AWESOME: A widget-based dashboard for awareness-support in Research Networks

Wolfgang Reinhardt, University of Paderborn, Germany
wolle@upb.de
Christian Mletzko, University of Paderborn, Germany
letris@upb.de
Hendrik Drachsler, Open University of the Netherlands, The Netherlands
hendrik.drachsler@ou.nl
Peter Sloep, Open University of the Netherlands, The Netherlands
peter.sloep@ou.nl

Abstract
In this paper we describe the rationale, design and evaluation of a widget-based dashboard to support scholars’ awareness in Research Networks. We introduce the concept of Research Networks and discuss Personal Research Environments that exist parallel to Personal Learning Environments in today’s modern working realm. Based on the results of an international interview study we designed a paper prototype of an awareness dashboard tailored to the use by researchers (AWESOME) that aims at covering necessary activities today’s researchers are faced with. Finally, we present the general framework of the performed user tests in which we compared existing scholarly toolsets with our paper prototype. The evaluation of the user tests shows that AWESOME performs better on all tested items than the existing toolsets and thus is easier to use, less time-consuming, more user-friendly, more supportive with regards to technology and awareness and finally helps researchers to carry out their tasks more effectively.

1. Introduction
In today’s economy, knowledge is one of the most important resources for both individuals and organizations. People invest significant efforts in the design and development of learning resources and software that strives to enhance the learning success of individuals and groups. In recent years, more and more tools were built on techniques and methods of the Web 2.0 movement; social networking and user-generated content in the domain of institutional learning as well as in research projects are of worth mentioning here. The term Personal Learning Environment (PLE) describes the services, objects, people, and contents that constitute the individual educational platforms learners use to direct their own learning (Educause, 2009). If the users are scholars - with their specific requirements on services and contents - the term Personal Research Environments (PRE) if often used to elucidate the distinction from PLEs. Many of today’s researchers for example use several online tools to communicate and collaborate. Networking, exchanging research ideas and using tools for research on the Web are now essential parts of research practice. While researchers are to a certain degree aware about their relations in their Research Networks and the partners of their communication, technology can make explicit related activities beyond the individual focus of attention. This is possible due to two advantages of computer-mediated communication, which are not obvious at first sight but from great importance: (1) selectively mirroring information that would be visible in face-to-face situations, and (2) mirroring information that would not be visible in face-to-face situations, but that
can improve the working or learning process. This information could help researchers to become and stay aware of their constantly changing connections and interactions beyond their individual context and help them to reflect upon. Also, fellow scholars are constantly generating information in a multitude of tools that the single researcher might want to stay informed about but fails because of lacking awareness-support.

In an international interview series, we asked 42 researchers about their problems with regards to awareness in their Research Networks and how they envisioned a tool that could leverage most of them. The preliminary results of this study lead us to a detailed consideration of what belongs to a researcher's Personal Research Environment and how it could be best supported in order to remove frictions from the working process.

In this paper we report about the design and evaluation of a paper prototype of a widget-based dashboard for researchers (AWESOME, Awareness Dashboard for Research Communities). We designed paper prototypes to target some of the most frequently named issues in a researcher's daily work practice: a) collaboratively working on a document, inviting co-authors and meet a given format requirement; b) finding experts for a given topic; c) get detailed information about a researcher in one’s own Research Network and some more.

2. What are Research Networks?
Each online social network is to be understood as a group of people that interact using electronic means of cooperation. Examples of such cooperation media are email, shared cooperative spaces, groupware applications, and more recently Social Software. Online communities have become a valuable supplement for groups that work together in face-to-face contexts but they also exist exclusively in the online world. Online communities may exist around various topics, they may be organizational, topical or regional and most often assemble people around specific objects (also see Knorr Cetina (1997), Engeström (2005)). Rheingold (1993) coined the term ‘virtual communities’ and claimed very broadly that they would form “when enough people [...] form webs of personal relationships in cyberspace”. Not least because of such broad understandings, the term ‘virtual communities’ has been used very liberally in recent years. Wellman (2001) provides an important and more precise definition of community as “networks of interpersonal ties that provide sociability, support, information, a sense of belonging, and social identity”. Kim (2000) adds that such web communities often “share a common interest or purpose” and need “some mechanism of identity and communication”. Wellman (2001) points out that – especially in the 21st century – thinking about communities must not be limited to neighborhoods, families, tribes and villages and further elaborates that “we find community in networks, not groups. In networked societies: boundaries are permeable, interactions are with diverse others, connections switch between multiple networks, and hierarchies can be flatter and recursive”.

In blended learning, classroom learning is combined with web-based learning that may use organizational learning management systems (LMS) or more open approaches in which the learners may decide on the tools the want to use. A learner's Personal Learning Environment provides access to all learning resources, peers and learning services he might need for pursuing his learning goals (Reinhardt et al. 2011b). Recently, the term ‘Learning Networks’ has been coined for such online communities of learners. According to Koper (2009b), Learning Networks (LNs) are online communities in which users share existing information and
cooperatively create new knowledge. This way, Learning Networks help participants to develop their skills and competences in rather non-formal, unplanned and ad-hoc learning situations and educational contexts. Different from formal education, there are little learning goals for the whole Learning Network as well as diffuse, hard-to-phrase individual ones. Koper (2009a) points out that the participants of a Learning Network could:

- exchange experience and knowledge with each other,
- collaborate on common research questions and tasks,
- offer and get support to/from other participants in the Learning Network (e.g. questions, answers, remarks),
- set up focused working groups,
- support each other when encountering learning problems, and
- use tools and services to create, share, find and access learning resources.

Each Learning Network - being a social network - is composed of people that share a similar interest or follow a similar goal. The commitment to the common interest or goal, the timeframe of the Learning Network's existence, the size of the networks and other properties vary between different Learning Networks. The participants in Learning Networks can be help seekers as well as mentors, coaches, teachers or lurking bystanders. The objects in a Learning Network are all digital artifacts that might help the participants to accomplish their learning goal or that make them aware of a lack of individual knowledge that they want to overcome. Sloep (2009) elaborates that learning services are software tools that increase a Learning Network's viability. Koper (2009a) adds that such services are designed to facilitate the participants to exchange experience and knowledge, to stimulate active participation in the Learning Network, to assess and develop the participants' competences, to find relevant peers and experts that could offer support in solving a certain problem, and to facilitate ubiquitous learning. Koper (2009) lists examples of Learning Networks and explicitly names researchers that would exchange information to find solutions for a specific problem as representative LNs. They could update each other with new findings and cooperatively solve problems, co-author documents, attend face-to-face events and carry out joint projects in a geographically and timely separated manner. As a matter of course, there exist a range of other Learning Networks with different participants, resources and learning services. If the participants in a Learning Network are scholars, the resources used and services in place are related to their research activities or the execution of research projects we call such Learning Networks Research Learning Networks or briefly Research Networks (RNs).

On a related note, Nicholls and Harrison (2009) anatomize the modern IT working environment of researchers and ascertain that the IT department of the affiliation provides many of the tools in use by a university's employees. Contemporaneously, more and more researchers are using services from outside the organizational boundaries to get their work done, connect to fellow researchers and join international expert communities and Research Networks. Nicholls and Harrison (2009) point out that the modern working environment of researchers is in fact identified as a multi-layered collection of learning and working services, data and information objects and knowledgeable people (cf. Figure 1). At the core of this collection they see 'central services' that all educational institutions have to provide
their staff and students (like file storage, email services, policies, templates or finance). On the second layer they place dedicated collections of services tailored to supporting researchers’ work in research, teaching or learning. Those ‘Managed Learning/Research Environments’ embrace all services, people and objects “concerned with enabling and supporting the administrative and management tasks associated with research work” and similarly for teaching and learning. The third layer in their model is labeled as virtual learning/research environment and would hold services, content and people that are more adjusted to the actual job role of a user. According to Nicholls and Harrison (2009) PLEs as well as PREs, span across the whole organizational stack of services, people and objects and are extending beyond them (cf. Figure 1). Recently, researchers (as well as students and teachers) are increasingly bypassing internal services and are making use of content, services and objects that are offered outside the controlled organizational boundaries.

![Diagram](image)

**Figure 1:** The modern working environment of researchers (based on Nicholls and Harrison, 2009)

Each Research Network is a dynamically evolving social activity system (cf. Pata 2011, Engeström 1987) where researchers may belong to several RNs at a time and take on different roles in the separate networks. Moreover, the single PREs of different researchers often overlap; so they are partially using the same services and objects and connect to the same people. Often this happens in different contexts. Thus, the objects may serve as (technology enhanced) boundary objects (Star and Griesemer 1989) between Research Networks. Awareness about fellow researchers with similar interests, already existing Research Networks that deal with a certain topic or about services that could simplify one’s own job is crucial for making use of such contents. In the following section we approach the notion of awareness in the context of Research Networks.
3. **Approaching the term ‘awareness’ in Research Networks**

As Schmidt (2002) pointed out very clearly, there is a fundamental problem with the term awareness in current research: it is “found ambiguous and unsatisfactory” and the notion of awareness is “hardly a concise concept by any standard”. In Computer Supported Cooperative Work (CSCW), researchers have used many adjectives to characterize their specific interest in the concept of awareness, resulting in terms like ‘general awareness’, ‘group awareness’, ‘workspace awareness’, ‘mutual awareness’, ‘background awareness’ and many more. Often, those terms relate to the efforts of providing users with technology enhanced interaction spaces that aim at re-establishing face-to-face interaction situations.

The term ‘awareness’ in Research Networks however is only partially coextensive with the concept of providing such media spaces that would enable dispersed actors to co-operate “approximately as if they were in the same physical space” (Schmidt, 2002). In fact, awareness in the context of Research Networks is much more concerned with making actors more efficient and effective by making objects (e.g. people, paper, projects, events, research domains, writings, experts, social media artifacts and so on) and their relations to each other more noticeable for users. Awareness of these objects serves as a trigger for individual and collaborative reflection and is the pre-condition for communication and any form of co-operation. Based on individual experience and the reflective process of the user, (collaborative) outcomes may arise (Boud et al. 1985). Especially in workplace learning, problem solving, awareness and reflective processes are closely related (Schön 1983, Krogstie et al. 2011).

Hofkirchner’s (2002) model of information as a threefold process describes cognition, communication and co-operation as the basic variables for social interaction. According to this understanding, individuals use their specific cognitive features to interact with others and to create shared spaces of interaction (Fuchs, 2010). In some cases, those shared spaces are not only used for communication, but co-operation may arise between the enlisted people. Hofkirchner’s model does not take into consideration the importance of awareness of objects and the reflection of them. Glahn (2009) names both, awareness and reflection to be essential for learner’s competence development and successful learning processes (cf. Reinhardt 2010). This is especially true in unstructured and unguided learning environments such as Research Networks. Glahn’s (2009) effectuations go back to the theory of Schön (1983, 1987) who distinguishes two types of reflection relevant for learning: reflection-in-action and reflection-on-action. The connection between action and reflection can be found in feedback from a learners network, outlining the need for continuous interaction with ones peers. Reflection-on-action refers to those contemplative processes starting after an action has ended and cannot be changed anymore. Contrary to these post-action considerations, reflection-in-action refers to the cognitive processes and application of individual knowledge that are needed to actively control an action. Vygotsky (1978) points out that interaction with others is vital for an individual’s mental maturity and individuality. Furthermore he stresses that one’s potential mental capacity depends on the self-awareness of one’s actions and the reflection of them. In this paper, awareness is thus considered as an attribute of action, a trigger for reflection and an enabler of co-operation.

In the context of Personal Research Environments and Research Networks, we already find awareness support in various instantiations. Mashups for example not only connect several previously separated functionalities of separate applications,
they often also provide awareness support for the respective users by providing a more holistic view on a problem. The concept of widget-based dashboards became mainstream with the rise of the PLE and Mashup-PLE (MUPPLE) research and forms the basis of our awareness dashboard. Form a user interface pattern point of view, a dashboard is considered the main working canvas in an online tool. Users may find aggregated information about the system's current state, personal notifications, news as well as other important transactions there. With the rise of widgets and widget-based online tools, the personalization of such dashboards became state-of-the-art technology and can be found in many contemporary applications.

Recommendations on the other hand make use of knowledge about the relevant objects, their content and connections to provide the user with guidance for making educated decisions on a topic. Those recommendations make users aware of the existence or linkage between objects that maybe would stay revealed otherwise. Recommendations can be given for learning objects that might help in solving an encountered problem, knowledgeable peers that can assist in getting the bottom of a problem as well as for scientific articles that are similar to the ones in a researcher's collection.

4. Design and evaluation of AWESOME

From a set of preliminary results of the analysis of an international awareness interview series we identified several use cases where scholars feel badly supported. The issues mentioned by the interviewees can be summarized as the following: 1) Monitoring research activities suffers from missing awareness of what researchers in the same field are doing. 2) The coordination of collaborative project work is made difficult because of the fact that a negotiation of a shared vocabulary and the corresponding meanings is time-consuming. Thus a development of a shared understanding of the scope, meaning and direction of a project is hampered. 3) Furthermore missing awareness of what the current state of work is hinders the coordinative aspects of collaborative work as well as a rapid progress in the process of collaborative authoring. Based on statements from the interviewees an agreement on a common toolset for collaboration is hard to achieve and thus versioning and merging of different artifacts often becomes a problem. 4) During the process of collaborative authoring further problems arise: the partition of contributions to be made and assigning the corresponding responsibilities often is perceived very challenging. Moreover, the coordination of the authoring process itself in order to meet a given deadline raises issues with the interviewees. In addition to this, the interviewees mentioned, that the management of references also is an issue.

In order to alleviate these problems AWESOME offers a user profile widget (cf. Figure 2) that contains an aggregated overview of the essential facts related to a scholar, such as a list of publications, a representation of his Research Network and co-author network, recent activities, etc. As shown in Figure 4, AWESOME contains a chat widget, a video-chat widget and a widget for sharing ideas (labeled “My ideas”) that can be used for information exchange, discussions and agreements. Offering a simple way of synchronous and asynchronous communication, these channels can easily be used for clarifying linguistic problems or providing information of the current state of work. The achievement of a shared understanding of the scope, meaning and direction of an artifact, a discussion or an entire project, is supported by widgets like the ‘reviews’ widget, the ‘mindmap’ widget and the ‘my
writings’ widget. These widgets offer the creation and retrieval of artifacts at a higher level of abstraction and can improve coordinative tasks of collaborative work.

Figure 2: Empty Dashboard in AWESOME

4.1 Paper prototyping
Paper prototyping is a well-known method of usability testing in which real users perform realistic tasks with a prototype. A facilitator runs the session and takes notes about what confuses the user and what works well (Snyder 2003). The paper prototypes of AWESOME were created using the mockup tool Balsamiq Mockups¹ (task 1-6) and Adobe Photoshop² (task 7). In the design phase, we paid attention to especially address factors that are hindering efficient and effective work according to the interviewed researchers. We especially addressed the expressed need for multimodal interaction with the interface: AWESOME was design to offer multiple ways of creating new interaction spaces. Users could add new widgets to their dashboard manually by clicking the ‘add widget’ button, by searching and selecting the appropriate object that would be represented in an own widget or by selecting a widget preset for a certain task. All widgets could be freely arranged and did not overlap. Users could have multiple instances of the same widget on their dashboard. In order to getting users started with the prototype easily we created an activity-centered interface element; a dropdown box asking “What do you want to do?” was placed in the users central perception area. The several options referred to pre-

¹ http://balsamiq.com/products/mockups
² http://www.adobe.com/products/photoshop.html
configured widget placements that reflect different roles of researchers and central knowledge actions (Reinhardt et al. 2011a). It is typical to paper prototyping that not all possible trajectories through a prototype are actually modeled and that it is assumed that the prototype would have access to all information for display. In the case presented here, we also assumed that all involved technical components would work properly and respond to queries on time.

Figure 3: Dashboard with an extended search widget and a user profile widget

4.2 Task definition
Each participant in the user test had to accomplish four out of seven defined tasks (cf. Table 1). Apart from task 7, all tasks have been carried out almost equivalently often. Each task relates to typical knowledge actions of knowledge workers (Reinhardt et al. 2011a) and is part of the research lifecycle as described in (CIBER 2010, Microsoft 2011).
Figure 4: Pre-configured dashboard for creating a new text artifact

Table 1: Tasks with different configurations

<table>
<thead>
<tr>
<th>Task</th>
<th>Description</th>
<th>Topic</th>
<th>Knowledge Action(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1, W</td>
<td>Compile a list with European experts in a certain domain including relevant information (projects, publications, research interests etc.) about them.</td>
<td>Learning Networks</td>
<td>expert search, analyze</td>
</tr>
<tr>
<td>2, W</td>
<td>Find out how many Journal articles have been written by an author dealing with a certain topic.</td>
<td>Erik Duval (author), Metadata (domain)</td>
<td>information search, expert search</td>
</tr>
<tr>
<td>3, W</td>
<td>Ask one of the authors of a given paper for access to the raw data of their analysis.</td>
<td>Who we are: Analysis of 10 years of the ED-MEDIA conference</td>
<td>acquisition</td>
</tr>
<tr>
<td>4, W</td>
<td>Find out which EU-funded projects are dealing with a certain topic.</td>
<td>Workplace Learning</td>
<td>information search, information organization</td>
</tr>
<tr>
<td>5, W</td>
<td>Create a new text document that allows synchronous editing, invite two colleagues to the document,</td>
<td>Awareness and Reflection in Technology</td>
<td>authoring, co-authoring, information</td>
</tr>
</tbody>
</table>
assign tasks and start writing the paper.

6, W  Find a suitable conference to publish your paper from task 5.

Enhanced Learning

Awareness and Reflection in Technology

Information search, dissemination

EC-TEL 2010 (conference), Stefanie Lindstaedt (person)

6, M  Find out how many persons from your Research Network are also attending a given conference. Find out how many papers a given person presents and where and when those presentations will take place.

W=AWESOME Web; M=AWESOME Mobile

4.3 Study design
First, the participants were introduced to the overall study design and the aims of the user test. The facilitator explained that the participants could not make errors throughout their processing of the task but that alternative trajectories through the paper prototype would help improving the design and realization of the next prototype. The facilitator informed the participant that not each and any interaction with the paper prototype would yield in a new interface as not all possible states of the interface were modeled in the preparation phase.

All interactions with the paper prototypes and the facilitator were recorded on video. Prior to the user test with the paper prototype, the given task was read to the participants; they were asked to reflect about the task and explain how they would cope with it using their common toolset. At this stage, the participants were able to ask questions about the task and the kind of information they should gather throughout the processing. After this reflection phase, each participant had to answer 6 questions with respect to the task execution using their well-known tools and techniques. The six questions were focusing on the difficulty of fulfilling the task (Question 1), the time exposure needed for fulfilling the task (Question 2), the technology and awareness support existing with the used tool (Question 3, Question 4), as well as the user friendliness of the tool (Question 5) and the perceived effectiveness of working with the tool (Question 6).

Afterwards, they had to process the same task using the AWESOME paper prototype. They were shown the empty dashboard of the web application (task 1-6) or the mobile application (task 7) and were asked to describe the interface in their own words. All interface elements could be touched, resulting in another paper prototype or the facilitator’s hint that the desired action was not modeled for this task. After the completion of the task, the participants were asked the same 6 questions and were asked to provide feedback about strengths and possible improvements of the AWESOME paper prototypes.

4.4 Findings
15 people in all took part in the evaluation. Six paired-sample t-tests were conducted to compare the means of each of the six items in the common working environment and in AWESOME; p-values were adjusted using the Bonferroni correction resulting
in a critical p-value of .008. There was a significant difference in the scores of all items, indicating that AWESOME performed better on all six items (see Figure 5).

The paired-samples t-test indicated that users found tasks significantly less difficult to accomplish with AWESOME ($M = 2.10$, $SD = 0.54$) than with their common toolset ($M = 3.53$, $SD = 1.07$), $t(14) = 5.011$, $p < 0.001$. One participant said AWESOME was “much easier than it is in real life” what made him perceive the given task less difficult.

Moreover, another paired t-test indicated that users felt working on a task significantly less time-consuming in AWESOME ($M = 2.21$, $SD = 0.73$) than with their well-known tools ($M = 4.97$, $SD = 0.77$), $t(14) = 8.472$, $p < 0.001$. One participant mentioned that for a given task only three clicks are needed in AWESOME where he would need much more time with his current tools. The participants also mentioned that the individual workflow was supported by the possibility of having multiple widgets open at the same time what allows for the comparison and re-use of information. This technology support added to their perception of AWESOME being less time-consuming than their existing tools.

The participants felt significantly better supported with technology in AWESOME ($M = 1.83$, $SD = 0.57$) compared to their daily working tools ($M = 4.53$, $SD = 1.09$), $t(14) = 10.011$, $p < 0.001$. The participants mentioned that the technological support they found in AWESOME were “exactly like [they] thought an improved version of the
status quo would be”. The widget-based interface approach was perceived as “easy to learn” and “more flexible than existing tools”.

Also the participants report about a significantly better awareness support in AWESOME ($M = 2.03$, $SD = 0.67$) than compared with their common toolset ($M = 4.81$, $SD = 1.43$), $t(14) = 8.391$, $p < 0.001$. Regarding the support for instant communication with peers and experts, the participants mention the existence of several communication possibilities as being supportive for their awareness. AWESOME was considered as “ingenious tool for researchers especially in the phase of preparing a project proposal” as it connects several “previously scattered information pools” and all necessary information “lie at one’s fingertips”. The “information densification” in AWESOME was seized as major relief and “very good awareness support for even more additional tasks”. In task 6 the participants were given the task to find a publication outlet for a given paper and were presented with a table and map of recommended conferences and workshops. The added awareness support of such a representation was commented by one participant with: “Such a tool would be so helpful: my god, how often was I seeking for something exactly like that.”

The test indicated that the users experienced working with AWESOME significantly more user friendly ($M = 2.30$, $SD = 0.91$) than with their daily working tools ($M = 4.37$, $SD = 1.20$), $t(14) = 6.816$, $p < 0.001$. One participant mentioned that working with AWESOME was “easier than Google and well adapted to the task”. Regarding the widget-based approach the given feedback was that through the mini applications “one single space for all tools” is provided which makes complex tool shifting and media disruptions unnecessary. The participants especially mentioned that the existence of faceted search results would make the navigability in AWESOME more user-friendly and joyful compared to their common toolset.

Finally, the users reported being significantly less efficient with their common toolsets ($M = 3.65$, $SD = 1.22$) than with the AWESOME paper prototype ($M = 1.88$, $SD = 0.62$), $t(14) = 7.051$, $p < 0.001$. Most of the participants felt certain that would be able to solve the given task more or less satisfactorily. Regarding their efficiency however, they felt much more effective using AWESOME than any of their common tools.

During the open feedback after each task, the participants gave valuable directions for further enhancements of AWESOME and the development of widget-based applications in general. For one, some of the participants were not familiar with the concept of widgets at all and where asking for guidance on how to work with such interfaces. In the discussion, the subjects said that a short video introduction into the concept would help them understanding how to interact with the tool. Moreover, each task started with an empty dashboard that showed the sentence “We’ll show your widgets here” (see Figure 2). Many participants were unsure about the meaning of this indication, as they did not recognize immediately where those widgets should come from. The participants suggested visual hints (e.g. an arrow pointing on the ‘Add Widget’ button with the label “Click here to add your first widget”) that would help familiarize with the interface. In some tasks, we provided the participants with pre-configured widget arrangements that aimed at supporting the participants in the execution of the task. While the approach was perceived very useful and supportive, the participants were recommending some kind of widget preview which would support them in looking ahead which widgets would be pre-selected for display instead of having to click and close all shown widget manually. Also they were
asking for different widget-arrangements for different people. One participant called this feature request ‘widget-arrangement pattern’. Such patterns might be useful for several tasks, e.g. when composing a new text document, there might be a widget-arrangement pattern for users that only want to focus on the text (the editor widget would be in full screen mode then), other users might be interested in additional widgets for access control or task management and other users might want to see the editor widget accompanied by some mind map widget.

5. Conclusion
In this paper we explored the relevance of Research Networks and Personal Research Environments for today’s scholars. As scholarly communication is increasingly adapting IT services from outside the organizational boundaries, knowledgeable peers and relevant pieces of information are also becoming a major part of the modern scholarly working environment. Research Networks are continuously evolving socio-technical systems that have to cope with the ever-changing technological landscape in which tools and practices change faster than rigid organizational systems can react upon. Developing IT systems to support users in such moving environments is a challenging task that will undergo continuous adaption to new services and user demands. Widget-based interfaces seem to be a feasible approach to cope with those requirements as they allow the piecemeal annexation of new functionalities.

The paper prototypes of AWESOME were designed based on the awareness issues expressed by a number of researchers in an international awareness study and successfully evaluated with users from the same target audience. They certified that AWESOME was significantly enhancing their awareness about fellow researchers, whole research domains and connections between several information objects. Moreover, the participating scholars could work significantly more efficient and in a more user-friendly way than compared with their existing toolsets. The technological support was perceived significantly better than with existing solutions and users felt working on tasks were much easier and less time-consuming as well. This study presented here has limitations that we are aware of. Firstly, we tested the prototypes with only 15 researchers. Secondly, the prototypes emulated a system that had structured access to many sources of information and made use of a ‘perfect’ recommender system. Thirdly, technically hard-to-solve problems like name disambiguation, named entity recognition and instant access to information were assumed to work properly. Those facts may have influenced the users perception of AWESOME in a positive way, nonetheless all of them pointed out how beneficial such a system would be. The participants gave valuable feedback towards the enhancement of any widget-based dashboard approach that we only became aware of through the evaluation of our paper prototypes with real users:

1. Guide your users through the interface. Explain details that they might overlook.
2. Declare your information sources.
3. Elucidate why your system recommends certain objects.
4. Directly support dedicated activities with pre-defined widget arrangements.
5. Provide different widget arrangements for different types of users.
6. Provide a preview of such widget-arrangements.
6. **Acknowledgements**

The authors would like to thank Christine Plesch (University of Freiburg, Germany) for her support in analyzing the results of the user tests in SPSS. Moreover, we thank all researchers that took part in the user tests.

7. **References**


