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Title: Design science research genres : introduction to the special issue on exemplars and criteria for applicable design science research

Year: 2018

Version: Accepted version (Final draft)

Please cite the original version:

Peffers, K., Tuunanen, T., & Niehaves, B. (2018). Design science research genres : introduction to the special issue on exemplars and criteria for applicable design science research. European Journal of Information Systems, 27(2), 129-139.
https://doi.org/10.1080/0960085X.2018.1458066

Design Science Research Genres

Introduction to the special issue on exemplars and criteria for applicable design science research

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Introduction

Since the early years of the information systems (IS) discipline, designing and evaluating artefacts has distinguished IS research from other disciplines in the business academe. Unfortunately, a majority of the highly regarded IS journals that evolved since the late 1970's adhered to a social science model for carrying out and presenting research. Consequently, researchers who designed artefacts (March and Smith, 1995), such as systems, algorithms, and methods, struggled to justify the value of their research and to place their results in those most valued outlets. Many design-oriented researchers were thereby limited to publishing in what were considered second or third tier outlets.

Versions of the term, design science research (DSR), have been part of IS research vernacular for at least 30 years, since Nunamaker et al (1971; 1990) "described and defended" the legitimacy of "Systems Development in IS Research" as a research methodology. More broadly, across the academe, the "design science" term can be traced as far back as the 1960's, as Buckminster Fuller is reported to have called for a "Design Science Decade" (Fuller, 1963). Herbert Simon's *Science of the Artificial* (1969) provided another design science precedent. Subsequently, influential papers, e.g., by Hevner, March, & Park (2004) and Peffers, Tuunanen, Rothenberger, & Chatterjee (2007), as well as design-centred conferences, particularly the *First International Design Science Conference* (*DESRIST*, 2006), created momentum for DSR as a mainstream research paradigm. Since then many DSR papers have been published in high quality IS journals, including in the Association for IS (AIS) basket of eight, *European Journal*

of Information Systems (EJIS), IS Research, IS Journal, Journal of Information Technology, Journal of Management IS, Journal of Strategic IS, Journal of the AIS, and *MIS Quarterly*. In many of these articles, authors did not carry out design science studies, but proposed conceptual, theoretical, and guidance contributions to help researchers conduct, present, and publish design science endeavours.

The objective of this *EJIS* special issue on "Exemplars and criteria for applicable design science research," is to enable IS researchers to accomplish more in terms of DSR's *raison d'être*, the development of artefacts that can be applied to the solution of real-world problems or to enhance organizational efficacy, e.g., (Goldkuhl, 2012; Hevner and Yao, 1979; J. Nunamaker et al., 1989). A key motivation that led us to edit this special issue has been the observation that to date, while there has been much research published about DSR, there has not been as much research as we might hope that applies the DSR research paradigm to carry out IS research.

Researchers have observed that it is difficult to publish DSR results in the best journals (Conboy, Fitzgerald, & Mathiassen, 2012). They have offered such explanations as, the comparative immaturity of DSR, when compared to applied social sciences (Winter, 2008); the low emphasis on practical relevance in the most highly regarded journals (Lyytinen, Baskerville, Iivari, & Te'eni, 2007); the expectation among highly regarded journals for scientific theoretical contributions (Baskerville, Lyytinen, Sambamurthy, & Straub, 2011); and the uncertainty for DSR outcomes coupled with a quest for perfection (Weedman, 2008).

Recent research has sought to frame the argument for the value of DSR knowledge contributions through concepts and guidance that distinctly differentiate it from design in practice (Baskerville, 2008; Gregor and Hevner, 2013). Steeped as we are in social science traditions of research contribution, this is an approach that is consistent with the culture of our

discipline. Others have expressed concern that such guidance may be rigidly applied in ways that prevent DSR from being an attractive paradigm for research, particularly for the junior researcher (Österle et al., 2011).

Over time, with the great number of guidelines, rules, and frameworks, DSR researchers found themselves faced with a difficult challenge, namely an excess of advice and expectations for how to carry out DSR. The many guidelines and objectives published in journals and conferences make it difficult and costly to carry out DSR projects. This problem remains unsolved to the present day and it remains difficult to present DSR outcomes without running afoul of some of these rules. Part of the problem may be that DSR continues to be viewed as an undifferentiated paradigm for research. This leaves reviewers and editors without concepts for how to differentiate among submissions, so as to apply different requirements to particular classes of research. This has led to reviewers following guidance published anywhere about DSR and applying it indiscriminately as the basis of criticism of any submitted DSR paper. Thus, a sidestep from any published guideline is a potential reason for a rejection.

Seeds of a potential remedy

Other research domains that are older than IS, such as those in the social sciences, economics, and business, have matured sufficiently so that researchers can employ a diversity of methods, such as closed form mathematical proofs, literature reviews, experiments, surveys, or the use of complex data analysis, to create rigorous research for publication in good outlets. Reviewers in these disciplines generally understand and respect well-developed research presentations that are based in research methodological traditions other than their own. They also know that it would be inappropriate to demand that researchers from one research genre, to conform to the standards

of another. Each genre of such research has its own processes, requirements, terms of evaluation, and presentation styles.

Sarker et al (2007; 2012; 2017) addressed the problem of within-domain diversity for qualitative research in IS. They urged qualitative researchers to adopt a remedy for the problem in a model of disciplinary maturity akin to Gibson & Nolan's (1974) four stages of EDP growth. They focused their attention primarily on Nolan's third and fourth stages: control and maturity. In the control stage a hitherto relatively uncontrolled environment is brought under some discipline, with a variety of rules, guidelines and process requirements. Efforts at this stage may soon lead to excessive control and restricted productivity. The fourth stage exhibits method diversity through the recognition of mutually respectful genre within the discipline.

Sarker's solution addresses qualitative research in IS, however, his approach is also of potential use in other domains within IS research. He proposed the development and recognition of a number of qualitative research genres, such as interpretive case studies, hermeneutics, grounded theory, and exploratory case studies. Each of these genres is grounded in one or more founding papers. Each defines its contribution differently and evaluates prospective contributions accordingly, has its own expectations for methodology, and has its own presentation style and minimum requirements. An important consideration is that authors in this domain can reasonably expect to avoid being confronted with unexpected and unreasonable criticism or demands from genres far afield. In the interest of clarity we note that research genres, as defined here are not to be conflated with "genres of papers," as defined by *EJIS* editors, e.g., literature review, theory development, research essay, etc. (Te'eni, Rowe, Ågerfalk, & Lee, 2015).

DSR may not be as far along in defining and mapping out genre as is the qualitative research community. It is reasonable to say, however, that we should be able to go some distance

in this direction by identifying DSR genres (or proto-genres, if you prefer) with their founding documents, identified requirements, expressed values, and particular characteristics.

Identifying Potential DSR Genres

To help us discover potential DSR genre characteristics, we conducted an interpretive review of articles published during 2004-2018 in the AIS Basket of Eight journals that contained the phrase, “design science research.” From the 303 articles found, we identified seven that appeared to have the potential to be regarded as anchors for research genre within the DSR paradigm. This effort led us to identify five exemplary genres that we use here to help us create a general mental model for possible DSR genres. We use the selected papers to explicate the nature of possible objectives, values, and standards for potential design science genres. These genre prototypes are summarized in Table 1, in chronological order by publication date, and further described below.

Potential DSR Genres	Characteristics	Favorable paper attributes
IS Design Theory (Gregor and Jones, 2007)	Focus: composition and presentation of design theories Process: flexible Role of theory: theory is central, focus on representation Evaluation: conceptual-oriented; instantiated artefact optional	• Definition of purpose and scope • Conceptualization of constructs • Proposition of an abstract "blueprint" of the artefact • Consideration of artefact mutability • Proposition of testable hypothesis • Inclusion of kernel theories
Design Science Research Methodology (Peffers, et al., 2007)	Focus: applicable artefact development Process: flexible process; least concerned with design rigor Role of theory: generalizability; reasoned argument that an artefact might work Evaluation: outcome oriented; practical	• Motivation • Contribution to efficacy of IS in organizations • Applicable solution for organizational problem • Artefact utility is generalizable • Sound evaluation
Design-oriented IS Research (Österle, et al., 2011; Winter, 2008)	Focus: instructions for design and operation of IS and innovative concepts within IS Process: Phase model with emphasis on diffusion of the findings Role of theory: relevant theory is means-end, but cause-effect theory can be valuable as intermediate artefact (Winter, 2008) Evaluation: method oriented; rigor focused.	• Benefits to stakeholders: economic, political, sciences • Artefacts, including concrete solutions and supporting artefacts • Normative, practically applicable means-end conclusions • Four principles: applicability to class of problems, original, substantial knowledge contribution, justification, and benefits
Explanatory Design Theory (Baskerville and Pries-Heje, 2010; Niehaves and Ortbach, 2016)	Focus: theory development; feature evaluation Process: evaluation processes, i.e., hypothesis testing Role of theory: theory at core Evaluation: emphasize on method and theory development	• Definition of normative effect-variable(s) • Proposition of testable hypothesis • Inclusion of kernel theories • Systematic manipulation of artefact design variables
Action Design Research (Sein, Henfridsson, Purao, Rossi, & Lindgren, 2011)	Focus: designing a problem-solving artefact, while learning from the intervention, practice-inspired research Process: iterative sequential stages that work in parallel Role of theory: theory ingrained artefact addressing class of problems Evaluation: iterative evaluation and design concurrent; a single process	• Problem as instance of class of problems • Participation of stakeholders and end-users • Practical relevance • Presentation of a theory ingrained artefact; prescriptive design knowledge • Generalization of problem, solution, and research principles

Potential DSR Genres

IS Design Theory

Focus. An IS design theory (ISDT) is understood to be similar to a theory in the behavioural sciences. It enables the IS design researcher to communicate design theory, independent of the applied science, from whence it was derived. ISDT was grounded in prior IS research about the theory of the artificial (Simon, 1969; Walls, Widmeyer, & El Sawy, 1992). Gregor and Jones (2007) proposed ISDT and identified its eight fundamental components: 1) Purpose and scope, 2) constructs, 3) Principles of form and function, 4) Artefact mutability, 5) Testable propositions, 6) Justificatory knowledge, 7) Principles of implementation, and 8) Expository instantiation. They assert that, while the objective is to ultimately include all eight components, we can expect that only well-developed theories are able to include them all. Early stage theories, still valid research outcomes, may include only sub-sets of them.

A design instantiation is not obligatory to support a design theory but it enhances how it is presented to an audience. According to Gregor and Jones (2007) "…An instantiation of a design theory, as an expository or representational tool, … can be seen as serving a communicative purpose in illustrating design principles that are embodied within it".

Process. Design theorizing can draw from the same development process as theories in behavioural science. Often, the development is conducted in the light of deduction, whereas kernel theories, i.e., theories from the natural and behavioural sciences, are used to justify the proposition of design-related hypotheses. Design-specific aspects such as artefact mutability require special attention.

Role of Theory. Developing an IS design theory is at the core of this genre. It can be considered the primary source of knowledge generation and knowledge representation. Hence, the instantiation of an information technology (IT) artefact is optional—not a necessary requirement. The focus lies in the elaboration of generic design constructs and their interrelationships.

Evaluation. IS design theories require the proposition of hypotheses, so researchers are able to apply a wide variety of analytical techniques for the evaluation. Extant literature provides several examples for how design theories are evaluated, e.g., by means of an experiment (Meth, Mueller, & Maedche, 2015).

Design Science Research Methodology

Design Science Research Methodology (DSRM) emphasizes the design and construction of applicable artefacts, such as systems, applications, methods and others, that could potentially contribute to the efficacy of IS in organizations (Peffers, et al., 2007). The distinct characteristics of the DSRM lend it credibility as the basis for a potential DSR genre. With its focus on artefact development, it accommodates the design of practically useful artefacts and is open to a variety of processes. DSRM may be the least concerned genre with whether a design process is rigorous; whether a design is based on formal theory, i.e., literature; or whether the artefact evaluation is a formal process embedded in the design effort.

Focus. DSRM's design was heavily influenced by design research predecessors, such as March and Smith (1995), Nunamaker (1990), and Walls (1992), the authors of which each had built research careers focused on building physical information systems. The resulting DSRM proceeded from an implicit premise that a designed artefact would likely be a system or an object intended to support system development, i.e., a method, algorithm, data theory, etc. Artefacts employed in case studies used to demonstrate the

DSRM included the adaption of data warehouses to public healthcare policy, a measure of software reuse performance, design elements for IP-based video conferencing (an innovation at the time), and a method for rich data collection in application planning.

Process. DSRM contains little that is intended to support a process orthodoxy. A DSRM research effort might start with a research problem, with a client request, or even with an already designed version of an artefact. Among the case examples, Berndt, Hevner, and Studnicki's CATCH (2003) was initiated to solve a public policy problem, Rothenberger and Hershauer (1999) initiated their DSR effort with specific development objectives, Tulu et al (2003) started with given objectives, and Peffers et al (2003) started with a prototype artefact. A practical axiom that guides DSRM is that researchers come to DSR at varied stages in a design or development effort, not always at the very beginning. A humble premise that guides DSRM led the paper to warn readers not to regard it as "the only way that DS research could be done…but just a good way to do it (Peffers, et al., 2007)."

Role of theory. DSRM artefacts incorporate generalizability in practice, however, the concept of a design theory does not appear in the DSRM article. In each of the cases used to demonstrate the DSRM artefact, reviewed literature focuses almost entirely on the technical bases for artefact design and the development context. For example, to justify the CATCH data warehouse, there is no review of data warehouse literature. DSRM asserts that the artefact design should "include knowledge of theory that can be brought to bear on the problem (Peffers, et al., 2007, p. 55). Most often this should be understood to mean knowledge about the specific context of the artefact, e.g., healthcare policy or database design, not necessarily to include a wider review of IS academic literature.

Evaluation. With respect to demonstration and evaluation, DSRM is outcome-based. A demonstration shows whether the artefact works as intended in an instance. Evaluation, in turn, focuses on whether the artefact works over a range of contexts. This is a richer mode for evaluation than is generally accepted to support applied social science research, but does not embed a specific iterative evaluation process into DSR, as some methodologies do. The CATCH data warehouse case noted its use by 20 US counties over 10 years; the software reuse measure was demonstrated in one case and evaluated in five subsequent ones, and the data collection method was demonstrated through its use at the firm and evaluated in context with its continued use there.

Design-oriented IS Research

Design-oriented IS Research (DOIS) or *gestaltungsorientierte Wirtschaftsinformatik* is a DSR genre, practiced within the German-speaking IS community and explicated by Winter (2008) and Österle et al. (2011). It is generally aimed toward the design of better performing IS solutions, with utility for practice being an important measure. Rigor and evaluation have generally varied in importance (Winter, 2008).

In a 2008 *EJIS* editorial, Winter explored how the German-speaking IS community has approached DSR and described the expected outcomes of such research. Österle et al. (2011), supported by 111 full professors from the community, advocated in a "memorandum on design-oriented IS research" an approach for the community to evaluate this research, particularly for the purpose of promotions, professorial appointments, and other personnel matters. Both Winter (2008) and Österle et al. (2011) differentiate between *design science* and *design research*, such that design research is aimed at "creating generalized designed solutions to classes of relevant problems by using a rigorous construction and evaluation process. … Design science reflects the

design research process and aims at creating standards for its rigor (Österle, et al., 2011).” Design science focuses on the philosophy of the science and how such research should be conducted, whereas design research is more about the application of such research principles to work with innovative IS artefact (Winter, 2008).

Focus. DOIS aims at developing and providing instructions for the design and operation of IS and innovative concepts (Österle, et al., 2011). Four important expectations are applied to DOIS results.

- Abstraction: Each artefact must be applicable to a class of problems.
- Originality: Each artefact must substantially contribute to the advancement of the body of knowledge.
- Justification: Each artefact must be justified in a comprehensible manner and must allow for its validation.
- Benefit: Each artefact must yield benefit – either immediately or in the future – for the respective stakeholder groups (Österle, et al., 2011).

Process. A four-step model describes the application of DOIS (Österle et al 2011). The steps include analysis, design and development, evaluation, and diffusion. In analysis, researchers or practitioners define interesting problems to address. This exploration may include data collection, analysis, and literature review. The outcome of analysis is a research plan. In design and development, an artefact is created, with the help of prototypes, computer-aided software engineering tools, and method engineering, etc. In evaluation a specified set of methods is employed to evaluate the artefact. In diffusion, the findings are communicated through a multiple channels such as scientific articles, technical books, seminars, on-the-job training, funding applications, start-ups, spin-offs etc.

Evaluation. In contrast to DSRM and ADR, the DOIS community argues for a specific set of evaluation methods that should be applied conducting such research. They include laboratory experiments, pilot applications, simulation procedures, expert reviews, and field experiments (Österle, et al., 2011). Winter (2008) sees the evaluation more context-dependent and advised that the research context and targeted outputs of the study should be closely taken account when considering how to evaluate the outputs a DSR study.

Role of Theory. DOIS "is not a non-judgmental scientific discipline; rather it is normative, in the sense that the construction of artefacts is guided by the desire to yield a specific benefit and to satisfy certain objectives (Österle, et al., 2011)." "Theory building is not design science research," asserted Winter (2008), however, theories as "valid cause-effect relations" can be considered as "foundations for choosing desirable ends, i.e., normative actions."

Explanatory Design Theory

Focus. Explanatory design theory (EDT) (Baskerville and Pries-Heje, 2010; Niehaves and Ortbach, 2016) is a type of design theory that emphasizes design features and their effects on the environment, e.g., on a user. Hence, an EDT requires at least one design variable that can be manipulated systematically and hypotheses that allow evaluating the relationship between a design feature and hypothesized effects. The evaluation of an EDT informs a designer whether specific features should be included within an artefact or not. By referring to the vocabulary of behavioural research, an EDT is closely related to what is commonly understood as a theory (Creswell, 2013; Dubin, 1978). Moreover, it allows the application of established research methods such as experimental research (Kampling, 2016). Due to the emphasis on design features and their effects on the

environment, the implementation of an artefact can be considered more a means to an end, not the value itself, however, the systematic manipulation is critical which requires some kind of instantiation, e.g., by means of a prototype or a simulation.

Process. The development of an EDT in similar to an IS design theory or a theory in the behavioural domain. In the development process, a researcher identifies alternative design alternatives (choices) to be the objects of investigation. The use of kernel theories is important to justify the proposition of hypothesis. Although the development process is not specified a priori, the resulting theory should include specific aspects such as a desired or undesired dependent variable, and design variables that can be manipulated systematically.

Role of Theory. A design theory is the major outcome of a research effort in this genre. Notably, a specific instantiation of an artefact is not required per se but is commonly needed for a systematic manipulation and evaluation of the artefact. Without some kind of prototype, a systematic manipulation of design alternatives limits an evaluation. Niehaves and Ortbach (2016) identified several aspects that are important to consider in the theory development and evaluation phase:

(1) There might be a conceptual distance between a latent independent variable (cause) and its corresponding items.
(2) There might be a conceptual distance between a latent dependent variable (effect) and its corresponding measurement.
(3) There might be a potential interdependence of simultaneously implemented design items.

Evaluation. The evaluation of an EDT can be conducted by means of hypothesis testing. For example, (Zahedi, Walia, & Jain, 2016) propose a theory that can be understood as an EDT and use an instantiation to evaluate effects of augmented

worlds. They used an experimental setting with a prototype to evaluate the proposed design theory.

Action Design Research

Action Design Research (ADR) (Sein et al 2011) focuses on the organizational context of DSR and how this affects the development and use of an artefact. It has found a receptive audience in the IS community, particularly for use when researchers have opportunities to work within an organization to develop the artefact. ADR integrates the, earlier developed, action research paradigm (Susman and Evered, 1978) with design science research to create a new methodology and genre.

Focus. ADR focuses is on designing practice-inspired artefacts, i.e., learning from the intervention. It is "a research method for generating prescriptive design knowledge through building and evaluating ensemble IT artefacts in an organizational setting," according to Sein et al (2011). While conducting DSR within an organization, they urge, it is vital to embrace the context of the research and to account for it in the evaluation of the developed artefact. Furthermore, by incorporating the to-be-developed artefact's organizational stakeholders and end-users in the research process, ADR will enable three kinds of contributions as outcomes of a study: (1) design principles that contribute to the literature in a specific domain area, (2) design ensembles that contribute to the know-how of developing specific artefacts and (3) enhanced practice and utility for the artefact end-users.

Process. ADR proposes four sequential stages that are to be interwoven to the building of the artefact,

1. Problem-formulation is based on existing knowledge gained from practitioners, end-users, other researchers and the extant literature Sein et al (2011). The problem

should be defined as an instance of a class of problems. Practice-inspired research solves problems that have practical relevance while generating knowledge applicable to a class.

2. Evaluation occurs concurrently with building. Concurrent evaluation of the artefact with other activities is an ADR thesis.
3. Reflection and Learning is a continuous stage and parallels problem formulation and building.
4. Formalization of Learning" focuses on generalization of the results. The developed artefact, or ensemble, represents a solution that addresses a problem that can be generalized (Sein et al 2011).

Role of theory. ADR results in theory-ingrained artefacts. A project outcome should be an artefact that has been developed with the support of literature, together with knowledge acquired from stakeholder participation (Sein et al 2011). The theoretical outputs incorporate, (1) generalization of the problem instance, (2) generalization of the solution instance, and (3) derivation of design principles from the research outcomes.

Evaluation. While most DSR methodologies view design and evaluation as sequential, ADR envisions design and evaluation as one process that occurs in researcher/organization interaction. Building the IT artefact involves organizational intervention and evaluation concurrently (Sein et al 2011). Reciprocal shaping emphasizes the recursive influence between researchers and practitioners and between the IT artefact and the organizational environment, where researcher and organization decisions evolve over many iterations. Mutually influential roles, in turn, highlights the importance of understanding that both the organization and the researcher(s) learn

together and bring their own contribution to the project and both should be equally respected.

On What do We Agree?

One way to approach a DSR definition is to identify the minimum set of functionality and attributes from among all five of the genres. After this discussion of DSR genres we might be tempted to think that there no common attributes. The five genres are quite diverse, however a close examination reveals several commonalities. The five genres all find these attributes to be required or highly desirable.

1. Artefact design, where the artefact is intended to produce or contain knowledge with some generalizability. On this dimension the genres vary from machine-like artefacts, to concrete solutions, to hypothesis testing, and to design theories.
2. A general process for problem definition and motivation, design and evaluation. The genres vary on this dimension from specifically defined, e.g., ADR, to loosely defined, e.g., DSRM.
3. Some use of theory, but where the role of theory may be very different, depending on the genre. From formal IS Design Theory to mere generalizability.
4. DSR provides alternative concepts to separate design research (creating general knowledge) from practical design (solving instantial problems). The DSR genre researchers view the specification of such knowledge differently among their genres, but they agree that it can arise generally through the design process. In the social science paradigm, theory generally comes from prior theory through the literature review (Ågerfalk, 2014; Hevner, March, Park, & Ram, 2004).

Discussion

What can be accomplished by defining DSR genres? Our first hope is that researchers

who work within a genre will, to some extent, avoid facing reviewer criticism based on premises that deny the legitimacy of work from the genre. In the past, much of qualitative research was dismissed because "it is not scientific, not objective, not trustworthy, nor reliable, not intersubjective, not a formalized method, not hypothesis testing, not quantitative, not generalizable, and not valid (Kvale, 1994)." Today, many well-regarded journals welcome qualitative research and so signal authors by including qualitative researchers among the editorial board. Researchers can hope that associate and senior editors will often, not always, send their papers for review to colleagues within their genre.

A reasonable expectation for DSR is that researchers should be able to place a paper for publication that is well done by the standards of a genre community of well-regarded researchers, without facing criticism from researchers from far afield niche communities with different values and standards. Future review processes may likely acknowledge the specific nature of distinct genres and focus their judgement accordingly. Consequently, a research paper that seeks to develop an IS design theory (genre: ISDT) would not necessarily be expected to develop a fully operational information technology-based machine on which to install and run it. In contrast, a research paper that seeks to develop an innovative artefact (genre: DOIS), would not necessarily be expected to present a fully-developed design theory. Instead, research papers would be evaluated based on the specific requirements of the genre from which they originated, with due consideration for the specific contribution claims of the authors and implicit requirements that would pertain to those claims.

Other positive outcomes that may well result from genre definition include presentation efficiency and an improvement in researchers' ability to build upon prior work within research streams. Currently, we see researchers frequently required to

independently build the intellectual infrastructure for a DSR presentation *in toto*, i.e., with lengthy problem definition and motivation, extensive literature review, and a well-justified design and evaluation process, all designed and justified anew for the project. Within a DSR genre, at least some elements may possibly be stipulated, e.g., accepted with reference to prior work. Such stipulation could result in more concise presentations that actually contain more substance targeted to artefact detail, discussion, and justification. In other words, a paper could say more with fewer words.

Any journal will normally desk-reject the majority of paper submissions. They may be unreadable, be defective on several dimensions, or they do not make a novel or interesting contribution. Of the minority of submissions not desk rejected, at least half will be eventually rejected, perhaps because authors will not do what is necessary for the paper to succeed or perhaps because the potential for a novel, important contribution is not revealed in the authors' revisions. There is a remaining portion of rejected papers, where the rejections might be called Type II errors. In the case of DSR, some may be rejected because the DSR literature provides so many plausible excuses to reject any paper and reviewers currently lack guidance about how to discriminate among paper types and their associated requirements.

Nothing in this guest editorial carries an expectation that all research outlets should respect and value all research genre equally. Journals differ dramatically in their expectations and we would not expect that the best journals will make basic changes in their various missions. *EJIS* "provides a distinctive European perspective on the theory and practice of information systems," while the *Journal of the AIS* mission says that it encourages "conceptual and empirical contributions." These statements suggest that quite different expectations are likely to attach to these publications for the long term.

Genre aside, researchers still must give considerable weight to the values and objectives of research outlets.

The reader ought to be aware that the genres described here are not the genres that will be DSR's future. They are genres that might be in DSR's future. In this editorial, we have selected several articles that appear to represent branches in DSR thought and we have pulled out concepts, assertions, objectives, and preferences that have some potential to differentiate among communities of DSR researchers that looked to these papers for guidance. We hope that this helps by suggesting a mental model for how a DSR genre might be defined. Any model necessarily represents a simplification. If DSR genres are to be defined, they are best defined by researchers within each genre community.

A hazard attaches to the publication of this editorial. It could become another layer of rules, the compliance with which researchers must prove to reviewers and editors. The hazard could manifest itself as expectations that the submitting authors explain in detail how they comply with the expectations of a genre or it could result in rejection if reviewers believe that it does not fit their genre. This article must not become a barrier to publishing DSR. This can be avoided by two mechanisms. Firstly, genre communities can define their standards, values, and beliefs flexibly to accommodate innovation and evolution. Secondly, if authors describe and justify their objectives, methods, and results with good, appropriate rationale, their arguments should be given due consideration, even though they do not fit prior patterns. Much to our bemusement, two of us have not unfrequently faced sceptical queries about whether we have followed our own published methodology.

Conclusions and Papers in this Special Issue

In this special issue of *EJIS* on "Exemplars and criteria for applicable design science research," at least two of the papers contain the seeds of potential new DSR genres. As DSR moves toward achieving an important role in its raison d'être, supporting the achievement of organizational objectives, Baskerville, Kaul, & Story (2018) propose a third dimension of value for DSR artefacts: aesthetics. A DSR artefact can be useful, it can be true, and it can also be beautiful or elegant. Since many systems in our economies and societies exist primarily to support hedonistic or aesthetic values, the solution that an artefact supports can be evaluated through its beauty and the pleasure that its use creates.

The other of the two papers goes not quite so far as to create a new dimension, but it reminds us that we ought to attend to an IS dimension that we have acknowledged but not always attended to in our zeal for designed artefacts and their role in improving IS and firm performance. That dimension is the social impact of artefacts (De Leoz and Petter, 2018). More and more systems are primarily targeted toward customers or other end users: to entertain or educate them; to evaluate their work; to keep them safe or observe their misbehaviour. For artefacts addressing wide-ranging phenomena that create observable effects on people and society, observance and evaluation of their social impacts should be regarded as very important. De Leoz and Petter (2018) have designed a process for incorporating this dimension into DSR.

We do not know that we need to task the researchers for every DSR research outcome with serious examination of the aesthetic value or social impact of their artefacts, but where the dimensions are clearly relevant, we may expect such attention. For example, for some DSR innovations, the social impact may be unobservable or indirect, e.g., directly affecting just one back-stage employee in the organization and the aesthetic dimension may be clearly irrelevant. Perhaps more interestingly, there may

develop research communities that focus on these dimensions and, thereby, create new DSR genres. These two papers should properly be considered essays. They are not theories; instead they express the carefully considered and well thought through views of their authors.

Another article seems to us to contain seeds for more than one potential additional DSR genre. Iivari (2015) proposes two strategies for IS design science research, (1) designing an IT meta-artefact as a solution to a class of problems and (2) solving a specific problem for a specific client and generalizing a packaged general solution for a class of problems. We're not sure that we can determine at this point whether these strategies represent potential new genres. It appears that strategy 1 has elements in common with DOIS and DSRM in that the objective is a meta-artefact that addresses a general class of problems, while strategy 2 has elements in common with ADR. Those are questions that the genre constituents will answer over time.

Aside from the two essays, we have a portfolio of papers in this issue that may be thought to represent a range of complexity. Three papers present generalizable IS designs. "Design and evaluation of a model-driven decision support system for repurposing electric vehicle batteries" (Beverungen, Klör, Markus, & Bräuer, 2018) straightforwardly presents the simplest form of DSR paper among those in this issue. It represents the design of an information system to address a class of problems and evaluates the artefact on those terms. "ERP Prototype with Built-in Task and Process Support (Babaian, Xu, & Xu, 2018)," presents a similar level of complexity, as it represents the development of a prototype information system that the authors evaluate with a proof of concept. In "Designing for Cyberphysical Systems: Insights from a Smart Grid Application (Brandt, Feuerriegel, & Neumann, 2018)," the authors develop a model for an information system that they evaluate using simulation. Designing a

generalizable artefact that goes some distance toward building an IS to improve the efficacy of the firm is the most straightforward DSR contribution. In each of these three DSR efforts, actually developing operational IS would likely have been infeasible for the researchers and produced little additional contribution for the readers.

Two papers in the special issue, "Design Principles for Sensemaking Support Systems in Environmental Sustainability Transformations (Seidel, Chandra, Székely, Gau, & Stieger, 2018)" and "An information system design theory for the comparative judgement of competences (Coenen et al., 2018)," each intend to go further toward presenting design theories than do the papers mentioned in the prior paragraph.

In conclusion, we observe that a trade-off appears to emerge as we view these seven DSR research efforts. DSR efforts potentially span the ends of a dimension. At one end, research outcomes specify an artefact well enough, or nearly so, that a reader could use the research outcomes to actually construct a system. At the other end of the dimension, only the conceptual outlines of a system are presented, but they are accompanied by lasting theoretical truths. As the DSR effort is more oriented towards developing practical IS as an outcome, more IS details are required. To support the development of a design theory, design detail required to build an operational artefact becomes optional or less complete.

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