

Interview with Beat Signer

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Beat Signer is Professor of Computer Science at the Vrije Universiteit Brussel (VUB) and co-director of the Web & Information Systems Engineering (WISE) research lab. He received a PhD in Computer Science from ETH Zurich where he has also been leading the Interactive Paper lab as a senior researcher for four years. He is an internationally distinguished expert in cross-media technologies and interactive paper solutions. His further research interests include human-information interaction, document engineering, data physicalisation, mixed reality as well as multimodal interaction. He has published more than 100 papers on these topics at international conferences and journals, and received multiple best paper awards.

Beat has 20 years of experience in research on cross-media information management and multimodal user interfaces. As part of his PhD research, he investigated the use of paper as an interactive user interface and developed the resource-selector-link (RSL) hypermedia metamodel. With the interactive paper platform (iPaper), he strongly contributed to the interdisciplinary European Paper++ and PaperWorks research projects and the seminal research on paper-digital user interfaces led to innovative cross-media publishing solutions and novel forms of paper-based human-computer interaction. The RSL hypermedia metamodel is nowadays widely applied in his research lab and has, for example, been used for cross-media personal information management, an extensible cross-document link service, the MindXpres presentation platform as well as in a framework for cross-device and Internet of Things applications. For more details, please visit <https://beatsigner.com>.

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You were the ACM Hypertext 2019 track chair for “User Interfaces and Hypertext Structures”. What were your expectations and your experiences regarding the topics you have received for that track?

It was a pleasure to serve as track chair for ‘User Interfaces and Hypertext Structures’. My expectations were quite high but unfortunately, the number of submissions to our track was much lower than, for example, to the very popular track on ‘Web and Social Media’. While it is nice to see the broad variety of hypertext applications, I think that it is essential to have a critical mass of contributions on the core business of linking and fundamental hypertext structures as well as new forms of hypermedia user interfaces and interaction techniques. However, I might be slightly biased based on my research in that domain.

What is your current primary research interest?

With my research group, I am investigating Cross-Media Information Spaces and Architectures (CISA) and their use in information science. We thereby aim to help people in organ-

ising, refinding and interacting with their information in digital as well as physical space. For this reason, we are developing innovative ways of representing and linking pieces of information across digital and physical information spaces based on the resource-selector-link (RSL) hypermedia metamodel¹. The RSL hypermedia model treats (bidirectional) links as first-class objects which can be used to represent context-dependent navigational as well as structural associations between entities.

In addition to the representation, linking and storage of information, we deal with the context-sensitive adaptation and cross-media transclusion of content. We are researching information concepts for the realisation of open and fluid cross-media information spaces where parts of documents can easily move between different mobile devices and where different heterogeneous data sources can be integrated. Our domain-specific RSL-based models enable new forms of personal information management as well as innovative document navigation such as in our MindXpres² platform for next generation presentation solutions. Based on a data-centric approach, we are further interested in next generation user interfaces enabling innovative forms of human-information interaction that go beyond the classical WIMP metaphor. Thereby, we are not only investigating new digital user interfaces but do also explore the possibilities for dynamic data physicalisation based on our recent Tangible Holograms (TangHo) platform.

Please tell us about your vision in this field of research.

While we have managed to address cross-media linking, flexible document representations as well as cross-media user interfaces based on the very same RSL hypermedia metamodel, we still get a fragmentation of information across different application instances and their corresponding RSL-enabled data stores. Therefore, our vision is that the necessary hypermedia functionality should no longer be implemented on top of existing file systems, but bidirectional navigational as well as structural links should be natively supported through an RSL-enabled associative file system³. As a result, documents no longer have to be stored as monolithic containers, but a hypermedia engine can provide access to the internal document structure represented via structural links. Any third-party application can further make use of the shared underlying hypermedia store for keeping track of application-specific metadata. For example, when a user saves an email attachment, a bidirectional navigational link could be automatically generated by the email client and the file explorer application could make use of this link metadata to show the corresponding email when a user later accesses the stored attachment.

By offering new tools for the flexible management of content in cross-media information spaces, we might have to reconsider the role of a document which just becomes a specific view of parts of the underlying shared graph of content fragments. An RSL-enabled associative file system would further enable cross-media transclusion as well as context-aware adaptive document structures and stimulate some discussions and further research

¹Beat Signer and Moira C. Norrie. *As We May Link: A General Metamodel for Hypermedia Systems*. In Proceedings of ER 2007. https://doi.org/10.1007/978-3-540-75563-0_25

²Reinout Roels and Beat Signer. *A Conceptual Framework and Content Model for Next Generation Presentation Solutions*. PACMHCI, 3 (Issue EICS). <https://doi.org/10.1145/3331149>

³Beat Signer. *Towards Cross-Media Information Spaces and Architectures*. In Proceedings of RCIS 2019. <https://doi.org/10.1109/RCIS.2019.8877105>

on innovative forms of cross-media information management in the hypertext, document engineering as well as the personal information management community.

What is the relevance of hypertext research for cross-device and cross-media projects?

Hypertext and hypermedia research is highly relevant for cross-media solutions where content should not only be accessed via different types of media, but where it should also be possible to seamlessly move between different media types. While this seamless transition can be enabled via navigational hyperlinks, complex cross-media document structures as well as cross-media transclusion might be realised via structural hyperlinks. In our own research, we have for example developed an RSL-based extensible cross-document link service enabling the integration and transclusion of content across arbitrary document formats as well as third-party applications via specific data and visual plug-ins⁴. In a similar way, hypertext structures can be used to navigate across different devices or to compose the loosely coupled user interface components of distributed user interfaces.

Would you briefly outline your personal view about how hypertext has evolved over time?

My personal opinion is that since the introduction of the Web, there has been a constant move away from traditional hypertext research to more applied and web-related research. While in the early days the hypertext community has been working intensively on different hypertext models and systems, we see less of this work at recent Hypertext conferences. Despite the fact that we never managed to realise many of the promising visions of early hypertext pioneers, there seems to be less work on fundamental hypertext research. I experience a shortage of visionary ideas and shared efforts on long-term research agendas.

Do you see a close relationship between recent developments achieved by the electronic literature community and “traditional” hypertext research?

The electronic literature community can still learn more by studying some of the early work of hypertext pioneers such as Ted Nelson and Doug Engelbart. Right from the beginning, Nelson saw the computer as a tool for non-sequential forms of reading and writing based on the Xanadu document model and its rich concepts of bidirectional links, transclusion and version management. However, most of today’s digital document formats are “simulating paper” based on the WYSIWYG (What You See Is What You Get) principle and are therefore not fully embracing the new opportunities offered by digital media. It is definitely time for a remediation of existing “paper simulation” approaches informed by hypertext-enabled structural cross-media models⁵.

⁴Ahmed A.O. Tayeh, Payam Ebrahimi and Beat Signer. *Cross-Media Document Linking and Navigation*. In Proceedings of DocEng 2018. <https://doi.org/10.1145/3209280.3209529>

⁵Beat Signer. *What is Wrong with Digital Documents? A Conceptual Model for Structural Cross-Media Content Composition and Reuse*. In Proceedings of ER 2010. https://doi.org/10.1007/978-3-642-16373-9_28

What is special about hypertext? What role does hypertext have within computer science?

I do not consider it absolutely necessary to offer a dedicated course on hypertext and hypermedia in a Computer Science curriculum. However, I think that it is vital that students get in contact with the seminal work of Vannevar Bush, Doug Engelbart and Ted Nelson! Only if they learn about the rich concepts and the vision of these early pioneers, they can understand some of the limitations of the Web, state-of-the-art word processors or hierarchical file systems, get inspired for future innovation, and discover other areas in Computer Science where some of these hypertext concepts have been applied. Therefore, I do not only discuss the history of hypertext and hypermedia in my course on ‘Web Technologies’, but in a course on ‘Next Generation User Interfaces’ I also highlight how hypermedia-enabled information architectures support innovative forms of human-information interaction.

If you had the choice, would you disinvent any technological advancement?

As a researcher, I do not think that we should disinvent any technological advancement. It is often not the technological advancement itself but the wrong use that might lead to some problems. For instance, while the majority of people might agree that the invention of email was a great achievement, the wrong use of emails can, for instance, lead to reduced productivity due to the continuous interruptions by notifications of incoming emails.

Well, on a second thought, we should disinvent hydraulic fracturing (fracking) and other technologies that are polluting and destroying our environment—and certainly any technologies for weapons of mass destruction!

What will be the next big thing in IT technology in general?

As Alan Kay stated in the 1970s “*the best way to predict the future is to invent it*”. So based on our own research, I strongly believe that augmented reality (AR) will become one of the next big things in IT technology. While Pokémon Go brought a simple form of see-through augmented reality to a large audience, recent developments in wearable AR solutions such as Microsoft’s HoloLens in combination with emerging standards like WebXR will lead to a widespread use of AR in business, leisure and entertainment. This will be the perfect platform for further realising Doug Engelbart’s vision to augment the human intellect through human-technology teamwork as envisioned by Don Norman. The good news is that while most people focus on the necessary AR hardware solutions, I think that a major challenge will be the development of an infrastructure providing all the necessary linked data and services for the concrete augmentation process, and that is where hypertext and hypermedia research can play a major role in the near future.

Dr. Claus Atzenbeck (<http://www.atzenbeck.de>, [@clausatz](https://twitter.com/clausatz)) holds a professor position at Hof University, Germany and is leading the Visual Analytics research group at the university’s Institute of Information Systems (<https://www.iisys.de>). His research interests in the field of hypermedia include spatial and navigational structures, spatial and temporal parsing for spatial hypertexts, and hypertext narratives. A specific focus of his work is on intelligent user interfaces for visual analytics. Dr. Atzenbeck has been involved in various tasks for the

previous European Seventh Framework Programme (FP7) and the current European Programme Horizon 2020 including serving as an expert reviewer for proposals or as a collaborating researcher on projects.

Furthermore, Dr. Atzenbeck is an active member of the hypertext community. As such, he is taking part of the SIGWEB Executive Committee as a member at-large, served as general co-chair of the 30th Anniversary ACM Hypertext Conference 2019 in Hof, Germany (<https://human.iisys.de/ht2019/>, [🐦 @ACMHT](#)), is co-organizer of the HUMAN workshop series (<https://human.iisys.de/human/>, [🐦 @HUMAN_HT](#)), and the initiator of the Historic Hypertext Project (https://human.iisys.de/hist_HT/, [🐦 @hist_HT](#)).