparatory work needs to be undertaken to understand what works, how and in what circumstances, and how this can be used in specific training programmes such as film production.

The current generation of film production trainees is the first generation to have grown up in a digitally connected environment that facilitates social learning. The advantages of social learning, including learning by example and the reinforcement of learning through social activity with peers, also characterize the form of collaboration to be facilitated by the digital learning tool that is the subject of this article. Bandura (1977) identified three major variables involved in social learning (the learner, the behaviour and the environment) and considered how each of these variables can influence the other two. Social networking technologies (social media) have created learning environments, where experts can act as role models, facilitators of effective collaboration and mentors. This has led to the creation of learning networks that can boost the learning of generic skills that are necessary to a professional career. In the case of film students, it has enabled students based in editing rooms and remote locations to make contact with a large Internet community of film professionals, through which they can obtain and exchange knowledge and ideas. Bryer and Zavattaro (2011) describe how social media tools facilitate

social interaction, enable and encourage collaboration and allow stakeholders to share information and discuss issues of common interest.

However, social learning is not the same as social media. Social media has transformed the sharing and exchanging of information, but it does not by itself enable people to identify the information they need. There is a concern that trainees may spend an excessive amount of time searching for information that may not prove relevant to the subject they are investigating. This is not necessarily wasted time, as the conversations and interactions they engage in during this process may contribute to their learning. However, in the case of film studies as with other subjects taught at university level, it is part of the lecturer's role to provide trainees with information on a range of Internet-based resources and references that relate directly to their programme of study, as well as for new interests that they may develop over the course of their training. Social learning and social media tools are separate entities, but social media tools can be used to make an important contribution to social learning. Social media tools provide learners with 'connections across boundaries and over time', facilitating informal discussion and collaboration, key elements in social learning (Chen and Bryer 2013).

Social learning theories, especially connectivism, provide insights on the role of experts in the social-networked environment. Siemens (2004) addressed how social learning can be integrated with social media technologies and how this can enhance and qualitatively change people's capacity to learn. The role of training course staff is to assist trainees build learning pathways and make connections with existing and new knowledge resources, assisting them to connect to shared knowledge using Wikipedia, Twitter, RSS and other similar platforms. The faculty seek to ensure that trainees develop the vertical, film-related expertise and knowledge that contribute to a T-shape-based skills programme.

In considering how digital tools and visualization can support training in film post-production, we addressed the following research questions:

- How can trainees, who are able and willing to participate in the creation of new film-related knowledge, be enabled to become proficient in film post-production through the use of digital tools and visualization?
- What kind of digital tools can promote collaborative and interactive learning by trainees?

Our concept design challenge was to co-design, in conjunction with film education experts, a concept for a tool for use in collaborative film education. The specific task, in the first instance, was to design a concept for an Internet-based interface and learning tool for use in the Film Department of Aalto University (ELO) in 2010–2011. This took place in the wider context of the research project 'Visual Innovations for Inclusive Projects with Diverse Participants' (VIPP; Raike 2010), which in turn followed the 'CinemaSense' project (Raike 2006; Raike and Hakkarainen 2009).

The design team consisted of designers with backgrounds in programming, graphic design and media production (Keune, Lindholm and Muttilainen, three of the four co-authors of this article, and the visual designer Martti Arvilommi). The team was joined by ELO staff members Jussi Lohijoki (a post-production workshop expert) and Anna Heiskanen (a film and television production lecturer). Lohijoki later acted as a 'design participant' and Keune as a 'design informant'.

In this article, we address how both the trainee's individual development, and the acquisition of the standard film domain-specific knowledge the

trainee needs to acquire can be facilitated through an online post-production learning tool. Collaborative knowledge-building is used as a way to train film students (trainees) in higher education institutions to achieve professional status as film-makers. This article discusses recognized film post-production design challenges and design opportunities in modern network-based film post-production. It illustrates the use of a design process used by film education experts, and describes the design results of a possible tool concept for film post-production. Finally, the article discusses the possible contribution of the design results in enabling the academic and industrial film sectors to work and collaborate more effectively together within higher education settings.

DESIGN CHALLENGES IN FILM POST-PRODUCTION DESIGN IN HIGHER EDUCATION

Film post-production is a data-dense process. The 'post-production' process of film production usually starts after the shooting of the film material. However, the planning of post-production often occurs during pre-production, when, for example, the budget, as well as the resources and the equipment to be used during filming are specified. According to a design participant (Lohijoki, personal communication, November 2010), the post-production process progresses through five main phases: *original material, offline, online, grading* and *distribution*. Understanding the differentiation that exists between these phases does in itself present a challenge during post-production training. The process does not necessarily progress linearly from one phase to the next, but may include project-specific iterations that may be perceived initially as contradictory by trainees. Additional phases may occur simultaneously without a defined start or end, such as the creation of sound, music and visual effects. For trainees, this often poses time management challenges. Experts in post-production are characterized by the ability to create an organized mental image of the flow of the post-production process, and the flexibility to adjust to project-specific conditions (Lawson 1980). Such flexibility is particularly important, as the post-production process is not the same across the film industry. Different process flows may be followed, depending on the specific requirements of a production. It is therefore important for trainees to gain an in-depth understanding of the overall process, as well as each phase of post-production. At each stage they must be able to adapt to different situations as they arise, and at the same time maintain and develop their creativity within the constraints of each project (Lawson 1980).

Therefore, both the educational and the design challenge is to consider how university educators can create a *developmental trajectory* that allows the talent and potential of the trainee to be developed within the disciplined creativity of film production, enabling the trainee in due course to become a film production professional.

Learning film production practices

Dreyfus and Dreyfus (1980) suggest that students usually pass through five developmental stages: *novice*, *advanced beginner*, *competent*, *proficient* and *expert* (the term *trainee* has been used instead of *novice* and *advanced beginner* in this article). They concluded that skills training must be based on a transparent model of skills acquisition. This allows the factors that facilitate learning at each learning stage to be identified and the progress to be monitored.

The process by which experts convey their accumulated knowledge and experience to trainees may take different forms at each stage of the training

programme. Experts are at each stage expected to provide guidance on how trainees can learn the skills associated with that particular stage, creating opportunities for, and encouraging trainees to, ask questions and explore their ideas. Experts are required to monitor and record the progress of trainees at each stage of their training, identifying at regular intervals the competencies that trainees have learned and those that remain still to be learned. It has to be recognized that expert tutors can only give a limited time to such training programmes. It therefore follows that there can be no guarantee that each trainee will satisfactorily complete the training programme (Heiskanen, personal communication, 2010).

It is reported that trainees gain a feeling for, and knowledge of, information and communication strategies, information design, the process of envisioning information, best practices and teamwork from practice and subsequent personal experience (Bratteteig and Stolterman 1997; Ehn and Badham 2002; Engeström 2001; Muukkonen, Hakkarainen and Lakkala 1999; Nelson and Stolterman 2003; Tufte 1990; Wenger 1998). In post-production, the topics addressed include information communication strategies, best data backup practices and how to proceed when material is filmed with incompatible mixed media or under a number of different lighting conditions, causing parts of the film material to differ. Moreover, crucial decisions may have to be made during post-production that alter the flow and budget of the overall process, especially during the original material phase. The causalities and effects of these decisions are not necessarily clear to trainees and these must be addressed during their training. However, challenges such as these are likely to have been encountered and solved by experienced practitioners, such as alumni of the same film study programme and other professional film practitioners. Trainees need to learn directly through collaborative work with such experienced practitioners, as well as through trial and error in undertaking independent projects. This dual approach creates excellent learning opportunities, and enables the trainees to develop flexibility as they progress, but is also a time-consuming method of training, and does not usually occur to the extent that film educators would wish. Further, trainees have to learn to work within limited budgets and exact time schedules from the outset of their training, and this also applies to the resources available on their training programme.

Scaffolding is a process where an expert enables a trainee to proceed beyond her or his current competence through dialogue and demonstration. The scaffolding process involves a series of diverse academic tasks that develop the trainee's competences. Currently, film experts in higher education need to be able to draw on a range of academic tasks that foster intellectual development at each step of the film training programme, and be aware of what kind of production projects might introduce learning and when such projects should be introduced. The creation of appropriate dialogues, demonstrations and tasks is both complex and challenging, but is central to creating an appropriate post-production training programme.

Bereiter and Scardamalia (2003) describe how expert practitioners draw upon improvisation learned through practice, rather than set formulas. Trainees seek coherence between the different components of their training course, and will make the greatest progress when they are able to see how the different elements of their programme are interrelated and complement each other (Heylighen 2000). In this context, the distinction between professional film knowledge and tacit knowledge (Polanyi 1966) is important. This is especially the case when providing trainees with the opportunity to engage

in knowledge-building activities and learning through collaboration with expert practitioners. Thus, providing the opportunity for experts and trainees to discuss artefacts that trainees are working on, as Schön (1983) suggests in his work on the *reflective practitioner*, seems to be a most important element in film production education. Through such conversation, educators are able to support trainees in developing their ability to analyse their own designs and work. As Schön (1983) makes clear, expert practitioners know more than they can put into words, and this is why collaborative practice between expert practitioners and trainees is such an essential component of training programmes. Expert practitioners tend to be more effective in film production-related activities and tasks for the obvious reason that they are able to draw directly on their professional experience in guiding trainees through this component of their training. This complex interactive and iterative process can be supported by collaborative knowledge-building activities with trainees (Engeström 2009). However, designing a digital tool that facilitates this process presents a complex design challenge.

DESIGNING TOOLS FOR NETWORK COLLABORATION

The CinemaSense project, which involved groups of hearing film students and D/deaf education students, demonstrated that access to communication tools and technology is important for effective collaboration and knowledge-building (Raike 2005, 2006; Raike and Hakkarainen 2009). This applies especially in the case of members of minority populations undertaking courses in higher education. There must be a provision in place to facilitate collaboration between members of minority groups and the majority student population. In addition, within university settings, it is essential to understand what is considered valid knowledge and how students and teachers engage in the creation of such knowledge (Raike 2006; Ludvigsen 2008).

What constitutes an appropriate and necessary range of film knowledge and skills to enable a trainee to engage in professional practice will involve the student engaging with the many different subjects covered by the course curriculum, with no particular subject being seen as more important than any other. In undertaking university-based training, trainees need to understand that they are primarily responsible for their own learning: as learners, they are expected to build their expert knowledge. Representations of film productions are highly situational, and film-related knowledge is socially shared and constructed. In problem-based learning (such as film-making), information is defined as that which needs to be explained. Instead of a direct assimilation of information, students construct knowledge through problem-solving tasks in collaboration with other trainees and expert practitioners (Wenger 1998).

According to Lund and Rasmussen (2008), the focus in learning has shifted from approaching a task as a controlled variable in an individual's learning experience, to understanding a task as an object that needs to be interpreted and negotiated by learners. Thus, what individual learners can achieve alone is seen as limited. What is considered to be of far greater importance is that which Vygotsky (1978) refers to as the *zone of proximal development*. This describes how people, in this case film production trainees, are capable of performing in collaboration with others. Digital tools and networked learning, which are increasingly used in universities, increase the possibility of using *double stimulation methods* in learning (Vygotsky 1978), which enable trainees to be in greater control of their own learning. However, Engeström

(2007, 2009) draws attention to the need to focus on enabling expansive learning and go beyond simply providing staff in higher education with personal instruments for structuring learning activities and obtaining and recording information about students. He argues that the aim of double stimulation is to elicit new, expansive forms of agency in subjects.

Berger and Luckmann (1966) suggest that any given culture does not reside solely in forms of knowledge, but also in social practices and in the manifestations of these practices. In the same way, film-related knowledge can be understood as the product of the social processes of communication, interpretation and negotiation. Williams Woolley et al. (2010) suggest that *collective intelligence* derives from a group's proficiency to collaborate. They put forward as evidence in support of this view the findings of research studies they conducted at MIT's Centre for Collective Intelligence and Carnegie Mellon. They divided 699 participants into groups of between two and five, and asked them to undertake a series of tasks. Their analysis of how groups undertook tasks led them to conclude that groups with members who had higher levels of 'social sensitivity' were more collectively intelligent. Moreover, they found that the performance of groups was not primarily due to the individual abilities of a group's members. Williams Woolley et al. (2010) suggest that it is possible to improve the intelligence of a group by changing the members of a group, teaching group members better ways of interacting and providing group members with better 'electronic collaboration tools'.

In summary, we agree with Bereiter and Scardamalia (1993) that collaborative knowledge-building is a continuous process and that the refinement of knowledge is achieved through collaboration between practitioners. A distinctive feature of knowledge-building in the field of film production is that such knowledge is not to be seen as an entity that can be stored inside a mind, but rather it is represented in the creation of knowledge artefacts that have value or function in the practice of film production. In considering the design challenges of this project, we formulated a number of questions: what form of digital tool can support the hands-on learning process of trainees in the field of film post-production, and enable meaningful collaboration between trainees and expert practitioners at each stage of their training? How we addressed these questions is described in the next section of the article.

METHODS AND DESIGN ACTIVITIES

The design challenges were identified through iterative participatory prototyping sessions, involving designers with backgrounds in media production, interaction design, software engineering and film production. This multidisciplinary design team analysed the practices of the post-production process and created a prototype of a collaborative digital learning tool for film post-production.

The participatory design process of the present project is based on 'Design for All' (DfA, universal or inclusive design), which is an inclusive and proactive approach to the design of products, services and environments in order that they be usable by, and accessible to, as many people as possible, regardless of age, ability, culture or situation. Raike (2005, 2006) and Raike and Hakkarainen (2009) demonstrate how joint participation in knowledge-building activities in collaborative design projects, and the use of traditional action research enable the effective development and production of sustainable learning artefacts. An important element of this approach is that the design activity is carried out in close collaboration with the people who will be future users of the

design (Bødker, Greenbaum and Kyng 1991; Henderson and Kyng 1991). The aim was to design an approach that can be embedded in higher education learning practices and which is based on current best practice in the field of film post-production. Crabtree (2003) argues that the design of collaborative systems begins with addressing *the requirements problem* – how do you know what is supposed to be built? Instead of hoping that a meaningful design emerges from the description of work processes by potential users, collaboration between designers and such users should inspire a design that addresses emerging challenges. In the case of film post-production, this involves film trainees understanding and experiencing post-production through field support, system administration, documentation, training, management and engagement (both directly and indirectly) with experienced film practitioners.

The design process followed a four-phase iterative and research-based design approach, which considers design to be a major outcome of research (Leinonen, Toikkanen and Silfvast 2008). Leinonen et al. (2010) describe the four phases as (i) *contextual inquiry*: the purpose of this first phase is to understand the context to be addressed by the research, that is the context in which the application will be used; (ii) *participatory design*: this involves obtaining input from the potential users of the design (Ehn and Badham 2002); (iii) *product design*: the creation of prototypes that can mediate design ideas between the designers and the potential users; and (iv) *software as hypothesis*: the development of functional prototypes.

The main research activities undertaken to understand the context took place during a workshop attended by the designers and the collaborators. As suggested by Leinonen et al. (2010), further work was undertaken following the workshop, which also informed contextual understanding. In the initial workshop, artefacts created by the collaborators, such as concept maps (Novak and Gowin 1984: later 'C-maps') of the post-production flow process, visual interface prototypes and a draft version of a post-production manual, were used as a means to identify and clarify initial questions.

Four two- to three-hour-long participatory paper prototyping sessions were held involving the designers and the design participants. As the design team was small, all designers participated in these sessions, which facilitated information sharing throughout the design process. During the sessions, the initial information was discussed, using the prints of the C-maps (Figure 2), the interface suggestions and photographs of early whiteboard drawings as inspiration. While the discussion took place, the designers used coloured pencils and adhesive notes to map each stage of the post-production process on a large sheet of paper. At the last prototyping session, further design recommendations were made. The paper prototyping sessions provided an in-depth contextual understanding of the post-production process and identified the design challenges and opportunities to be addressed.

The artefacts that resulted from the paper prototyping sessions were used as the basis for the next design stage, which was conducted without informants. This included the visual design and programming of an interface prototype. During the visual design activities, the initial paper prototypes were analysed and redesigned through iterative visualizations. Based on this visual design, an HTML and CSS software prototype was developed, which allows basic interactions to be carried out, such as colour changes. The close collaboration established between the visual designers and programming designers during the earlier phases of the project facilitated communication during this crucial phase of the design process.

VISUALIZATION: DESIGN OPPORTUNITIES AND DESIGN RESULTS

In addressing the design challenges presented in section 'Design challenges in film post-production design in higher education' of this article, three main design tasks were identified: (i) visual representation of each phase and the key components that comprise each phase; (ii) visual cues for project-specific information; and (iii) peer documentation of expert knowledge. These design tasks informed the design of the learning tool concept. Figure 1 illustrates the artefacts used in the creation of the prototype post-production tool.

We recognized that the inclusion of a timeline would provide a useful means of visualizing the post-production process. In the process of creating the paper prototypes, we were able to identify the key steps that needed to be visually represented on the timeline. In designing more dynamic digital interface prototypes, we were able to identify and create visual cues for project-specific information. The design of the prototype post-production learning tool enabled us to determine how we should document expert knowledge.

The visual representation of the phases and key steps

The visually rich material, in particular the C-maps created with the IHMC CmapTools software (Figure 2), which the expert collaborators provided, proved to be inspirational input during the design process. These artefacts enabled us to recognize that the timeline visualization of the main phases of the process would support the learning of the post-production process by addressing difficulties experienced by trainees, in particular their conception of the overall post-production process.

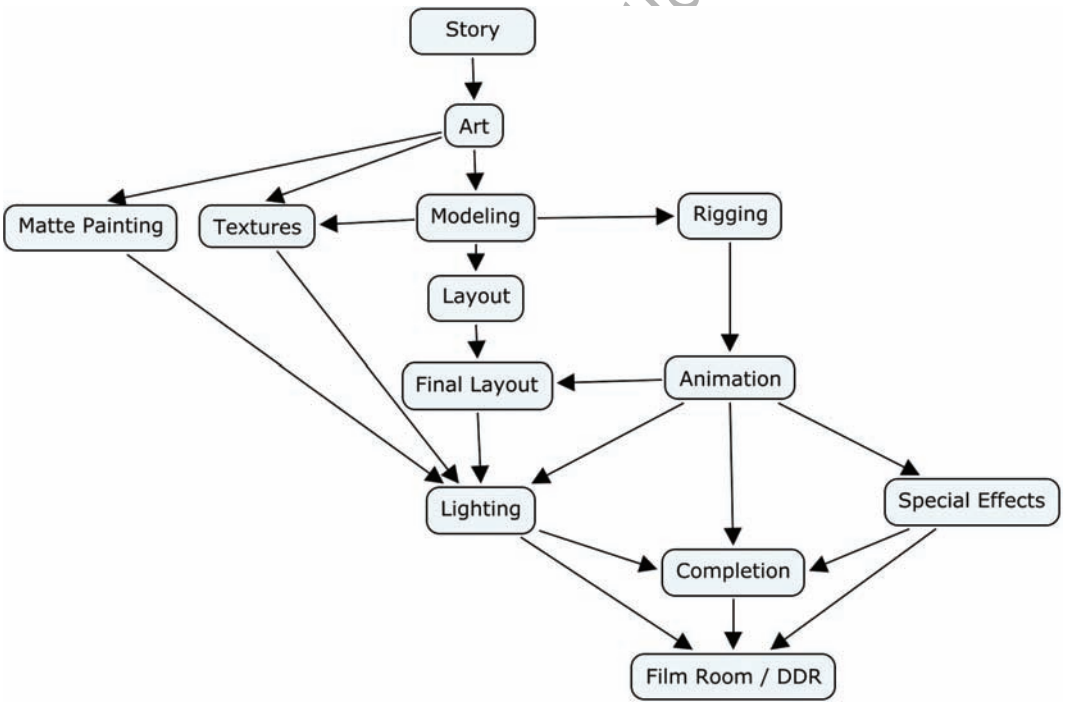

Figure 2: The concept map of the animation process created by Deepa Agarwal.

The first participatory paper prototype workshop resulted in a note-based paper prototype (Figure 3) that visualizes the main phases of the post-production process. The prototype was used to discuss, clarify and organize the main phases with the participant, using differently shaped and coloured paper notes.

As a consequence of several design iterations of the paper prototype in collaboration with the participant, we removed excessively detailed descriptions of steps and optional software recommendations. Although the duration of different phases varies considerably (e.g. the online phase takes longer than choosing the production medium at the start of the process), the duration of each phase is represented equally. During the iterative paper prototyping, key steps and decision-making points were identified and included. Examples of these include checking the flawlessness of the metadata after the film has been digitized, and visual cues for budget management and for creating data backups. The backup reminders occur with important project milestones, which enables each phase to be clearly demarcated. Figure 3 shows the phases in the form of diamond-shaped notes.

The creation of the paper prototype enabled the 'trainees' to gain an in-depth understanding of the project context. This suggested that the phase visualization could serve as an appropriate representation of the post-production process for the navigational interface of a digital learning tool. The phase visualization shows the most important phases and all concurrent steps in one representation.

Based on the paper prototype, digital interface prototypes were created by members of the design team. In discussion with the participant, it was agreed that the learning tool should visually differentiate sequentially fixed post-production process phases from those that may shift and overlap. It was further agreed that the tool should enable trainees to arrange the latter in accordance with particular project requirements. This personalized visualization capability was considered also to have the potential to support individual reflection by trainees, enhance communication within teams, and facilitate collaboration with expert practitioners.

To support trainees in developing good data backup practices, visual cues were included that remind trainees at important milestones to create backups. In relation to project budget planning, it was recognized that trainees need to be able to enter budget updates, change the budget in the interface and receive immediate feedback on the budget implications of a path change. It was agreed with film production experts that budget-related information should be transparent and accessible to all team members. Figure 4 illustrates the digital interface prototype, including shifting and fixed phases, as well as the cues for backups and budgeting.

Peer documentation of expert knowledge

Documenting expert knowledge and making it accessible to trainees is an important component of training programmes. When confronted with difficult situations, or making decisions that have major budget implications, direct guidance provided by experienced practitioners based on their experiences of similar situations can be invaluable, and of far greater value than the generalized guidance that can be found on social media resources. Expert insights on how to tackle a challenging situation may indicate how a problem can be addressed, but cannot be used as a formula to be followed in a step-by-step manner. The challenges that film practitioners encounter during the post-production process are largely

project-specific and vary immensely. Based on conversations with the design participant, it was agreed that expert knowledge should be linked directly to the post-production phase that it addresses. The idea was to enable trainees to browse through expert commentary on issues relating to each specific phase.

A vital objective of the design concept is to create the opportunity for students, faculty members, alumni and professional film practitioners to share and transfer tacit knowledge on an ad hoc basis (Gibson 1979). The methods by which this could be achieved would include the asking and answering of questions, retrieving information and editing existing information. Hence, the post-production phase visualization is complemented by a *wiki* space, for film practitioners to view, edit and add information or examples relevant to a particular phase. In order to enable the entry of local and personal content, as well as to encourage the participation of practitioners from different sectors, the wiki can be edited by anyone. The use of HTML allows, for example, integrating open source project content, such as that to be found on *Wikipedia*. Combining the phase visualization with a wiki allows the editing of information in context. By moving the mouse above any of the post-production phases, a hovering window presents a short description of the phase and its requirements. Clicking the phases offers a more elaborate description and explanation. The wiki loads under the visualization without reloading the page. Figure 5 illustrates the collaboration design tool concept, including mock-up wiki entries for the offline phase.

Although not functionally implemented, a visual mock-up of an administrator panel for the wiki was designed, and this can be seen in Figure 6. It was considered important to include within the administrator panel the facility to edit information in context.

Figure 6 also illustrates a second administrative tool, that of Colour Utility. Colour Utility is a simple colour selection and grouping tool, through which the colours of the interface can be changed. This facility allows each phase, step, repetition and key step of the post-production process to be distinguished by a different colour. This categorization by colour coding allows an interrelationship to be made visually evident, for example the steps involved in a particular phase, repetitions and distinguishing between an actual activity and additional information about that activity. Administrators can change the colours of any group. Colour Utility was developed with jQuery, a JavaScript library, to allow instant feedback on selected colour changes upon refreshing the page. Currently, reloading the page resets the colours. A colour swatch grid with a limited selection of colour choices opens upon selection. Additional colours can be added with standard hexadecimal codes. Colour Utility was designed as a separate module that can be bound with HTML pages that use standard Cascading Style Sheets (CSS) for colour definition. At this time, not all functions of the Colour Utility tool are fully developed, and work is on going on the prototype.

DISCUSSION OF POSSIBLE FURTHER DEVELOPMENTS

The development of film-related knowledge involves epistemological change in which trainees build upon personal knowledge and, through training, learn how to engage with, and produce critical reflective judgements as exhibited by experts in the field of film production (Honkela et al. 2000). It follows that film educators need first to define the entry-level and base knowledge required to enter the profession. Training programmes, through their curriculum,

structure, learning tools and facilities, need to enable trainees to access, interpret and evaluate information, and provide access to a range of experiences in each facet of film production and the opportunity to engage and collaborate with experts in film production. As a consequence, on completion of their training, they should have the ability and technical competence to be employed in a professional capacity in film post-production.

In order that trainees gain maximum benefit from training courses, it is necessary for educators to provide students with guidance, the tools to develop their learning and the capacity to collaborate in ways that directly relate to film production. As suggested earlier (in section 'Learning film production practices'), an educational programme based on the concept of *scaffolding* is seen as being especially suited in enabling film production trainees become reflective, professional practitioners in the field of film production (Schön 1983).

The conceptual construct of film production is complex, and educators based in higher education institutions need to give particular attention to the role of *activity-based learning* in such training programmes. The form this takes, and how it is organized, needs to be informed by research evidence on how situated learning in relation to film production may be influenced by the educational, social and linguistic context in which it is conducted.

In the next section we consider the potential for further development of the prototypes, and ideas on how learners can be more actively engaged in their own learning during their training in relation to each phase of film production.

DYNAMIC VISUALIZATION OF INDIVIDUAL PROJECT PATHWAYS

In discussion of the digital prototype with the design participant, the clear need for other project-specific information, such as progress, dependencies and deadlines, was recognized. In order to support collaboration between learners, a function that generates a pathway through the interface, highlighting the stages and possible dependencies, and allowing the updating of project progression, was conceptualized (Figure 7).

Through such a personal project pathway, the effects of early process decisions could be visualized, enabling trainees to compare how changing particular variables could affect outcome media, the project budget and the project completion schedule. In order for the project path to appear, the distribution channel, film material, resolution, aspect ratio and tools to be used have to be selected. A line on the interface shows the steps that the project needs to follow, and warns about upcoming dependencies and requirements. The visualization could also assist learners in navigating production phases, and in communicating their choices to team members and to experts. It was conceptualized that, as the project progresses, learners would be able to update the state and schedule of specific, simultaneous and flexible phases of the project by horizontally moving the phases that are illustrated as blocks under the main production diagram (Figure 7). The use of the visualization facility allows film team members with different roles to recognize if a phase of the project requires their involvement.

Effective collaborative knowledge-building requires the enthusiastic engagement of students and a diverse range of contributions from teaching staff committed to the process. Well-designed and planned networked learning is seen as making a significant contribution in the training of film production trainees. The process needs to incorporate *on-location* instruction

and interactions between the trainees and teachers, film practitioners and industrial stakeholders. *On-location* instruction is seen as critical, based on Vygotsky's (1978) construct of the *zone of proximal development* – nothing is considered more important in film production training than a true engagement between trainees and experts in film production. It was recommended that a printing and screenshot feature of the post-production timeline be included. Paper prints or screenshots taken during the process could be used as artefacts for reflection on changes made during or after production, and for discussing phase dependencies *on location*, where the online learning tool cannot be accessed.

Collaboration with industry experts

It is valuable to invite industry experts and academic researchers in the area of film and post-production to contribute advice and knowledge to the wiki pages, in particular to share accounts of the challenges and problems that they have encountered, and the solutions they identified. The design participant proposed that the repository of this collective knowledge should be accessible to anyone who is interested. This would, in the view of the design participant, encourage more experts to participate (Lohijoki, personal communication, August 2011). The design participant considered the issue of the inclusion of incorrect information not to be a matter for concern. The design participant was confident that incorrect information would be detected quickly from within the community, as the community of film professionals in Finland is not large in number, and is made up of specialists in every phase of film production who are known to one another. It was anticipated that people not interested in film would have no reason or wish to contribute to such a repository. However, concerns were raised that a publicly accessible repository could inhibit trainee participation. Design participants expressed a concern that trainees may worry that sharing their experiences on a public forum could result in unanticipated consequences in how they are perceived within the rather small Finnish film community.

Participatory design workshops with film trainees

It has been demonstrated how children and adults can learn about new areas of interest through designing software and games collaboratively with others (Kafai 1996, 2003). These projects aim in particular to foster young people's interest in science and engineering. The collaborative design of the post-production prototype described in this article demonstrates how the design of software in multidisciplinary teams could, in a similar way to that described by Kafai (1996, 2003), enable trainees to learn film-specific expert practices.

During the participatory design sessions of this project, the designers undertook the role of film trainees. They participated in classroom activities in the role of trainees and were taught by the expert participant about particular post-production practices. They learned about the particular film production context from the design participant, who used the paper prototype as a teaching tool. These exercises enabled the team to form a clearer understanding of how the film post-production process should be presented.

The documentation of expert knowledge by academic and industry experts could provide the basis for a far closer engagement and collaboration between trainees and expert members of the film community. The availability of up-to-date, peer-reviewed information, in addition to the information provided

as part of the training programme, is seen as providing a much enhanced knowledge base, as well as a facility that enables and encourages discussion between participants with common interests.

In furthering the development of the learning tool, we will seek to incorporate not only expert views, but also the views of trainees. Although visualization-based collaboration with trainees represents a more challenging approach, we suggest that this approach provides a training programme that can be tailored to the individual needs of each trainee in a way that 'universal' approaches to visualization cannot provide. It is a concept design that equally allows for the training programme to recognize and build on the knowledge that trainee film-makers bring to their course, or obtain outwith their course during their training. In evaluating the concept design with the expert participant, specific ideas and open questions were identified, which we plan to further explore with film trainees.

The use of the current version of the post-production prototype as a teaching tool in participatory design workshops enables the students to place their learning activities within the wider context of their training programme, and identifies possible strategies and tools that can facilitate their learning. Their existing practices, as well as common misconceptions, can be used to inform teaching, and the graphic design of how this information can be presented and utilized within teaching tools. We believe that trainees and experts should be able to add tags, linking to the wiki space, as one possible way of adding, editing and browsing information. The design participant expressed the view that uncommon or rarely used applications of software should not be referenced through tags on the interface, as the university should be seen to be engaged in the promotion of good practices rather than software applications. Nevertheless, in the view of the design participant, this information should not be omitted entirely. Depending on the technical provision made available by the university, the visual predominance of single tags could change. The project team consider controls for enabling accounts of film production experiences by trainees and expert practitioners to be entered into the knowledge repository, the detailed indexing of content to facilitate access and the dynamic visualization of personal project pathways to be important ways in which the current prototype could be significantly improved.

It is recognized that the experiences of current and past trainees can make an invaluable contribution to the training of the next generation of film production professionals. It is proposed that the views of current and past trainees be obtained on their experiences of progressing through each phase of their training. In addition, it is suggested that they be asked what advice they would give to trainees about commencing their training, and in doing so describe the significant challenges they faced during their training, errors they made, turning points in their training, tools they found valuable and what information they would recommend be added or removed from the post-production timeline visualization. The inclusion of budget information is seen as important. An earlier version of the learning tool included *financial markers* that identified critical points in the process at which funding would need to be utilized.

The project team believe that the prototype concept described in this article, a tool to enable collaboration between academic and industry members in the training of film production professionals, has the potential to deliver significant advances in how trainees are trained and how they can be more effectively involved in their own training.

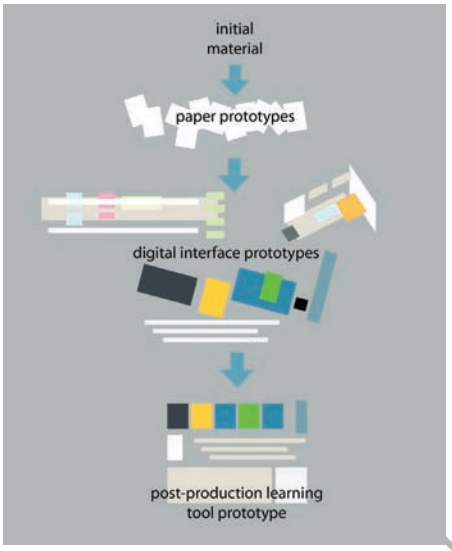

Figure 1: Illustration of the artefacts created during the design process by Jussi Muttilainen.

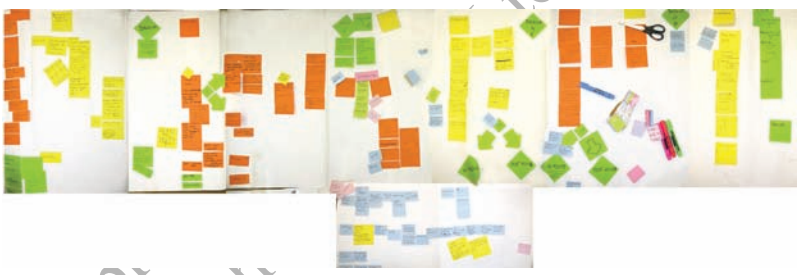

Figure 3: Paper prototype of the post-production phases used for communication purposes during the design process created by Matti Arvilommi.

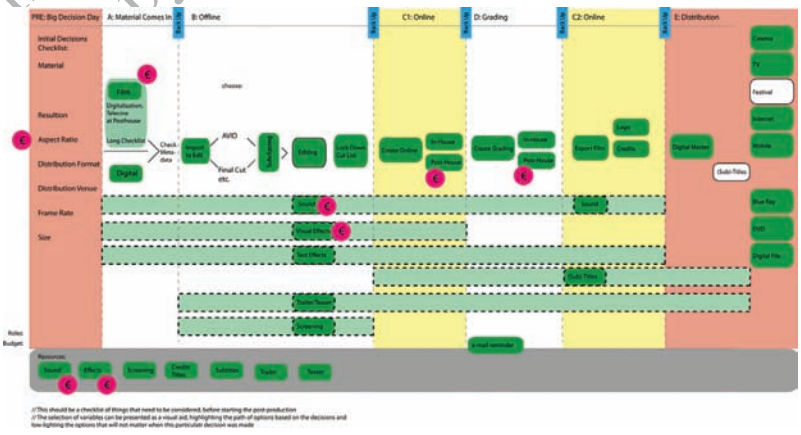

Figure 4: A prototype illustration of the digital interface created by Matti Arvilommi, Anna Keune, Björn Lindholm and Jussi Muttilainen.

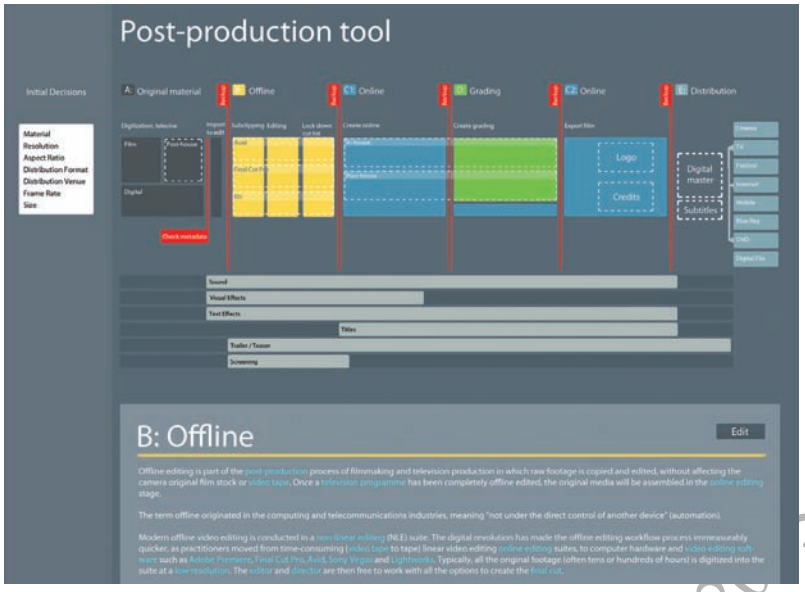

Figure 5: An interface concept illustrating an example project created by Björn Lindholm and Jussi Muttilainen.

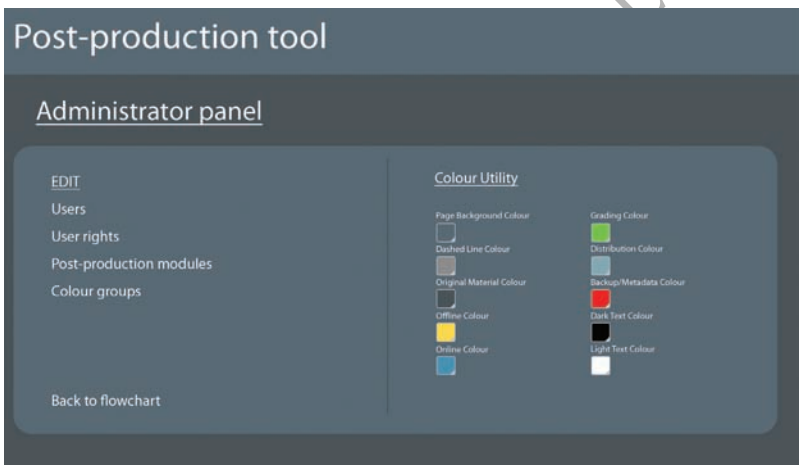

Figure 6: Visual mock-up of the administrator panel created by Björn Lindholm and Jussi Muttilainen.

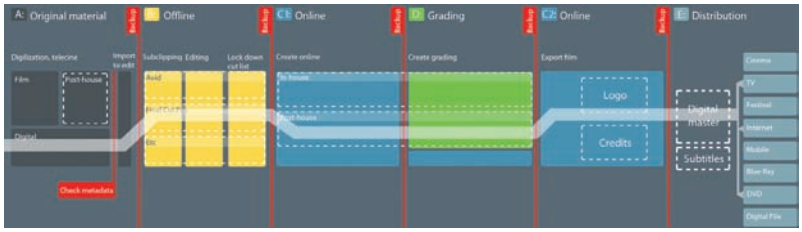

Figure 7: Clipping of post-production interface with conceptual project path created by Björn Lindholm and Jussi Muttilainen.

CONCLUSION

This article presented information on a concept for a digital learning tool in relation to film post-production, and in so doing sought to contribute to the discourse on collaborative film education. We hope our findings will form the basis for a more in-depth analysis of the role of social learning in relation to film production. It should be emphasized that a 'learning environment' is not an entity that can exist independently of learners, forms of teaching or the participation of other stakeholders (Bandura 1977; Engeström 2009). Within a learning environment, individuals construct new knowledge, especially in their role as contributing partners in the collaborative film post-production process. Seeing a student as a contributing partner challenges certain existing practices in higher education. Every student is a unique individual, with their own personal interests, developmental goals and aspirations, who is developing their personal path through their studies. This is particularly apparent in training programmes based on a project-based learning approach to film education. Each project in which students are involved, and each different group in which they participate, offers the trainees unique opportunities to develop their competencies and, over the course of their programme, become professionally proficient in the use of conventional tools, and skilled in the practices involved in post-production. They are then in a position to employ these tools and practices to articulate their unique perspective through their contribution to film production. They are active learning trainees, conscious of the need to become skilled collaborators with their peers. The proliferation and availability of social media, and the way in which it can support social learning, challenges conventional notions of novice and expert, amateur and professional. At the same time, it provides new opportunities for staff to develop training programmes based on the concept of scaffolding, critical thinking and formative interventions, rather than traditional class lectures and the use of rote learning.

The design team, and Aalto University's Film Department with whom the team closely collaborated, view the post-production learning tool prototype as a potential free and open public repository, for use in particular by academic and industry-based film practitioners. The Aalto University Film Department have suggested that the collaborative building of the knowledge repository could present opportunities for strengthening ties between the department's staff and students, and that alumni of the department could continue to be beneficiaries of the repository long after their graduation.

The development of the digital learning tool is seen as a means of providing good T-shaped skills of direct relevance to graduates in developing their professional careers. The need to develop both a trained professional and a film artist is reflected in the evolving nature of digital learning tools. Through their training course and placements, trainees learn important generic skills that will enable them to become experts capable of coping with continuous change in film technology, work practices and production processes. Planned and chance opportunities for social learning will prepare trainees to effectively adapt to changes in media production requirements. The proposed learning tool-based model encourages a creative engagement with formal production processes by incorporating a synchronized flexibility that encourages trainees to consider options and variants without placing excessive demands on faculty members.

In conclusion, in the view of the design participant, the design concept presented here could add considerable value to university-based film

post-production training, if further developed into a functioning prototype. The further development of the prototype, in collaboration with film trainees (as discussed in section 'Discussion of possible further developments'), is seen as providing a most valuable opportunity to develop their capacity for knowledge-building. The design participant, the design informant and Aalto University Film Department collaborators share this view. All are agreed as to the value of further investigation and development of the presented concept. We therefore encourage anyone who shares our interest to build on the concept design and ideas presented in this article in order to develop a functional tool that addresses the challenges involved in enabling trainees to become qualified professionals in the field of digital film post-production.

ACKNOWLEDGEMENTS

We wish to warmly thank all our collaborators and contributors. In particular, we thank Jussi Lohijoki for his committed and flexible collaboration, Anna Heiskanen and Deepa Agarwal for their valuable comments during the design process and Matti Arvilommi for his graphic design contributions. David Brien assisted in making revisions to the text. The work was part of the Visual Innovations for Inclusive Projects with Diverse Participants (VIPP) postdoctoral project at Aalto University's Department of Media, directed by Antti Raike and funded by the Academy of Finland (decision no. 123445).

REFERENCES

Bandura, A. (1977), *Social Learning Theory*, Englewood Cliffs, NJ: Prentice Hall.

Bereiter, C. and Scardamalia, M. (1993), *Surpassing Ourselves. An Inquiry into the Nature and Implications of Expertise*, Chicago, IL: Open Court.

——. (2003), 'Learning to work creatively with knowledge', in E. De Corte, L. Verschaffel, N. Entwistle, et al. (eds), *Powerful Learning Environments: Unraveling Basic Components and Dimensions*. Advances in Learning and Instruction Series, Oxford, UK: Elsevier Science, pp. 55–68.

Berger, P. L. and Luckmann, T. (1966), *The Social Construction of Reality: A Treatise in The sociology of Knowledge*, Garden City, NY: Anchor Books.

Bødker, S., Greenbaum, J. and Kyng, M. (1991), 'Setting the stage for design as action', in J. Greenbaum and M. Kyng (eds), *Design at Work: Cooperative Design of Computer Systems*, New Jersey: Lawrence Erlbaum, pp. 139–54.

Bratteteig, T. and Stolterman, E. (1997), 'Design in groups – And all that jazz', in M. Kyng and L. Mathiassen (eds), *Computers and Design in Context*, Cambridge, MA: The MIT Press, pp. 289–315.

Bryer, T. and Zavattaro, S. (2011), 'Social media and public administration: Theoretical dimensions and introduction to symposium', *Administrative Theory & Praxis*, 33: 3, pp. 325–40.

Chen, B. and Bryer, T. (2013), 'Investigating instructional strategies for using social media in formal and informal learning', *The International Review of Research in Open and Distance Learning*, 13: 1, pp. 87–104, http://www.irrodl.org/index.php/irrodl/article/view/1027/2073. Accessed 1 April 2013.

Crabtree, A. (2003), *Designing Collaborative Systems: A Practical Guide to Ethnography*, London: Springer-Verlag.

Dreyfus, S. E. and Dreyfus, H. L. (1980), 'A five-stage model of the mental activities involved in directed skill acquisition', University of California, Berkeley. Unpublished report supported by the Air Force Office of Scientific Research,

USAF (contract F49620-79-C0063), http://www.dtic.mil/cgi-bin/GetTRDoc?Location=U2&doc=GetTRDoc.pdf&AD=ADA084551. Accessed 1 April 2013.

Ehn, P. and Badham, R. (2002), 'Participatory design and the collective designer', in T. Binder, J. Gregory and I. Wagner (eds), *PDC 2002. Proceedings of the Participatory Design Conference*, Palo Alto, CA: CPSR, pp. 1–10, http://cpsr.org/issues/pd/pdc2002/index_html/. Accessed 1 April 2013.

Engeström, Y. (2001), 'Expansive learning at work: Toward an activity theoretical reconceptualization', *Journal of Education and Work*, 14: 1, pp. 133–56, doi:10.1080/13639080020028747.

——. (2007), 'Putting Vygotsky to work: The change laboratory as an application of double stimulation', in H. Daniels, M. Cole and J. V. Wertsch (eds), *The Cambridge Companion to Vygotsky*, Cambridge: Cambridge University Press, pp. 363–83.

——. (2009), 'From learning environments and implementation to activity systems and expansive learning', *Actio: An International Journal of Human Activity Theory*, 2, pp. 17–33, http://www.chat.kansai-u.ac.jp/english/publications/actio/pdf/no2-2.pdf. Accessed 1 April 2013.

Feightner, B. and Eicholz, R. L. (2004), 'Digital post production for film', in S. H. Burum (ed.), *American Cinematographer Manual*, 9th edn., Hollywood: The ASC Press.

Gibson, J. J. (1979), *The Ecological Approach to Visual Perception*, Boston: Houghton Mifflin.

Henderson, A. and Kyng, M. (1991), 'There's no place like home: Continuing design in use', in J. Greenbaum and M. Kyng (eds), *Design at Work: Cooperative Design of Computer Systems*, New Jersey: Lawrence Erlbaum, pp. 219–40.

Heylighen, F. (2000), 'Referencing pages in Principia Cybernetica Web', in F. Heylighen, C. Joslyn, and V. Turchin (eds), *Principia Cybernetica Web*, Brussels: Principia Cybernetica, http://cleamc11.vub.ac.be/epistemi.html. Accessed 1 April 2013.

Honkela, T., Leinonen, T., Lonka, K. and Raike, A. (2000), 'Self-organizing maps and constructive learning', in D. H. Benzie and D. Passey (eds), *Proceedings of Conference on Educational Uses of Information and Communications Technologies. 16th IFIP World Computer Congress: Beijing, China. August 2000*, Beijing: Publishing House of Electronics Industry (PHEI), pp. 339–43, http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.117.2706&rep=rep1&type=pdf. Accessed 1 April 2013.

Kafai, Y. B. (1996), 'Learning design by making games – Children's development of design strategies in the creation of a complex computational artifact', in M. Resnick and Y. B. Kafai (eds), *Constructionism in Practice – Designing, Thinking, and Learning in a Digital World*, New Jersey: Lawrence Erlbaum, pp. 71–96.

——. (2003), 'Children designing software for children: What can we learn?', In *IDC '03, 2003 Conference on Interaction Design and Children*, Preston, UK, 1–3 July 2003, New York: ACM, pp. 11–12.

Kottolli, A. (2006), *ITtoolbox: Making Multicultural Virtual Teams Work*, Posted 25 October 2006, http://blogs.ittoolbox.com/cio/marketing/archives/making-multicultural-virtual-teams-work-12508. Accessed 1 April 2013.

Krippendorff, K. (2006), *The Semantic Turn: A New Foundation for Design*, Boca Raton, FL: Taylor and Francis.

Kuutti, K. (2007), 'Design research, disciplines, and the new production of knowledge', in S. Poggenpohl (ed.), *Proceedings of the International Association of Societies for Design Research (IASDR) Conference: Emerging*

trends in design research (paper 39), http://www.sd.polyu.edu.hk/iasdr/proceeding/papers/Design%20Research%20Disciplines%20and%20New%20Production%20of%20Knowledge.pdf. Accessed 1 April 2013.

Lawson, B. (1980), *How Designers Think*, London: The Architectural Press.

Leinonen, T., Purma, J., Põldoja, H. and Toikkanen, T. (2010), 'Information architecture and design solutions scaffolding authoring of open educational resources', *IEEE Transactions on Learning Technologies*, 3: 2, pp. 116–28, April–June 2010, http://doi.ieeecomputersociety.org/10.1109/TLT.2010.2. Accessed 1 April 2013.

Leinonen, T., Toikkanen, T. and Silfvast, K. (2008), 'Software as hypothesis: Research-Based design methodology', in D. Hakken, J. Simonsen and T. Roberston (eds), *The Proceedings of Participatory Design Conference 2008*, PDC 2008, Indiana University. Bloomington, IN: ACM, pp. 61–70.

Ludvigsen, S. (2008), 'What counts as knowledge: Learning to use categories in computer environments', in R. Säljö (ed.), *ICT and Transformation of Learning Practices*, Oxford, UK: Pergamon, http://www.intermedia.uio.no/kal/readings/supplementary-reading/stenversjonfinal.pdf. Accessed 1 April 2013.

Lund, A. and Rasmussen, I. (2008), 'The right tool for the wrong task? Match and mismatch between first and second stimulus in double stimulation', *International Journal of Computer-Supported Collaborative Learning*, 3: 4, pp. 387–412.

Muukkonen, H., Hakkarainen, K. and Lakkala M. (1999), 'Collaborative technology for facilitating progressive inquiry: Future learning environment tools', in C. Hoadley and J. Roschelle (eds), *The Proceedings of the CSCL '99 Conference*, Stanford University, Palo Alto, CA, 12–15 December, Mahwah, NJ: Lawrence Erlbaum, pp. 406–15, http://www.gerrystahl.net/proceedings/cscl1999/A51/A51.HTM. Accessed 1 April 2013.

Nelson, H. G. and Stolterman, E. (2003), *The Design Way: Intentional Change in an Unpredictable World*, Englewood Cliffs, NJ: Educational Technology.

Novak, J. and Gowin, B. (1984), *Learning How to Learn*, Cambridge, UK: Cambridge University Press.

Polanyi, M. (1966), *The Tacit Dimension*, New York: Doubleday & Company.

Raike, A. (2005), 'Löytäjät Elokuvantajua rakentamassa – yhteisöllinen WWW-palvelun tuotanto' (in Finnish). Ph.D. thesis, Helsinki: University of Art and Design. http://www.uiah.fi/ISBN/951-558-172-9/. Accessed 1 April 2013.

——. (2006), 'Searching knowledge: CinemaSense as a case study in collaborative production of a WWW service in two universities', in A. Miesenberger et al. (eds.), *Computers Helping People with Special Needs: 10th International Conference, ICCHP 2006*, Linz, Austria, July 2006 Proceedings, pp. 568–74.

——. (2010), 'Visual innovations for inclusive projects with diverse participants', http://vipp.mlog.taik.fi/. Accessed 1 April 2013.

Raike, A. and Hakkarainen, K. (2009), 'Concept maps in the design of an accessible CinemaSense service', *Art, Design, and Communication in Higher Education*, 8: 1, pp. 27–55.

Sanders, E. B. N. and Stappers, P. (2008), 'Co-creation and the new landscapes of design', *CoDesign: International Journal of CoCreation in Design and the Arts*, 4: 1, pp. 5–18, http://www.tandfonline.com/doi/abs/10.1080/15710880701875068. Accessed 1 April 2013.

Schön, D. (1983), *The Reflective Practitioner: How Professionals Think in Action*, New York: Basic Books.

Siemens, G. (2004), *Connectivism: A Learning Theory for the Digital Age*, elearnspace, http://www.elearnspace.org/Articles/connectivism.htm. Accessed 1 April 2013.

Tufte, E. R. (1990), *Envisioning Information*, Cheshire, CT: Graphics.

——. (2002), *Ask E.T. Forum:* Project Management Graphics (or Gantt Charts), https://www.edwardtufte.com/tufte/index. Accessed 1 April 2013.

Vygotsky, L. S. (1978), 'The development of higher psychological processes', in M. Cole (trans.), *Mind in Society*, Cambridge, MA: Harvard University Press.

Wenger, E. (1998), *Communities of Practice: Learning, Meaning, and Identity*, Cambridge, UK: Cambridge University Press.

Williams Woolley, A., Chabris, C. F., Pentland, A., et al. (2010), Evidence for a collective intelligence factor in the performance of human groups. *Science*, 330: 6004, pp. 686–88, 29 October 2010, doi: 10.1126/science.1193147. Accessed 1 April 2013.

SUGGESTED CITATION

Raike, A., Keune, A., Lindholm, B. and Muttilainen, J. (2013), 'Concept design for a collaborative digital learning tool for film post-production', *Journal of Media Practice*, 14: 4, pp. 307–329, doi: 10.1386/jmp.14.4.407_1

CONTRIBUTOR DETAILS

Antti Raike is a senior advisor in accessibility at Aalto University. He directed the three-year post-doctoral research project *VIPP – Visual Innovations for Inclusive Projects with Diverse Participants*, which was funded by the Academy of Finland (2008–2010). Antti was awarded his DA in New Media in 2005 and an MA in Film Production in 1997, both by the University of Art and Design, Helsinki, and an MA in Education in 1988 by the University of Eastern Finland.

Contact: Aalto University, PO Box 11110, 00076 Aalto, Finland.
E-mail: antti.raike@aalto.fi

Anna Keune is a researcher at the Learning Environments Research Group at the Aalto University School of Arts, Design and Architecture. Anna was awarded an MA in New Media by the Aalto University School of Arts, Design and Architecture in 2010, and a bachelor's degree (honours) in 2007 in Media Production by the University of Applied Sciences, Darmstadt and the Cork Institute of Technology. Anna is currently (2013) a visiting scholar at the School of Information at the University of California at Berkeley. Her professional interests lie in the design and research of new media tools for learning.

Contact: Aalto University, PO Box 11110, 00076 Aalto, Finland.
E-mail: anna.keune@aalto.fi

Björn Lindholm is an MA student studying New Media at the Aalto University School of Arts, Design and Architecture. He obtained a bachelor's degree in 2009 in Media Technology at the Arcada University of Applied Sciences. He is one of the founders of Rockway.fi, a Finnish Internet community created to promote the learning of music. Björn's professional interests lie in the design and research of educational games.

Contact: Aalto University, PO Box 11110, 00076 Aalto, Finland.
E-mail: bjorn.lindholm@rockway.fi

Jussi Muttilainen is an M.Sc. student studying at Aalto University. He is undertaking a major in Media Technology. He has a background in software development and has a particular interest in user-centred service and concept design.

Contact: Aalto University, PO Box 11110, 00076 Aalto, Finland.
E-mail: jussi.muttilainen@aalto.fi