

DESRIST 2008 Program Abstracts

DESRIST 2008 Doctoral Consortium – May 7, 2008 (Georgia State)
Supported by National Science Foundation and Pennsylvania State University

PE00: Doctoral Consortium (8:30 am – 5:30 pm)

Chairs:

Sandeep Purau (Penn State University)
Ying Zhu (Georgia State University)

Faculty Mentors

Carliss Baldwin (Harvard Business School)
Al Hevner (University of South Florida)
Jan Pries-Heje (Roskilde University, Denmark)
Brian Smith (Penn State University)
Veda Storey (Georgia State University)

The Animated Work Environment: A Vision for Working Life in a Digital Society, **Henrique Houayek** (Clemson University)

Abstract Dramatic transformations in the nature, place and organization of working life in the United States suggest a redesign of the work environment as a socially and technologically responsive system occupying both home and office. Emerging characteristics for new ways of labor are defined less by standardized behavior and more by multiple shared group activities with information exchange and human interaction. Work activities have become more than just the completion of specific tasks; instead, these are now characterized by an overlapping process of work, study, and leisure.

In response to these conditions, our transdisciplinary team (from Architecture, Robotics, Sociology and Human Factors Psychology) asks: (1) How can Intelligent Systems, Information Technology and Robotics become design elements in the creation of work environments? (2) How to design technological spaces supporting positive human interaction? (3) What are the metrics to evaluate such a project?

Our “Animated Work Environment” [AWE] is an environment-as-responsive-robot: an articulated, programmable, interior environment accommodating a range of digital technologies that facilitates productivity, connectedness and innovation across fluid assemblages of people working with printed and digital materials in a variety of locations and settings. AWE sits technologically at the interface between computer technology, robotics, and architectural design, where the physical environment is also subject to manipulation. The AWE project involves designing, prototyping, demonstrating and evaluating a fully operational workspace which uses robotic components to achieve certain levels of responsiveness and adaptation to support different work configurations.

In developing AWE, the team investigates why, how and what computing possibilities and robotics can contribute to work spaces towards generating a new vision for working life in a digital society. Our research is in part inspired by William Mitchell’s vision that our buildings will “become...more like us. We will continually interact with them, and increasingly think of them as robots for living in.” Featuring a continuous, morphing surface controlled by a user-friendly interface, AWE is characterized as adaptive and robust when applied to a range of work activities and working populations currently not accommodated by robotics, architecture or interface-design alone. The AWE prototype can reasonably be expanded to the scale of a room having walls and ceiling altered in response to users’ demands or environmental stimuli.

The effectiveness and continuity of enterprise architecture, **Marlies van Steenbergen** (Sogeti Netherlands and Utrecht University)

Abstract **Research question.** The topic of the Ph.D. research is the effectiveness and continuity of enterprise architecture in the field of Information Systems. Enterprise architecture, the application of principles and models to guide the design and realization of processes, information systems and technological infrastructure, is seen by many as a means to make complexity in IS manageable. For this promise to come true, sound architectural practices, by which we mean the whole of activities, responsibilities and actors involved in the development and application of enterprise architecture, have to be implemented. We aim to answer the question “How can architectural practices achieve effectiveness and continuity?”. This is translated into the following sub-questions: (1) What goals, tasks and responsibilities is the architecture practice comprised of? (2) Do different types of

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organizations require different approaches to the architecture practice? (3) How can the effectiveness of the architecture practice be measured? (4) What factors provide continuity of the architecture practice for various types of organizations? and (5) What kinds of interventions lead to improvements in architecture effectiveness?

Methodology and results so far. A mixed method approach is adopted, including design research, case studies, action research, and surveys. Design research is applied in the development of instruments to measure various aspects of architectural practices. The instruments are tested and refined in one or more case studies. They are applied to conduct an in-depth action research study of the architecture practice within a multinational financial institution. A survey will be done to complement this in-depth insight with an overview of the state of architecture maturity over many organizations.

Thus far, design research has been conducted delivering two instruments: the Architecture Maturity Matrix and the Architecture Effectiveness Model. A case study exploring the relationship between organizational aspects, architecture maturity and architecture effectiveness is in progress. The action research in architecture practice is in the initiating stage.

Learning Profiles from User Interactions, **Pelin Atahan** (The University of Texas at Dallas)

Abstract Personalization and recommendation systems play an important role in online business settings. They increase customer retention and loyalty by providing enhanced personalized services, and improve the profitability of firms by deploying targeted marketing strategies and exploiting cross-sell and up-sell opportunities. An important determinant of the performance of these systems is the reliability of the user profile available to the system. Prior research on learning user profiles has focused on learning sets of terms (i.e., feature vectors) that best describe documents or web pages liked by a user. However, such profiles are not particularly useful in identifying products and services that a firm should advertise to its users. Profiles consisting of demographic, psychographic, and behavioral characteristics of users are more relevant for such purposes.

We develop a technique that a firm can use to implicitly learn such a profile based on a user's web traversals. We compare the proposed model's performance with well-accepted classification techniques using real-world data on sites visited by users. We find that the performance of the proposed model is as good as, and often better than, other established classification techniques.

We then extend our analysis to show how a firm can expedite learning a user's profile by dynamically determining the set of links to be made available to the user, referred to as the *offer set*, at each interaction. We refer to this learning approach as *active profile learning*. The set of links that is more informative in terms of inferring the profile attribute values are determined and made available to the user at each page. We present a technique for determining the optimal offer set for each page visited by the user. We also develop a heuristic approach to determine the offer sets in an efficient manner for when the number of potential offer sets to evaluate are large.

A Conceptual Modeling Method to Use Agents in Systems Analysis, **Kafui Monu** (University of British Columbia)

Abstract There are many system analysis and design methodologies that represent events and processes. However, none include or analyse the assumptions behind the processes or the context of the events. It has been proposed that the conceptual agent may act as a new concept that system analysts can use to better represent the domain. Unfortunately, there is much confusion about how agents interact, and the mechanism of their behaviour.

We propose that by conceptualizing the agent as a feedback system, that a new system analysis methodology, called the conceptual agent model (CAM) methodology, can be developed. We propose that this new methodology will be able to aid modellers in explaining the processes in a domain and why certain events occur in a domain. However, we must not only develop this design artifact but also test it. To create the methodology and validate it we divide our proposed study into three essays which will: provide a precise definition of agents (essay 1), create a methodology of using the conceptual agent concepts (essay 2), and test the methodology's usability, usefulness, and quality (essay 3).

We have begun our study and currently have developed conceptual models of conceptual agents, analysed the constructs in relation to other agent methodologies, and compared the CAM constructs to those developed by novice modellers to create conceptual agents. We have found that the novice modeller's understanding of an actor in a domain is similar to the CAM constructs and that the CAM constructs explicitly represent agents as defined by other researchers. We have also developed part of the methodology for CAM and tested it.

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For future research, we can conduct a larger empirical test of the usefulness of the method . We are also interested in using this work to analyse work systems in non-business areas such as government.

Developing Computational Tools that Facilitate Individual and Group Creativity, **Brittany Smith** (University of Illinois at Urbana-Champaign)

Abstract A considerable amount of research has been conducted in order to explore and define creativity, and there has been much work exploring how computers are and can be used to support the creative process. I am interested in working within the intersection of these spaces by developing computational tools that help facilitate both individual and collocated group creativity within two particular domains: design and computer programming. Designers typically use pencil and paper when generating early ideas because paper can be easily and quickly accessed and is very flexible; however, computers provide some affordances that pencil, paper, and other traditional mediums do not effortlessly provide such as the ability to interact with one's ideas, easily modify one's ideas, and easily store and transmit one's ideas to others if so desired. Such interactions have the potential to positively affect the creative process. Computer programmers, on the other hand, use computers extensively. However, many of the tools that have been developed to aid in the programming process are designed with the idea that only one user will be utilizing the tool at once. This is increasingly not the case with the adoption of paired programming and other team software development techniques, and this lack of proper support could be affecting programmers. With the above notions in mind, I submit that there are many ways yet to be actualized in which computers can help individuals and groups to not only record ideas and solutions but aid in creating and better conveying these ideas and solutions as well.

Both the use and the functions of sketching for designers have been explored, and earlier work shows that sketching is a useful tool during the early stages of design. I am interested in utilizing and expanding upon this research by augmenting and studying the use of computer-based tools that provide sketching capabilities in addition to other functionalities that assist and enhance the creative process. One such functionality, in a tool with which I am currently working, is the ability to work on multiple ideas in parallel, which allows designers to better re-interpret existing ideas and thus generate better ideas and products.

My focus is a little different in the computer programming domain. As noted above, programmers are increasingly utilizing the paired programming development framework, which means that not one, but two individuals are using one machine and one integrated development environment (IDE) at once. There have yet to be many software tools developed that seek to make this setup less awkward. There is, consequently, a need for computer tools, and specifically IDEs, to help make the programming environment more conducive to paired work, that aid in improving communication and work flow between the programmers, and that enhance the programmers' creative output. I am currently exploring how best to modify these IDEs in order to both retain and add to the advantages of the pair programming practice.

Modeling Service Systems to Support their Analysis and Design, **Lysanne Lessard** (University of Toronto)

Abstract Services, once considered a residual economic activity of the manufacturing sector, have come to play a major role in our economy. Researchers have started to investigate the paradigmatic changes at play in the service sector, but these efforts have yet to result in strong theoretical constructs. There is thus a need for integrated theories and models of modern services that can act as an effective bridge between the understanding of services throughout their lifecycle and the design of Information Systems able to facilitate stakeholder interactions and service adaptation. In order to explain the principles governing modern services beyond existing management and economic frameworks, theories need to be inductively generated from empirical research.

My research project aims to use methods and theoretical insights from social sciences to develop conceptual models of services suitable for Service-Oriented Information Systems design. This aim is structured around three objectives: 1) analyze real-world instances of service design projects using a framework derived from social sciences, 2) incorporate knowledge gathered from the analysis into descriptive and analytical conceptual models of services, and 3) assess the ability of the models to lead to the design of Information Systems able to support the creation and evolution of services.

Services are often described as being co-created at the time of their delivery to end users by a service provider. But this interaction is extended when the service provider designs its service with the help of a consulting firm. A chain of services is then recognizable, from the contractual service between the consulting firm and the service provider to the transactional service between the later and the service end user. While this complete chain of co-creation must be accounted for in order to understand how and why services are designed and evolve, my study

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focuses on services as they are being co-created by the consulting firm and its customer. As such, focusing on service design projects may shed light on the complete lifecycle of services.

To adequately express the process of service design, the nature of the resulting service and its perceived value by those involved, current modeling approaches such as agent orientation will be adapted. The method of grounded theory will guide a systematic analysis of service design projects, ensuring a strong cohesion between the conceptual models and the phenomena they try to express. Participant and peer validation will be used to refine conceptual models and reflect on their descriptive, analytical and design capabilities. The resulting conceptual models of service systems will contribute to the field of Information Systems analysis and design by proposing extensions to current conceptual modeling approaches leading to Service-Oriented Information Systems design.

Improving Design Intent Research for Software Maintenance, **Paul Grisham** (The University of Texas at Austin)

Abstract Managing system evolution is one of the fundamental problems of software engineering. A system is the result of a long design process during which various design trade-offs and decisions about both functional and non-functional requirements are made. In the process of abstracting actual requirements into models and converting those models into code, only the end result of the design process is reflected in the code, leaving the designers' intent to be represented, if at all, in some form of external documentation.

A *descriptive software architecture* is a model of the current, implemented architecture of a system in a non-prescriptive, non-normative manner. Although certain emergent properties of a particular design, such as an architectural style, can be explicitly expressed in some architecture languages, in practice, such properties are often only implicitly represented. A *prescriptive architecture* provides guidance for implementation of the system. The prescriptive architecture for a system captures the intentional design qualities for the system and may express a normative view of subsequent design considerations.

We define *architectural drift* as the divergence of the implementation from the prescriptive architecture. Architectural drift may begin early in the initial implementation and can only become exacerbated during post-installation maintenance and system evolution. In practice, it is often only the code itself that is kept current with respect to the requirements and the design. *Architectural erosion* occurs when changes in the descriptive architecture violate critical constraints in the prescriptive architecture. Violating these constraints erodes the coherence of the design and may yield errors or make additional changes more expensive. Architectural drift often leads to architectural erosion, which means that without up-to-date documentation, starting with a good initial design only delays erosion.

To ameliorate the problem of design erosion, research into explicit models of *Design Rationale* has been increasing. Moreover, the revision of IEEE-Std-1471-2000, "IEEE Recommended Practice for Architectural Description of Software-Intensive Systems" may include explicit representation for design decisions as first-class entities. Despite the current flurry of research activity, it became clear that as researchers, we lacked the instruments for evaluating the effectiveness of various rationale and design decision modeling systems, for comparing these systems to each other, and for using these analyses to drive future research.

The goal of this research project is to develop a better understanding of the documentation needs of maintenance designers for software systems and to build a model of how those maintenance designers interact with knowledge about legacy designs. To accomplish this goal, we propose a course of empirical study that uses surveys, expert interviews, talk-through protocol analysis, and ethnography as the basis of a theory of maintenance design. The theory will be tested using experimentation by protocol analysis and validated through further ethnography in real-world industrial contexts. In particular we are investigating the differences in how initial designers and maintenance designers interact with the design space, and what the role of experience is when interacting with legacy design artifacts.

How to embody digital information into product interfaces, **Heekyoung Jung** (Indiana University)

Abstract **Background:** While conventional computers or information appliances have been typically manipulated through screen-based graphic user interface, interfaces of recent interactive devices have become diversified into different forms such as touch screens, smart materials, and physical controllers. Introduction of dynamic relations between information and interface have opened up new design opportunities in terms of product aesthetics and usability. However, at the same time, they have brought problems of cognitive overload or confusion to users from arbitrary couplings between information and interface. As information is embodied into visual or

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physical interfaces of various products, characteristics of information and user activities should be reflected in interface considering appearance, symbolic meaning and context of product.

Research objectives and questions: This study aims to *explore new interaction design factors* to represent unique characteristics of information into everyday objects in various contexts of use. The study also includes discussions about *how to evaluate their influences* on product design and user experience. Followings are specific research questions:

- What types of design factors can we explore for intuitive interaction with digital information?
- Which of them (new design factors) can users control or perceive as product interface?
- How can we match new design factors to appropriate types of information and tasks?
- How can we evaluate influences of those new interaction design factors?

Research plans and ideas: As a systematic approach for exploring new interaction design factors, we suggest an interaction model. Referring to Chris Crawford's listening-thinking-speaking model, we specified unit modes of interaction between user and interactive product into user's input (action), data, data processing (or task) and object's output (response). Then we exemplified some possible design factors for each unit mode. Based on this framework, we will create new types of interactive products by combining different factors of unit modes. Such case studies are expected to provide a common ground for designing new forms of interactive products considering tight couplings between information and interface.

Designing Deeply Engaging Online Communities for Adolescents, **David Gurzick** (University of Maryland, Baltimore County)

Abstract For many of those who are connected to the Internet, online communities have become a staple of modern life. Though it is only within the last few decades that they have become mainstream, recent years have seen an increase in both the number and type of people who use them. One group that has experienced considerable growth in their use of online communities is American adolescents (which, at the time of this study, are those aged 12-18, and born in the years 1988-1994). They are characterized by a hyper-connected lifestyle and constitute the sub-population with the largest number of members online, using mobile phones, and participating in socially based e-services. However, though members of this group are among the largest consumers of online communities, it is unknown whether the current understanding of online community design applies to the design of communities specific to adolescents.

This study looks to bridge this gap, presenting a research strategy for addressing, 1) In what ways does an online community, designed in accordance with existing best practices, succeed or fail when used by a population of adolescents, and 2) How might best practice be emended by new theories and guidelines for the design of adolescent online communities? This strategy follows a design science approach centered on the detailed investigation of an adolescent-centric online community as it progresses through an iterative design.

Two broad stages are identified for this research, each consisting of a build/evaluate cycle of an online community artifact. In the first stage, an online community for adolescents will be created and evaluated in accordance with existing design guidelines. As a better understanding is constructed on how an adolescent population responds to existing design practices, this research will move to create theory to explain the phenomena that are discovered and to suggest improvements for any uncovered deficiencies. The second stage will allow for the evaluation and refinement of those theories that emerge from the first stage that might offer improvement to the existing design guidelines. Within this stage, these theories will be codified into modifications to the online community artifact. To explore the effects of the new design theories, a study using new participants will compare the redesigned online community (modified according to the refined guidelines) and a replica of the previous existing online community (designed around current best practice). The results of this second stage will be incorporated into refinements to the design theories, with the resultant refined theories organized and presented in terms of design guidelines for online communities for adolescents.

By evaluating, and possibly improving, the guidelines from which this type of online community is created, the future development of such systems in practice can be better informed. Moreover, investigating the design of online communities for a population that is, in many ways, divergent from those populations that underpin the current understanding of design, may lead to new and novel ways of approaching the design of online communities in general. Such conceptual understanding might have far reaching results, leading to the creation of more sustainable and effective online communities.

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Facilitating and measuring older people's creative engagement in a user centred design process, **Helena Sustar** (City University of London)

Abstract Interfaces and products are usually designed for a broader market and general use by younger users. In the classic design process older people are rarely involved. If they are, they are brought in for focus groups or at the end of the design process as participants in usability tests. Despite the fact that there is existing research that (a) looks at the involvement of older people in participatory design activities and (b) supports the creative potential of older people, there is no research that looks at combining the two themes i.e. ways of facilitating and measuring creative involvement of older people in participatory design activities. The goal of my research is to address this limitation in the research of the relationship between creativity and age in the user centred design (UCD) process for user interfaces. As a first step I wanted to check whether classic UCD techniques could initiate creative engagement. To achieve this I used UCD methods to design a simple and intuitive interface with technology and wireless media to the stage of mock-up model. The main interactions happened between the user and device with touching the “plants” – gadgets, and changing their position in the device. This mock-up model has been used in a creative process as a stimulator of new ideas. Three different age groups of users were chosen: students (23+), older people in their sixties, and older people in their eighties. A series of interviews based around interacting with the mock-up model were conducted (see photos). We tried to find out how familiar the participants were with certain parts of the device and how they will use different pieces of the model in a new innovative way. In addition, we asked them to use a model in different situations: having a conversation with a friend, taking medicine, being reminded of daily activities, managing the household (smart house) and thinking how a device could provide different services to support these situations. I was especially interested to find out: (a) what was the role of the model in stimulating new ideas, (b) what kind of ideas the model generated and (c) what were the main difficulties that block creativity. The results of the qualitative research showed that the mock-up model was able to stimulate ideas at all age groups. New ideas were stimulated by the participants’ interaction with it, from the mock-up model as visual presence, the participant’s existed experience and from environment that sounds participant. The only differences in define age groups were in way how participants generated ideas.

Supporting Scenario Generation in Product Design, **Irene Anggreeni** (University of Twente, Netherlands)

Abstract Designing consumer products has grown more challenging due to the increasingly complex characteristics of these products. Consequently, product design has recently turned to scenario based design to address this challenge. Scenario based design is originally a heuristic method that arises from computer system development. The main idea behind scenario based design is to use concrete descriptions of people using technology, referred to as scenarios, to discuss and analyze how the technology could fit into their activities. Scenarios have promising qualities to help a project team formulate, communicate and evaluate design ideas with stakeholders early on. Despite the potentials, available scenario approaches mostly address the high-level use of scenarios and therefore often miss the low-level guidance for identifying, creating and communicating the scenarios. We believe that a scenario generation support tool could aid designers by providing a framework to create, use and organize their scenarios as an integral part of designing.

There exist scenario-related support tools that provide more prescriptive steps towards the construction of scenarios (e.g. [1, 2]). However, they are often focused in specific activities such as the capture and collection of design requirements. The application of scenarios could be more useful when they are created, maintained and reused throughout a design process. Therefore, this research started broad by studying scenario uses from theoretical as well as practical point of view. Six categories of scenario uses over different design phases have been identified. This categorization was used to identify the difficulties currently experienced by designers in practice. Furthermore, designers will be given an active role in the concept development of the support tool. In the end, the success measure of the project will be whether the designers find the support tool useful in their practice and whether it helps them to design better products.

This research is expected to contribute in an understanding on how product designers can entangle the chaos of designing by structuring their rationales and using scenarios to register them. As an illustration, consider the complexity of nowadays consumer products, in which a single product is often designed to have many functions to accommodate diverse users in different settings. Designing such a product requires the design team to deal with an enormous amount of relevant, yet not uncommonly contradicting design aspects at once. The scenario generation support tool will be developed to give method guidance to the process, specifically focusing on generating ‘useful’ scenarios. The generated scenarios will construct a frame of reference for the designers to deal with all relevant design aspects.

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DESRIST 2008 Day 1 – May 8, 2008 (The Westin Buckhead Atlanta)

PE11-2: Keynote: Charles Eastman (Georgia Institute of Technology) (9:30 – 10:30 am)

“The Philosophy of Design Science”

DESRIST 2008 seeks to focus on the development of design science researchers. Our Keynotes, Invited Speakers, and Panels discuss areas of advanced research designs, methodologies, empirical issues, epistemology and the dissemination of knowledge, as specifically embraced by Design Science Research approaches. In particular, we envision these sessions to constitute a Philosophy of Design Science track that will informally focus the expertise of all DESRIST 2008 attendees on the needs and development of the research students.

Sessions Coded as P (as in P132-A) are components of The Philosophy of Design Science Track.

Sessions Coded as PE (as in PE11-2) are components of The Philosophy of Design Science Track as well as the Exemplars Track.

Sessions Coded as E (as in E14-2B) are components of the Exemplars of Design Science Track.

P12-A: Advancing DS Approaches (11:00 am – 12:30 pm)

Session Chair: **Juhani Iivari** (University of Oulu)

Theory Development in Design Science Research: Anatomy of a Research Project by **Bill Kuechler** (University of Nevada, Reno) and **Vijay Vaishnavi** (Georgia State University) (Nominated for Best Paper Award)

Abstract The common understanding of Design Science Research in Information Systems (DSRIS) continues to evolve. Only in the broadest terms has there been consensus: that DSRIS involves, in some way, learning through the act of building. However, what is to be built – the definition of the DSRIS artifact – and how it is to be built – the methodology of DSRIS – has drawn increasing discussion in recent years. The relationship of DSRIS to theory continues to make up a significant part of the discussion: how theory should inform DSRIS and whether or not DSRIS can or should be instrumental in developing and refining theory. In this paper we present the exegesis of a DSRIS research project in which creating a (prescriptive) design theory through the process of developing and testing an IS artifact is inextricably bound to the testing and refinement of its kernel theory.

The Use of Focus Groups in Design Science Research by **Monica Chiarini Tremblay** (Florida International University), **Alan R. Hevner** (University of South Florida) and **Donald J. Berndt** (University of South Florida)

Abstract Focus groups to investigate new ideas are widely used in many research fields. The use of focus groups in design science research poses interesting opportunities and challenges. Traditional focus group methods must be adapted to meet two specific goals of design research. For the evaluation of an artifact design, exploratory focus groups (EFGs) study the artifact to propose improvements in the design. The results of the evaluation are used to refine the design and the cycle of build and evaluate using EFGs continues until the artifact is released for field test in the application environment. Then, the field test of the design artifact may employ confirmatory focus groups (CFGs) to establish the utility of the artifact in field use. Rigorous investigation of the artifact requires multiple CFGs to be run with opportunities for quantitative and qualitative data collection and analyses across the multiple CFGs. In this paper, we discuss the adaptation of focus groups to design science research projects. We demonstrate the use of both EFGs and CFGs in a design research project from the health care field.

Dissemination and Importance of the "Method" Artifact in the Context of Design Research for Information Systems by **Tobias Bucher** (University of St. Gallen, Institute of Information Management) and **Robert Winter** (University of St. Gallen, Institute of Information Management)

Abstract During the last decade, design research (DR) has evolved into a key research paradigm in information systems (IS). DR for IS is aimed at creating solutions – so called "design products" or "artifacts" – to

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problems of practical relevance. From a product perspective, these artifacts can be distinguished into the five types "constructs", "models", "methods", "instantiations", and "theories". This paper analyzes the proceedings of the First and Second International Conference on Design Science Research in Information Systems and Technology (DESRIST) and categorizes the presented papers in regard to the topics covered. It turns out that the "method" artifact is addressed least frequently. Moreover, almost all DESRIST publications which do address the "method" artifact describe the design of some kind of algorithm or mathematical/statistical technique. The "method engineering" (ME) discipline is concerned exclusively with the processes of constructing, adapting, and implementing generic methods that are aimed at the design of socio-technical information systems. However, explicit references to the ME discipline and its body of literature are used rarely – if at all – in the DESRIST proceedings. To overcome this gap, this paper briefly introduces the principles of the ME approach. Moreover, it discusses potential reasons for the lacking integration of DR for IS on the one hand and the ME approach to IS development on the other hand. The paper argues that the transfer and application of the basic ideas of the ME discipline hold a strong potential of bringing forward the DR paradigm.

Goal-Framing and Breakdowns in the Design of Boundary-Spanning Information Systems by **Susan Gasson** (Drexel University)

Abstract It is argued that design groups which span organizational boundaries are becoming increasingly common and present a unique problem for information system design. Such groups attempt to integrate design understanding across many different domains of expertise and knowledge. This means that no one design group participant is likely to understand either the problem domain or the solution domain in full. This paper critiques traditional and emerging process models of design, in terms of their applicability for boundary-spanning design groups. Findings from studies of boundary-spanning design groups were synthesized across multiple levels of analysis to present an integrated model of design for such groups. The model builds on the notion of technological frames, to develop a theory of framing at the three levels of project coordination, group consensus-building, and individual learning and dissonance.

E12–B: Invited Papers – NSF Science of Design Projects (11:00 am – 12:30 pm)

Session Chair: **Atish Sinha** (University of Wisconsin-Milwaukee)

Self-Adaptation in Software Agents: An Initial Case Study in Game-Playing Agents by **Ashok K. Goel** (Georgia Institute of Technology), **Joshua Jones** (Georgia Institute of Technology), **Christopher Parnin** (Georgia Institute of Technology), **Spencer Rugaber** (Georgia Institute of Technology) and **Avik Sinharoy** (Georgia Institute of Technology)

Abstract As the task environment of a software artifact evolves, so must its design. For example, as the task environment in a computer game evolves, so must the design of the software agent that plays the game (or the agent's behavior is likely to become more suboptimal than before). We are exploring how a software artifact may adapt itself as its task environment evolves incrementally. In particular, we are investigating how a game-playing agent may adapt itself as the percepts, actions, rules and constraints of its environment evolve from one version of the game to the next. A core research question in our work is what must an agent know about its design so that it can identify and make the right self-modifications to meet the needs of the new task environment? Our hypothesis is that the agent's self-knowledge of its teleology (i.e., the mechanisms by which its design achieves its functions) may support the process of self-adaptation. In this paper, we describe the preliminary design of an interactive environment called GAIA in which a human game engineer and a game-playing software agent cooperatively adapt the agent's software design and program code. As the game-playing agent uses its self-knowledge of its teleology to identify modifications to its design and code, the game engineer may (or may not) accept specific modifications and thus guide the process of self-adaptation. We also illustrate a first, simple example from FreeCiv, an interactive turn-based strategy game, at a high-level of specification.

Designs Can Talk: A Case of Feedback for Design Evolution in Assistive Technology by **William Robinson** (Georgia State University)

Abstract Design science researchers gain insights and make improvements on their designs, as they are applied in natural contexts. Software artifacts are particularly useful design instantiations because feedback can be

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obtained directly from the artifact. A software design talks to its designers.

We illustrate software design feedback with a case study in assistive technology (AT). A specialized emailing system was designed for cognitively impaired patients in an effort to decrease their social isolation, which often occurs after a brain injury. The patients continue to expand their email system usage, which is remarkable for AT. We attribute this unusual success to the feedback obtained directly from the software, through monitoring user goal models. Such monitoring has allowed the designers to understand and evolve their designs to meet the changing user needs. It illustrates how an operational artifact, like software, can drive design evolution faster than artifacts that are more static.

Adaptation Architectures by **Kevin Sullivan** (University of Virginia)

Abstract The complexity of emerging software-intensive systems, and the complexity and dynamism of the environments in which they are developed and operated, are growing to unmanageable levels. We now even foresee the emergence of *ultra-large-scale* (ULS) systems, which are project to be so complex that developing them will be unmanageable with the current scientific, engineering and managerial paradigm of largely centralized control and substantially top-down development [ULS]. Notwithstanding some important progress away from traditional methods, such complex systems will nevertheless still require significant advances beyond the current state of the art in design theory and methods. As the U.S. President's Council of Advisors on Science and Technology (PCAST) put it, "As software's complexity continues to rise, today's... problems will become intractable unless fundamental breakthroughs are made in the science and technology of software design and development [PCAST]."

In this paper we focus on the need for fundamental advances in the particularly important discipline of software and software-intensive systems architecture. While recognizing that many important advances that have been made, we see advantages in exploring a significant change in perspective to support *design for adaptation* of complex software-intensive *ecosystems*. In this paper we outline one promising direction and summarize evidence developed to date in support of ongoing work in this direction.

PE-Plenary Speaker: Subu Goparaju (Infosys) (1:30 pm – 2:00 pm)

Enterprise IT – Quo Vadis?

IT is playing an increasingly important role in making business agile and innovative. CIOs are moving away from reactively aligning IT with business and are proactively synchronizing IT with business. The best practices powering agility and faster innovation include globally distributed work models that engage talent across the world, best of breed pre-configured industry vertical and business function specific IT platform solutions, and transaction based pricing models for generic IT capabilities. While most organizations are leveraging some or all of these practices, only a few have realized their full potential. IT organizations today leverage global talent for cost reduction but only a few have harnessed them for innovation. Agility is provided by IT platform based business solutions that make it easy to configure, run, and reconfigure business processes. Software as a service is becoming mainstream even in domains that were once considered "core" to the organization. So how can we create the blueprint for the next generation enterprise IT? Researchers and practitioners will have to co-create the blueprint for next generation enterprise IT using design research. The new paradigms, methodologies and tools that result in the next generation enterprise IT model should become part of the research agenda.

PE13-1: Invited Speaker: Anindya Datta (Walking Stick Solutions) (2:00 pm – 2:25 pm)

From the Research Lab to Enterprise Data Centers - My Experiences in Commercializing Science

Moving ideas from the research lab to the marketplace is a long journey with few well-trodden paths to show the way. In this talk, Anindya Datta will describe his experiences in commercializing research-based ideas, e.g., radically differing expectations in academia and the marketplace, and applying for grants versus asking for venture funding, and why the experience is worth all the effort and work.

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PE13-2: Panel I (2:30 pm – 3:30 pm)

Moderator: **William Robinson** (Georgia State University)

Panelists: **Sham Navathe**, (Georgia Institute of Technology); **Sandeep Purao** (Penn State University); **Al Hevner** (University of South Florida)

What makes design science research different?

Design science research (DSR) can be defined from a number of perspectives. Recent foundational articles present frameworks for understanding DSR. From inception to experimentation and test, many frameworks aim to be comprehensive rather than focus on a few core DSR concepts. Consequently, DSR is associated with quantitative, qualitative, and action research projects. This panel will discuss core concepts, methods, and technologies that distinguished DSR from more common IS research methodologies.

PE14-1: Invited Speaker: Jay Nunamaker (University of Arizona) (4:00 – 4:25 pm)

Design Science Involves Traveling the Last Research Mile

Design Science is a research methodology for creating new innovative IT artifacts. Traveling the Last Research Mile in IT means going from an idea to acceptance in the marketplace and having achieved wide spread use of the IT artifact. However, it is all too common to generate an idea, a concept, and a theory, develop a model, develop a prototype to test in the lab, write an article, dust off your hands and the task is complete. “The rest is just trivial details.” Yet the best academic adventure lies in traveling “the Last Research Mile.” The moon is 238,000 miles from Earth. Would you go 237,999 miles on a trip to the moon and then abandon the expedition if by going one last mile, you could find out what the moon is really made of? You might prove that Newton was right about a lot of things—a feather really will fall as fast as a cannon ball in a vacuum, and you really can jump six times higher on the moon. If you don’t go that last mile, you leave many key questions unanswered. Sometimes as you contemplate the Last Research Mile, the effort it requires may seem to be all uphill and fraught with problems, but it is certainly worth doing. It is in the Last Research Mile that the deepest insights and understandings emerge. It is the Last Research Mile that makes an enduring difference to society. This talk will explore the role of going the Last Research Mile by examining the benefits and sharing the insights gained from over 40 years of traveling the Last Research Mile. A framework will be presented with the steps involved and examples from my collaboration technology research in traveling the Last Research Mile. The stages involved in traveling the Last Research Mile – Proof of Concept, Proof of Value and Proof of (wide spread) Use will be described. To go the Last Research Mile one must use Design Science methodology to integrate theory, systems development, lab experiments, and field experiments. Lab and field experiments then inform theory and systems development and the cycle continues. In summary, 12 principles for success will be outlined

P14-2A: Integrating DS Approaches (4:30 – 5:30 pm)

Session Chair: **John Venable** (Curtin University of Technology)

On the Interplay of Design Research and Behavioral Research—A Language Community Perspective by **Joachim Schelp** (University of St. Gallen, Institute of Information Management) and **Robert Winter** (University of St. Gallen, Institute of Information Management)

Abstract While the results of behavioral research are often used in design research, and contributions back to the “knowledge base” by behavioral research are considered as well, the implications of the divergent underlying epistemological foundations are rarely discussed. This paper investigates the effect of these foundations on the mutual usability of research outcomes in both directions. The design perspective is represented by reference modeling and method engineering, while the behavioral research perspective is represented by social science methods. Whereas research results from behavioral research may be used in design research under certain circumstances—proper translation into the realm of the language community in question—the usability of design research results in behavioral research is more limited: These results can only be utilized under the restrictions which behavioral research imposes regarding research goals, research procedure, and quality goals genericity. In consequence, most design research outcomes fall short of this provision at least in the short run. The only solution is the establishment of longer lasting, broader language communities which provide the setup for repetitive work on design research outcome to comply with the restrictions of behavioral research styles.

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Enacting Design Science with Action Research: An Illustrative Case Study in Methodology Development by **Michael Johnstone** (Edith Cowan University) and **John Venable** (Curtin University of Technology)

Abstract At face value, the relationship between Design Science Research and Action Research seems to be a natural one and has been under some discussion in the IS field (Venable 2006, Järvinen 2007). This paper reports on a research project that used an Action Research approach to enact Design Science Research. The paper describes why and how the approach was used, relating it to existing models of Design Science Research activities. The fit of Action Research, as enacted in the study, to those models is described. The appropriateness and benefits of undertaking an Action Research approach are evaluated. The findings are that Action Research has an excellent fit with Design Science Research and is particularly useful as a means of naturalistic evaluation of Design Science artifacts and IS Design Theories, but also is very useful for building new Design Science theories/hypotheses and creating opportunities for developing new Design Science artifacts.

Towards a Design Science Research Approach for IS Use and Management: Applications from the Areas of Knowledge Management, E-Learning and IS Integration by **Sven Carlsson** (Informatics, School of Economics and Management, Lund University), **Stefan Henningsson** (Computer and Systems Science, Uppsala University), **Stefan Hrastinski** (Computer and Systems Science, Uppsala University) and **Christina Keller** (Informatics, Jönköping International Business School)

Abstract Design science research is an essential part of IS research since the field should not only try to understand how the world is but also how to change it. We argue that the aim of IS design science research should be to develop practical knowledge not only for the design and improvement of IS but also for IS use and management. Whereas substantial methodological support exists for researchers engaged in behavioral IS research, only limited methodological support exists for researchers with the ambition to develop new IS design theories and new IT artifacts. For the development of design theories for IS use and management the methodological support is even weaker. To overcome this shortcoming we suggest an approach for design research on IS use and management. We give three examples of the proposed approach in use by applying it to the areas of knowledge management systems, e-learning and IS integration.

E14-2B: Design Patterns (4:30 – 5:30 pm)

Session Chair: **Bill Kuechler** (University of Nevada at Reno)

A Design Science Based Evaluation Framework for Patterns by **Stacie Petter** (University of Nebraska, Omaha), **Deepak Khazanchi** (University of Nebraska, Omaha) and **John Murphy** (University of Nebraska, Omaha)

Abstract Many researchers have created patterns to provide guidance and solutions in solving problems associated with virtual project management, software development and engineering, and even engaging in design science research. The development of patterns is a design science activity in which an artifact (i.e., patterns) is being created to improve upon the current state-of-practice. Patterns are presented to address a relevant problem in practice, which is capturing of a recurring problem and solution. However, many patterns proposed by researchers have not been evaluated. In this paper, we propose a framework to evaluate patterns after they have been developed in an effort to complete the evaluation component of design science research. We draw upon the literature associated with patterns and explanation research methods to develop an approach to validate patterns in a more consistent, rigorous manner.

Designing Enterprise Integration Solutions - Effectively by **Karthikeyan Umamathy** (University of North Florida), **Sandeep Puro** (Penn State University) and **Russell Barton** (Penn State University) (Nominated for Best Paper Award)

Abstract The design of large and complex enterprise integration solutions is a difficult task because designers must respond not only to the ‘requirements’ from a diverse set of users, but also because a successful design outcome must respond to the ‘constraints’ provided by the current set of legacy applications. The problem, therefore, belongs to a category of problems where design knowledge is difficult to articulate and reuse. In particular, the nature and form of knowledge for conceptual design of systems integration solutions continues to be a

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concern. In this paper, we investigate whether design knowledge in the form of patterns can be reused to develop systems integration solutions, and whether such reuse leads to more effective design outcomes. The research follows Design Science guidelines in that we describe a research artifact, and evaluate it to assess whether it meets the intended goals. The results indicate that approaches to facilitate reuse of conceptual design knowledge are feasible in the domain of enterprise integration, and that such reuse does, in fact, lead to more effective design solutions.

Hitting the Collaboration Target: Computer-Guided thinkLet Selection by **John Murphy** (University of Nebraska, Omaha), **Stacie Petter** (University of Nebraska, Omaha), **Ke Cheng** (University of Nebraska, Omaha), and **Robert Briggs** (University of Nebraska, Omaha)

Abstract Collaborative work practices are now vital to the success of many organizations. Research shows that, under certain circumstances, groups using collaboration technologies can be more efficient and produce better work products than teams who collaborate without technology support. However, despite the advantages collaboration technologies can provide, the key to gaining those advantages is to carefully match specific collaborative activities to a group's needs. This paper presents a proof-of-concept prototype that demonstrates how an expert system, guided by knowledge of the collaboration domain, can support the engineering of effective group work sessions by aiding in the selection of specific collaborative activities that match a group's needs.

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DESRIST 2008 Day 2 – May 9, 2008 (The Westin Buckhead Atlanta)

PE21-2: Keynote: Kalle Lyytinen (Case Western Reserve University) (9:30 – 10:30 am)

Design – “shaping in the wild”

Following Hutchins’ well known idea “cognition in the wild” I approach in this talk design as evolutionary, localized and constant shaping of socio-technical systems “in the wild.” Design involves multiple, often independent actors who intentionally shape and craft artifacts and contexts through constant interactions and mappings between ideas, representations, artifacts and contexts. This view extends and supplements the artifact centered view which has been the dominating “paradigm” behind the design research or science movement. The talk will outline key elements of “shaping in the wild” view of design. It motivates the need to approach design as long standing evolutionary processes that have characterized e.g. the growth of Internet or mobile platforms. The key elements of this view are

- a. Evolutionary design knowledge and process are generative and permit new ideas and skills to emerge which provides a new path dependent basis for path breaking
- b. Design “happens” always with heterogeneous, conflicting, ambiguous and incomplete knowledge that is distributed across many stakeholders and actors
- c. New design knowledge or context shaping can have non linear effects on design processes and outcomes
- d. Design knowledge is located in and generated by the structure, dynamics and topology of socio-technical design networks that consist of actors, artifacts and their dynamic connections.
- e. Design networks affect how critical design knowledge circulates, diffuses and is enacted depending on the localization and mobilization capabilities of the knowledge and its cost and stickiness in different parts of the network.

Several research challenges associated with large scale, complex and evolutionary designs are noted.

PE22-1: Invited Speaker: Al Hevner (University of South Florida) (11:00 – 11:25 am)

Research Directions in Software-Intensive Systems

Software-intensive systems have altered and enhanced nearly every aspect of human life. Yet, a lack of software science and engineering foundations and unpredictable operational environments leaves such systems at high risk for failures, security breaches, and user dissatisfaction. A bold new conceptualization of the science and engineering of software-intensive systems is required – from the basic concepts of design, evolution, and adaptation to the integration of human capabilities. Emerging technologies, such as multi-core processors, pervasive computing, and autonomic applications heighten the urgency for new ways of thinking about software. This presentation overviews current funding programs and proposes a vision for future directions in software research at NSF.

P22-2A: Contrasting Perspectives in Design Research (11:30 am – 12:30 pm)

Session Chair: **Jan Pries-Heje** (Roskilde University, Denmark)

Twelve Theses on Information Systems as a Design Science by **Juhani Iivari** (University of Oulu)

Abstract This essay discusses twelve theses to guide design science research. The theses aim to strengthen the design science orientation of Information Systems, to clarify future discourses on design science aspects of the discipline, and to give some further guidelines for DSR in Information Systems.

The Application of a Prescriptive and a Constructive Perspective to Design-Science Research by **Marlies van Steenberg** (Sogeti Netherlands), **Rik Bos** (University of Utrecht) and **Sjaak Brinkkemper** (University of Utrecht) (Nominated for Best Paper Award)

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Abstract Design-science research is much valued for its relevance to the IS community. How to achieve rigor in design-science research is less well-established. We compare two perspectives on design-science research that address rigor, by applying both to the design of the Architecture Effectiveness Model, a model for making explicit the contribution of enterprise architecture to business value. One perspective, which we will refer to as the prescriptive perspective, focuses on how to contribute to the IS research knowledge base. The other perspective, which we will refer to as the constructive perspective, focuses on how to improve the process and products of the design process in general. Our conclusion is that both the prescriptive and the constructive perspective contribute to improving our understanding of rigor in design-science research within the field of IS. The two perspectives are complementary and can be applied in combination.

Design of Emerging Digital Services: A Taxonomy by **Kevin Williams** (Claremont Graduate University), **Samir Chatterjee** (Claremont Graduate University) and **Matti Rossi** (Helsinki School of Economics) (Nominated for Best Student Paper Award)

Abstract There has been a gigantic shift from a product based economy to one based on services, specifically digital services. From every indication is likely to be more than a passing fad and the changes these emerging digital services represent will continue to transform commerce and have yet to reach market saturation. Digital services are being designed and offered to users, yet very little is known about the design process that goes behind these developments. Is there a science behind designing digital services? By examining thirteen leading digital services we developed a design taxonomy to be able to classify and contrast digital services. What emerged in the taxonomy were two broad dimensions; a set of fundamental design objectives and a set of fundamental service provider objectives. The paper concludes with an application of the proposed taxonomy to three leading digital services. We hope that the proposed taxonomy will be useful in understanding the science behind the design of digital services.

E22-2B: Design Research in Action (11:30 am – 12:30 pm)

Session Chair: **Sham Navathe** (Georgia Institute of Technology)

Designing Web Page Classifiers as Alternatives to Commercial Internet Filters by **Chen-Huei Chou** (University of Wisconsin-Milwaukee), **Atish P. Sinha** (University of Wisconsin-Milwaukee) and **Huimin Zhao** (University of Wisconsin-Milwaukee)

Abstract While the Internet has become a valuable and necessary resource for many organizations, Internet abuse in the workplace, a severe problem, is increasingly catching management's attention. Employees' non-work-related activities, such as gaming, shopping, online chatting, and illegal downloading, result in loss of workers' productivity, network congestion, security risks, and legal liabilities. To address this problem, organizations have started to adopt Internet usage policies, management training, and software packages to monitor and block employees' abuse usage. Internet filtering software products are finding an increasing number of adoptions in organizations. These products mainly rely on black lists, white lists, and keyword/profile matching to filter out undesired Web pages. In this paper, we design Web page classifiers, using text mining, for Internet abuse detection. We have empirically compared the performance of several classification models with CYBERSitter, a top-ranked commercial Internet filtering product, for Internet abuse detection in the workplace of software programmers. The experimental results are very promising, showing that trained classifiers outperform this commercial filter, and effectively substitute some of the commercial filtering products available in the market.

Secure Activity Resource Coordination: A Method to Design Secure Business Processes by **Fergle D'Aubeterre** (University of North Carolina at Greensboro), **Rahul Singh** (University of North Carolina at Greensboro) and **Lakshmi Iyer** (University of North Carolina at Greensboro) (Nominated for Best Student Paper Award)

Abstract Software engineering methodologies conceptualize security requirements as an afterthought in the non-functional requirements of systems. Existing methods in the design of secure information systems lack a conceptualization of secure business process. We develop the modeling concepts and modeling grammar that are used by the Secure Activity Resource Coordination (SARC) artifact to represent a secure business process. SARC can be used by business analysts to analyze and model secure business process. Using a real-world business process, we show how SARC can be used to create models that depict the secure activity resource coordination for secure

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business processes. We plan to empirically evaluate the SARC artifact against the enhanced Use Case (Siponen et al, 2006) and standard UML activity diagram to demonstrate the utility of the proposed design method.

Client as Designer in Collaborative Projects: What Does Design Theory Tell Us? by **Judith Weedman** (San Jose State University)

Abstract This paper reports a study of a design science research project in which researchers in computer science and earth science collaborated to attack a looming problem in the earth sciences – the need to analyze data from many different sciences (hydrology, meteorology, atmospheric science, and others), of many different types (aerial photos, satellite readings, measurements made by hand in the field), and at different resolutions. The motivations of the two partners appeared complementary – the computer scientists needed a hard problem to solve to focus their research, and the earth scientists had a hard problem in need of solution. This study draws on design theory to understand why some aspects of this collaborative project worked well and others generated frustration and distrust. It concludes that it is very difficult for a client partner to enter the “design world” as full collaborators and analyzes the features of the design world that are perhaps inevitably in conflict with the work practice of a client.

PE23: Poster Session (2:00 pm – 3:30 pm)

The Animated Work Environment: A Design-Research Exemplar Supporting Social and Virtual Collaboration in an Increasingly Digital Society by **K. E. Green** (Clemson University), **L. J. Gugerty** (Clemson University), **J. C. Witte** (Clemson University), **I. D. Walker** (Clemson University), **H. Houayek** (Clemson University), **J. Rubinstein** (Clemson University), **R. Daniels** (Clemson University), **J. Turchi** (Clemson University), **M. Kwoka** (Clemson University), **I. Dunlop** (Clemson University), and **J. Johnson** (Clemson University)

Abstract While single-user computing (i.e. laptop, desktop and hand-held) connected to the Internet has established a powerful link between people, it offers little to individuals working intensively and collaboratively with an array of tools, peripherals, documents and materials that are both digital and analog. This shortcoming in the everyday employment of Information Technology (IT) has prompted the architect-author to assemble a team of researchers to develop a physical, programmable work environment supporting both social and virtual collaboration in an increasingly digital society. The transdisciplinary team – architect, robotics engineer, human factors psychologist, and sociologist – envision the work environment less as a design product and more as the locus of interaction between people, software, information, machines, furniture, and other physical surroundings – a complex manifestation demanding the expertise of all four disciplines. The Animated Work Environment (AWE) project involves the designing, prototyping, demonstrating and evaluating of an articulated, programmable robot-environment with embedded IT. The development of AWE follows a careful design science research methodology involving early prototyping, scenario-generation, and three kinds of ethnographic investigation performed iteratively throughout the design process. This paper presents the early and current full-scale, working AWE prototypes and their programmable configurations. Such a design-research investigation redefines research in all four participating disciplines, here meeting to realize a complex, responsive, physical environment aimed at facilitating productivity, connectedness and innovation across fluid assemblages of people working in a variety of locations and settings.

A Framework of Ontology-based Modeling Patterns by **Sofia J. Athenikos** (Drexel University) and **Il-Yeol Song** (Drexel University)

Abstract The problem of identifying relevant classes is fundamental for object-oriented systems analysis and design, even more so for conceptual modeling. We introduce a new conceptual modeling methodology named OMP (Ontology-based Modeling Patterns). The OMP methodology relies on an ontology of domain-specific class categories and a catalog of modeling patterns. By employing both a structured ontology that captures domain-specific entity types and a set of reusable and adaptable patterns that captures their relationships, the methodology provides a systematic yet easy-to-use guideline for conceptual modeling. OMP captures the major concepts and relations that are most useful for modeling relevant activities in a given domain, without exhaustively enumerating any and all categories and relations that may be too context- or situation-specific. It therefore serves as an effective tool for teaching how to identify relevant classes in solving modeling problems.

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Case Study Perspectives on Design Science Research by **Joerg Becker** (European Research Center for Information Systems), **Bjoern Niehaves** (European Research Center for Information Systems) and **Daniel Pfeiffer** (European Research Center for Information Systems)

Abstract An intensive discussion on research methodology can be observed in the information systems (IS) discipline. Especially design science research has recently gained much attention. According to March & Smith (1995), IS research consists of behavioral science research (“problem understanding paradigm”) and design science research (“problem solving paradigm”) (see also Hevner et al. 2004; Jani 2001; March and Smith 1995). In order to facilitate the evaluation of design science research efforts, Hevner et al. (2004) proposed a set of guidelines which was heavily adopted since. However, the interpretation of these design science research guidelines very much depends on the research methods and data collection technique applied. As a consequence, central issues in using design science research guidelines can be defined in more detail with regard to specific research methods. Hence, we seek to elaborate this argument taking the stance of case study research in order to reflect on design science research guidelines. Thus, the presented research seeks to facilitate the use of design science guidelines for case study research by interpreting Hevner et al.’s work (2004) from the specific perspective of case study research.

Database Training for Novice End Users: A Design Research Approach? by **Peter Blakey** (Massey University, Palmerston North, New Zealand), **Clare Atkins** (NMIT, Nelson, New Zealand) and **Barbara Crump** (Massey University, Wellington, New Zealand)

Abstract The purpose of the research to be undertaken is to identify a method that will assist end-users to come to an improved understanding of relational data structures and organisation. Following unsatisfactory results from a previous approach, this study investigates and evaluates the use of Design Research as a framework in which to design, construct and evaluate a suitable tool. This is a tale of two treatments, and the discovery that the best approach by far would be design research.

Living Labs in IS Design Research: A Conceptual Approach for Structuring IS Design Research by **Stefan Henningsson** (Center of Applied ICT, Copenhagen Business School) and **Liana Razmerita** (Center of Applied ICT, Copenhagen Business School)

Abstract Design research is becoming more and more accepted and integrated in IS research. Based on the argument that the IS discipline has a severe relevance and utilization problem IS researchers approach design research as a way to increase the relevance of IS research. In doing so, there is a risk of increasing research relevance on the expense of research rigor since very limited methodological support exist for the researcher who wants to do IS design research. One of the methodological questions that have to be addressed is the involvement of business and governmental institutions in the research. In this paper we address the research activities of IS design research and how the activities are dependent on participation from business and governmental institutions to a higher extent than in traditional research. Our contribution is the introduction of the concept of Living Lab as a conceptual approach for structuring IS design research that we argue offer a way of securing the involvement of all necessary parts to complete a IS design research project. We illustrate the use of the Living Lab concept with a research project where the approach was used to redesign and improve customs and taxations export procedures through advanced ICT.

iMade (Internet Multi-Attribute Decision Expert): A System for Analysis of Multi-attribute Decision Problems by **Jamshid Etezadi** (Concordia University)

Abstract A variety of systems for assessment of utility functions have been developed and are available on the market. A major shortcoming of these systems, regardless of the underlying methodology, is the lack of attention given to response error, which is present at all phases of assessment. In the following, a decision support system generator for assessment of multi-attribute decision problems is introduced which is based on the methodology proposed by Etezadi and Mak (2004). This system is quite general and can be used as a base to develop applications for handling specific multi-attribute problems.

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Towards a Design Theory for Hedonic Systems: Delivering Superior User Experience in the Digital Home Entertainment Context by **YoungKi Park** (University of Southern California) and **Omar El Sawy** (University of Southern California)

Abstract This paper proposes a design theory for hedonic systems in the digital home entertainment (DHE) context, focusing on delivering superior user experience. Hedonic technologies are different from utilitarian technologies in that they have a goal to deliver fun and enjoyment, and focus more on the interaction between people and system than on the outcome while utilitarian technologies are used for outcome-oriented tasks and have a goal to achieve high performance. Hedonic systems for DHE are different from working-place systems in terms of complexity and heterogeneity, since such systems comprise multiple hedonic technologies with which multiple types of content are delivered through diverse channels to multi-generations of people. User experience has been at the center of entertainment in which hedonic technologies play a key role. However, we don't have an adequate design theory which guides the design of hedonic systems to deliver superior user experience especially in the emerging DHE context. Based on theories of exploitation and exploration in organizational learning, personalization, and the characteristics of hedonic systems in the DHE context, we propose a design theory which defines meta-requirements of hedonic systems and proposes design principles and testable hypotheses. The proposed design theory uses a framework which modifies information system design theory developed by Walls et al. (1992), following recent design theory modifications (Gregor and Jones, 2007; Markus et al., 2002). This study can stimulate more active design science research in that it considers the boundary between work and play and shows the possibility of modifying ISDT framework in a way that follows the recommendations from recent IS design science research. The proposed design theory also gives theoretical foundations which can be used in design practice for hedonic systems for emerging DHE. Key words: hedonic systems, user experience, design theory, digital home entertainment, exploitation and exploration, mutual learning, personalization

Evaluation Risks in Design Science Research: A Framework by **Jan Pries-Heje** (Roskilde University, Denmark), **John Venable** (Curtin University of Technology, Western Australia) and **Richard Baskerville** (Georgia State University)

Abstract Many things can go wrong in Design Science Research (DSR). From software development and other design related areas we know that foresight is a good idea; if you can foresee potential problems then you can prevent or prepare for them. In fact, that is the underlying idea in risk management. In this paper we apply the ideas and practices of risk management to DSR to develop a framework for identifying, assessing, prioritizing, and treating potential risks inherent to DSR. The framework developed identifies six potential risk areas and analyses the risks inherent in each area. It also includes a scale designed to simplify quantification and prioritization of risks. Finally, the framework suggests measures to mitigate risks in DSR. The paper also applies the framework to an ongoing DSR case study.

Identifying unobvious requirements- an exemplar of Design Science approach by **Smita Ghaisas** (Tata Consultancy Services), **R Venkatesh** (Tata Consultancy Services), **Alka Kanhere** (Tata Consultancy Services), **Amit Kumar** (Tata Consultancy Services), **Manish Kumar** (Tata Consultancy Services) and **Preethu Rose** (Tata Consultancy Services)

Abstract This paper presents our work on applying Design Science approach to identify unobvious requirements. In spite of attempts to address this problem, requirements continue to pose a challenge [1]. Globally dispersed teams, increasingly complex and larger systems and pressures for rapid development add to this challenge. 'Missing requirements' has been known to be one of the top five causes for poor software estimation [2]. In our experience, stakeholders are typically able to visualize 'first order' scenarios that result out of direct interactions, but find it hard to detect 'second order' scenarios that result out of multiple stimuli. We present a method and an assisting toolset to identify unobvious requirements from stakeholders' inputs. Consistency checks between information captured from different sets of users and tool-assisted analysis are emphasized in our approach. We explicitly correlate inputs from multiple representative stakeholders. In the process of establishing such a correlation, we identify gaps and inconsistencies that would otherwise have been undetected during requirements elicitation. Further, we use stakeholders' inputs to auto-populate requirement models as UML diagrams. The models are then analyzed using a requirements analysis tool that generates multiple scenarios and uncovers inconsistencies. The generated scenarios help in detection of additional inconsistencies and requirements missing in the original specifications. The method requires frequent interaction among stakeholders. To facilitate such interactions; we have developed a tool that uses collaborative architecture of participation. This helps stakeholders capture requirements

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using guidelines in our method, reuse existing knowledge (such as domain-specific guidance, best practices from previous projects and successful governance models) available in an organizational eco-system and generate and share requirements specifications and models frequently to refine them.

Design for Situated Decision Support: Application to Personal Finance by **Rustam Vahidov** (Concordia University), **Xin He** (Concordia University)

Abstract Design research projects in IS look to introduce novel solution concepts to address classes of problems. The concept of Situated Decision Support System (SDSS) has been recently introduced in the literature as type of DSS that maintains close links with the target environment and has capabilities for sensing, monitoring, decision support and limited decision making, action generation and implementation. Though the generic description of SDSS had been provided, little work has been done in the past to illustrate the models and tests its potential value of the approach. This work presents the design and results of experiments involving human subjects with the SDSS prototype. Personal finance management has been chosen as application domain, and the design and implementation of the SDSS prototype is presented in the paper. Overall, the results attest to the superiority of the SDSS model over traditional approaches in terms of key decision performance variables.

Applying Representational Framework for Design Researcher's IS Artifact: the Case of Electronic Negotiation Systems by **Rustam Vahidov** (Concordia University) and **Gregory Kersten** (Concordia University)

Abstract Recent rise of interest in design research in information systems discipline calls for advances in philosophical and methodological work that would provide guidance for design researchers to better organize their research projects. One important issue in this regard is the choice of an adequate representational framework to convey important perspectives on and salient characteristics of design researchers' artifacts. Current work expands on the previously introduced representational framework by illustrating it using the case of electronic negotiation systems (ENSs). In particular two ENS design research concepts: Inspire and Invite are discussed in the context of the representational framework.

A Multidimensional and Visual Exploration Approach to Project Prioritization by **Guangzhi Zheng** (Georgia State University), **Vijay Vaishnavi** (Georgia State University) and **Art Vandenberg** (Georgia State University)

Abstract Managing projects in an organization, especially a project-oriented organization, is a challenging task. It is popular to have a portfolio approach to manage these projects, but some of these activities and decisions are still weakly supported by current project portfolio management (PPM) tools. One of these tasks is project prioritization. This paper proposes a multidimensional information analysis and visualization approach to provide better decision support for project prioritization and other PPM tasks. The research follows a common design science research methodology involving phases of analysis, design, development, refinement, and evaluation of an IT artifact. The project is expected to bring a new perspective and create a new tool for project portfolio management. It also contributes to new solutions and new knowledge of multidimensional information analysis in many business activities.

Architectural Control Points by **C. Jason Woodard** (Singapore Management University)

Abstract System designers and technology strategists have long recognized the concept of an architectural control point as a way to identify parts of a system that have particular strategic importance. Owning or exerting influence over a control point has been thought to yield economic rewards. Despite the vast body of work on system architecture in the engineering design literature, however, few authors have attempted to define architectural control points or study them systematically. Moreover, some industry participants have questioned whether in an era of increasingly open standards, architectural control is still a valuable or achievable goal. This paper offers tentative definitions of architectural control, architectural control points, and architectural strategy. The utility of these concepts is demonstrated through examples drawn from the history of the personal computer industry. These examples, although informal, reveal both simple and subtle interactions between system design and market competition, and suggest that architectural strategy continues to play an important role in the competitive dynamics of system-oriented industries. The paper concludes with a call for design researchers to take a more active role in shaping the theory and practice of high-technology strategy, and to apply these concepts to system industries such as music and mobile communications that are converging with the traditional sphere of information technology.

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PE24-1: Invited Speaker: Sal March (Vanderbilt University) (4:00 – 4:25 pm)

Ontology in the Design of IT Artifacts

Design is a creative activity in which people construct the plans (the design result) by which components (objects) are configured into artifacts (the design implementation) that achieve desired goals. Representation of the problem space is a crucial part of the design process. Ontology is an important part of representation in that it provides a conceptualization of the artifact itself and a conceptualization of the reality in which the artifact is expected to perform. IT artifacts are constructed primarily of conceptual objects (software and databases) and the reality in which they are expected to perform is primarily a designed social system (business organizations, value chains, competitive markets, and societies). An ontology for the design of IT artifacts is different from an ontology of the material world. An ontology for the design of IT artifacts must explicitly represent conceptual objects and mutable agreements characteristic of the social reality constructed by humans to enable social intercourse. This reality has arbitrary, but agreed to, rules and ascriptions of meaning to material and conceptual objects. These rules and ascriptions represent goals, purposes, intentions, and the criteria by which business and IT artifacts are evaluated. Thus they are integral to the representation of the requirements imposed on information systems, which are partially *designed* as part of the overall design of the business and its operational systems and partially *constrained* by the design of the broader social environment in which the business operates. The challenge is to construct a systematic ontology for artificial systems that is capable of representing the arbitrary and mutable nature of social constructions in a precise and unambiguous manner.

PE24-2: Panel II (4:30 – 5:30 pm)

Moderator: **Matti Rossi**, Helsinki School of Economics and Claremont Graduate University

Panelists: **Ola Henfridsson**, Jönköping International Business School & Viktoria Institute, Sweden; **Björn Niehaves**, University of Münster, Germany; **Robert Winter**, University of St. Gallen, Switzerland.

European perspectives on Design Research

Abstract The recent growth of interest into studies of designing information systems has made design research and accepted way of doing research in North America. This is a welcome phenomenon and we would like to further the discussion by providing European perspectives into design research in this panel. In European IS research there have been quite a few approaches that come close to design research (e.g. Scandinavian approach to IS, Soft Systems Methodology as a research methodology, reference process modeling, method engineering) and many action researchers here have combined artifact construction into their studies. These somewhat softer approaches are complemented by a long tradition of constructive research and method engineering.

In this panel we offer different perspectives for doing and publishing design research and perhaps challenge a few prevailing notions about it.