Two Hurdles to Take for Maximum Impact of Design Science Research in the IS-Field

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Abstract. Design science research (DSR) in the IS-field is getting more and more an accepted place. Yet it has still not yet realized its full potential impact. I suggest in this conceptual article that design science researchers need to take two hurdles to realize maximum impact of their publications. The first one is taken by explaining to editors, reviewers and readers the nature of DSR contributions in general and their fundamental differences with explanatory contributions: the model one uses in DSR for IS is engineering research, rather than physics, for many the mother of all academic research. The iconic contributions of DSR are well analysed and validated generic design models. Design theories are not about explaining nature, but about artefacts, realized on the basis of generic design models, producing desired effects in given contexts. The second hurdle is to be taken by explaining the special nature of design science contributions in the IS-field: information systems are socio-technical systems. Design science for their 'hard' technical components is much like design science for engineering, but design science and design science research for their 'soft' components is different. In actual designing these differences include issues in the evaluation and realization of designs and in design science research the validation and generalization of designs. These differences are discussed as well as strategies to deal with them.

1 Introduction

Design science (DS) and design science research (DSR) are getting more and more an accepted place in IS-research (March and Smith, 1995; Hevner et al., 2004; Gregor and Hevner, 2013). Nevertheless, DSR has yet to realize its full potential impact, due to gaps in the understanding of its nature, application potential and of its methodology (Gregor and Hevner, 2013).

Gregor and Hevner (2013) address this issue by calling for better explanations to editors and reviewers of the special nature of IS design research contributions. They articulate the types of DSR-contributions to the knowledge base of the IS-field, discuss the nature of theory in design research and develop a knowledge contribution framework and a format for presenting DSR-contributions in academic journals. The present conceptual article follows their call for better explaining IS-design research contributions and builds on their work. It defines two hurdles to take for realizing full understanding and thus full impact of these contributions.

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The first hurdle is to explain the nature of DSR-contributions in general by defining DSR-contributions squarely on the basis of the design paradigm. Many researchers feel that the model to follow in *any* academic research is the explanatory model of physics and that physics research provides norms for *all* kinds of academic research. However, there are fundamental differences between the explanatory paradigm of e.g. physics and sociology and the design paradigm of e.g. engineering and medicine (van Aken, 2004 and 2005). These differences are not always fully understood by non-designers and this has consequences for the definition and assessment of DSR-contributions. Taking the first hurdle for full understanding is to be taken by explaining that the model followed by IS-design science research is engineering research rather than physics.

But there is also a second hurdle of misunderstandings to take. This one is caused by the special nature of information systems, the consequences of which are not always fully recognized. Information systems are socio-technical systems, i.e. complex arrangements of hardware, software, procedures, data and people (March and Smith, 1995). Design in information systems is not only about the design of technical artefacts. It is also about designing and changing social practice to realize desired effects in which the technical artefact plays a pivotal role (Sjöström, 2010). As will be discussed, the behaviour of technical (or material) systems is governed by 'strong mechanisms', while the behaviour of social systems is governed by 'weak mechanisms' (van Aken, 2013). Because of this, material systems are often called 'hard' systems and social systems 'soft' ones. One may conceptualize an information system as a 'hard' system of hard and software components[1], embedded in a 'soft' social system of users, user processes, and user capabilities and attitudes. This makes that design science as well as design science research for IS-systems differs from engineering design. Hard systems are expected to behave as designed, so also non-designers can understand that design knowledge on hard systems can be valid and valuable. However, human agency makes that 'soft' social systems do not necessarily behave as designed. Designs can influence human behaviour, but do not determine it. If this is true, what, then, are the nature, validity and value of design knowledge for 'soft' systems[2]? So the second hurdle is to explain these differences and the approaches and methodologies needed in DSR for socio-technical systems.

The article starts with giving definitions of DS and DSR. Also a distinction will be made within design science research between design questions and knowledge questions.

Next the first hurdle, misunderstanding the nature of design research contributions, is discussed on the basis of the model of engineering design. First by giving a brief analysis of designing in engineering, followed by a discussion of engineering design research. Well analysed and validated *generic design models* can be regarded as the iconic DSR-contributions, in engineering research as well as in IS-research.

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[1] From the perspective of IT-hardware software may look soft (nomen est omen), but from the perspective of social system design the combination of hard and software is 'hard' enough to allows almost fully the approaches and methodologies of 'hard' engineering design.

[2] Soft systems is a concept coined by Checkland (see e.g. Checkland and Scholes, 1990), but this article does not use his various concepts and methodology, however important they are.

However, this is a necessary but not sufficient explanation and justification of DSR-contributions in IS-research. This is because human agency introduces an element of non-determinism in IS-design which makes generalization of design models difficult. This issue produces the second hurdle. To prepare the discussion on this second hurdle the article proceeds with a brief discussion on social system design and its differences with material system design. These differences include issues in the evaluation of designs, the realization of designs and of the role of the so-called 'hidden properties'. The generalization issue is discussed in the following section on DSR for social system design. This involves a discussion on the differences between the strong mechanisms of the material world and the weak mechanisms of the social world, governing human behaviour. Then the second hurdle is addressed by arguing that well analysed and validated generic design models can also be regarded as iconic DSR-contributions in the IS-field. However, the way in which these design models are to be used in designing in the field and the way in which valid and valuable generic design models are developed and validated differ from engineering design. Rigour in developing design knowledge for social systems is quite possible, but is does involve a type of science that differs from physics. The article ends with a discussion and a conclusion.

2 Design Science and Design Science Research

Articles on DS and DSR do not always define what is meant by these two concepts, but in an article intending to define DSR-contributions this seems to be useful. The following definitions are from van Aken (2013), who follows Cross (1993 and 1995). These definitions do not differ from most common sense understandings of these concepts.

'Science' can be defined as a body of knowledge ('scientia' being Latin for knowledge), i.e. valid knowledge produced by rigorous academic research. Design science can be defined as such a body of knowledge on designs and designing to be used in an instrumental way. The addition in this definition on instrumental use draws on the distinction Pelz (1978) makes between instrumental and conceptual use of knowledge. In case of conceptual use knowledge is used for general enlightenment on the subject in question, while instrumental use involves acting on knowledge in specific and direct ways.

Design science research is simply research producing design science. DSR is driven by field problems. A field problem can be defined as a situation in reality, which according to (some or all) stakeholders can or should be improved. In DSR the field problem is translated into a design problem: what (realized) design can solve the field problem or at least improve the problem situation? DSR does not only deal with these design problems, but also with knowledge problems, that is with questions about the behaviour and effects of artefacts (realized designs) in context[3].

[3] This distinction between design problems and knowledge problems draws on Wieringa (2009). However, Wieringa does not make a distinction between field problems and design problems, combining these problems by using the term 'practical problems'.

Like any academic research, DSR aims at generic knowledge. A DSR-project is driven by a *type* of design problem, derived from a class of field problems, like the need or desire for improving a certain type of business function or the wish to exploit a new IT-technology in the field.

3 The First Hurdle: The Design Model as the Iconic Design Science Research Contribution

The fundamental differences between research based on the explanatory paradigm and research based on the design paradigm (van Aken, 2004, 2005) are a major source of misunderstandings. Not only for non-designers, but quite often also for designers as they try to meet apparent general criteria for valid knowledge and for rigorous research, which are almost invariably based on the ones for explanatory research. Explanatory research, main stream research in e.g. physics and sociology, is a *search* for understanding, and natural laws or causal mechanisms can be *discovered.* Design, on the other hand, deals with the world that can be. One cannot search for this world, nor can it be discovered, because it does not (yet) exist. The world that can be is to be designed and designing always involves a creative jump to something new (abduction[4]), be it a small jump in incremental design or a large one in radical design. Abduction plays a key role in dealing with design questions. For knowledge questions the research strategies and methods of explanatory research can be used.

The model followed by DSR in the IS-field (consciously or unconsciously) is not physics, but engineering research, like research in mechanical, civil or electrical engineering. The iconic DSR-contribution in engineering research is the well analysed and validated generic design model, like a design for a new transmission system for cars, or for a new way to build bridges in unstable riverbeds or a new design for electronic receivers at higher frequencies than usual.

Generic design models have a key function in the design process. Designing is done in synthesis-evaluation iterations (Roozenburg and Eekels, 1995). In the synthesis step one makes a version of a design that may solve the design problem and may satisfy the requirements, made for the design. In the evaluation step one analyses ex-ante the design ‘on paper’ to see whether it meets specifications. If that is (not yet) the case, an adapted design is made and again evaluated. These iterations are continued until a satisfactory design has been made (see also van Aken, van der Bij and Berends, 2012, on this process). Generic design models play an important role in the synthesis step. Designing is typically *variant design*, in which a variant is made of a known generic design model. In incremental design the variant can stay close to the design model, but one can also make a big jump to something very different on certain properties of the design model as in radical design. But even in radical design the exploration for possible radical solutions for the design problem still uses to some

[4] See e.g. Pierce (1923) or Samuels (2000) on abduction, and Roozenburg and Eekels (1995) and Van Aken et al. (2012) on the role of abduction in designing. Abduction plays a key role in dealing with design problems, but the earlier mentioned knowledge problems can be dealt with by using the research strategies of explanatory research.

extent generic design models. Furthermore, every engineering discipline uses a specific 'design language' to describe its designs during the design process and to communicate its final designs through e.g. texts and drawings with the people who have to realize them in workshops or construction sites. The layperson, not having mastered this language, is not able to 'read' the designs made in the discipline in question.

For the evaluation step engineers have a lot of engineering mathematics at their disposal to set the values of the various parameters of their designs and to evaluate their designs 'on paper'. Evaluation on paper is the evaluation of a 'paper design' (even if computers are used to do this job) to decide whether or not to transfer this design to physical reality. If the design is too complex to analyse their design mathematically, engineers can use *case-based reasoning*[5], which involves an analysis of their 'paper design' by comparing it with similar well analysed and documented *realized* designs (which is, of course, much more difficult in radical design than in incremental design).

As said, the iconic DSR-product is the generic design model. Typically it is made by realizing and field-testing a series of instantiations until a version is made that satisfies the researchers. This final version is further field-tested to validate it. Validation[6] of a design model is gathering evidence for the core claim of design science research. This core claim with respect to a generic design model is that realized artefacts, made on the basis of this generic design model, will produce the desired and claimed performance. As will be discussed, because of the strong mechanism in the material world engineering design needs in principle only one test to get sufficient evidence for this core claim. Like Galileo also needed but one test to prove that small balls fall equally fast as big ones.

I suggest that also IS-design science research can present its results in terms of well analysed and validated generic design models. Design theories are not about explaining nature, but about artefacts, realized on the basis of generic design models, producing desired effects in given contexts (Wieringa, 2009), preferably with explanations on why, through what mechanisms, the use of the artefact produces the desired effects. Examples of generic design models in IS are a type of Enterprise Resource Planning system, a type of expert system or a type of office automation system. Like discussed under engineering design, such generic design models can be used in variant design to design context-specific instantiations[7]. A type of information system can be used a generic design model if it is well analysed, if it is validated and if it is known through what mechanisms its effects are produced.

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[5] See e.g. Leake (1996) or Watson (1996) on case-based reasoning for evaluating material system designs.

[6] In this article the *validation* of a generic design model to prove the core claim associated with this generic design model, is distinguished from the *evaluation* of a paper design for a specific application as discussed earlier in the context of the synthesis-evaluation iterations.

[7] Gill and Hevner (2013) use the term 'fitness' for instantiations that can be reproduced (in analogy with biology, where the fitness of a given organism is its ability to reproduce within a given ecosystem). In the terms of this article an instantiation with a proven high 'fitness' can be regarded as a generic design model.

As said, the validation of a generic design model is about the potential of artefacts, realized on the basis of the design model in question, to produce through their use desired effects in given contexts. What effects are to be desired is to be defined by their (future) stakeholders. The validation of a generic design model is not about the definition of desired effects themselves, but about the realization of already established desired effects.

This use of generic design models to design specific instantiations is a mode of generalization. One instantiation is generalized to a series of instantiations with similar properties producing the desired effects. It is not the statistical, sample-based generalization of quantitative social science research in which propositions are generalized from samples to populations *as they are*. It is instead the mode of generalization, called analytic generalization by Yin (1984), in which generic propositions are transferred from the settings in which they have been developed to other contexts, while being *translated and contextualized* on the basis of a careful analysis of the differences between the target context and the (average) source contexts[8].

March and Smith (1995) give the following, well-known, types of DSR-contributions in the IS-field: constructs, models, methods and instantiations. These can be interpreted in terms of generic design models. Constructs can be regarded as elements of the 'design language' of IS-design to be used in describing generic design models as well as individual specific designs. Models and methods are typically already presented as design models (without using this term), being generic proposals for making specific designs of for following a course of action to achieve a given objective. Finally, instantiations provide evidence for the validation of the generic design model, showing that designs made on the basis of the generic design model do indeed produce the desired effects. However, as we will see, unlike in engineering design, one instantiation is seldom enough to validate a design model.

In aiming in research for developing generic design models and subsequently presenting them to editors, reviewers and readers as key DSR-contributions in the IS-field, one should also follow Gregor and Hevner's (2013) call for in-depth explanations. A generic design model is a type of research contribution that differs from the explanatory theories and causal models of most common research, also in IS, and thus needs explaining and justification.

But there is a second hurdle to take because of the special nature of IS-design. Unlike engineering design IS-design does not only operate in the material world but also in the social one. In the social world human agency introduces elements of non-determinism in the behaviour of realized designs and that makes that both the development of design science and the use of design science differs from engineering design. Design models can be the iconic DSR-contribution also in IS-research, but they need a further explanation: the second hurdle. In order to develop this explanation the following section gives a brief discussion on social system design and the following one on social system design research.

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[8] See Lee and Baskerville (2003) on a thorough discussion of the issue of generalization and the various modes of generalization.

4 Social System Design

Although some believe that social systems cannot be designed, but are emergent, social system design is a routine business process in almost any organization. New company structures or departmental structures or business processes are routinely designed and implemented. Even if implementation of a social system design has its problems, in general social system design can be done with reasonable success. What is true, however, is that social system designs do not determine system behaviour like designs for material systems do and that a significant part of a realized social system is indeed emergent: the so-called informal organization[9]. What is also true is that quite often social system design, and in particular implementation, is done in a non-professional way.

Social system design has many similarities with engineering design. These include

- the use of design requirements (why make a new design and what are the demands for the new system)
- gathering relevant input for the design process (like an analysis of the problem that triggered the design process and its context)
- executing the core design process in synthesis-evaluation iterations
- the use of generic design models for the synthesis step (like the functional, business-unit of geographical organization structure and the very idea of the superior-subordinate structure)
- the ex-ante evaluation of designs ‘on paper’
- the documentation of the final design in a way that it can be realized by others.

However, social system design is not always done in a professional way. Because of the above-mentioned similarities, it can learn a lot from engineering design (see van Aken et al., 2012). Typically the elements of the design process mentioned above are done in a very informal way, more visible in an analysis by an observer, than consciously executed by the designers. From engineering design one can for instance learn

- rigorous attention for the design requirements and the need to get full understanding and consensus of the various stakeholders on these
- rigorous attention for the inputs (and their quality) to the design process, like these specifications, the analysis of problem and its context, and relevant generic design knowledge like design models and general industry knowledge
- and in particular attention for the rigorous ex-ante evaluation ‘on paper’ of the design.

There are also fundamental differences between engineering design and social system design. One is the ex-ante evaluation ‘on paper’ of designs. In engineering design one can often use mathematical modelling and analysis (or simulation) to evaluate designs on paper, but the indeterminate nature of social systems designs makes this infeasible.

[9] See e.g. Gray and Starke (1988) on the informal organization.

Therefore, like has been discussed for certain complex instances in engineering design, also in social system design case-based reasoning can be used as an important method for the evaluation of designs.

The second fundamental difference is in the realization of the design. In material system design the design can be realized by a workshop, factory of construction firm largely as it has been designed. A good design gives them all the information they need to do so. In social system design the design is realized by the members of the (new) system by internalizing the design. This involves a redesign of the formal design: the interpretation and appropriation of the formal design from the perspective of the actors who have to operate in the new system. This realization of a design has also to deal with the fact that often social system design is a 'brown field' and not a 'green field' design and thus involves a redesign of an existing situation. Therefore this interpretation and appropriation step has been called 'the second redesign'. This second redesign and the subsequent phase of 'learning to perform' in the new situation (involving further adaptations of the formal design), leads to the emergence of the informal organization (see van Aken, 2007, on this process of second redesign, realization and emergence).

The emergent informal organization can be discussed in terms of 'hidden properties'. Any *realized* design – material and social alike – has unlimited hidden properties, properties present in reality but not in the design that was used to realize it. For instance, the colour of the housing of a machine may be a hidden property: the designer did not specify it in the design because he/she felt that this property is unimportant and left it to the workshop to choose the colour. Good designers only specify in their designs the properties that are important for the performance of the realized design.

In social system design one can regard the informal organization as the hidden properties of the realized social system, not specified in the formal design, but present in social reality. But, contrary to material system design, the hidden properties of a realized social system typically have an important impact on performance. Therefore, designers or change agents have to monitor the second redesign and the learning to perform and to intervene if deemed necessary for performance (see van Aken, 2007, on hidden properties and the importance of the informal organization).

5 Social System Design Research

I have suggested that the iconic product of design science research is the well analysed and validated generic design model, both for material system and for social system design research. The core scientific claim associated with a generic design model is that its application (in the given application domain) will indeed produce the desired effects: the validation issue. So the core issue in DSR (again both in the material and social world) is the prediction of system performance. The golden standard for this is field testing, the testing of instantiations of the design in various contexts within its intended application domain.

In the material world this prediction of system performance through field testing does not pose specific methodological problems, different from methodological issues in developing valid explanations. The reason for this is that in the material world there are *invariant, universal, individual behaviour determining mechanisms*. An electron does not have the freedom to act tomorrow differently from today, nor in New York differently from Amsterdam. A machine, developed, assembled and tested in Helsinki, will work next month likewise in Dublin. Through these mechanisms in the material world the test results on one instantiation of a given research product (for which standard analytical methodologies of explanatory research can be used) can be readily generalized to other times and places.

This applies to engineers and to some lesser extent also to medical doctors[10]. However, in the social world there are no universal, invariant, individual behaviour determining mechanisms. Therefore, the prediction of system performance in the social world is difficult. In the social world the evaluation of one application of a generic design model cannot simply be generalized to other times and places. This is the fundamental methodological problem of design science research in the social world. It is caused by human agency.

Even if there are no behaviour determining mechanisms in the social world, there are regularities and patterns in social behaviour. In fact, the prediction (within certain ranges) of the behaviour of other people in response to one's own behaviour is an almost universal human competence. Without this competence intentional social behaviour would be impossible. The extent to which this competence is important and universal can be seen in people, lacking this competence because of an autistic disorder.

This competence is developed by personal social experiential learning, learning from personal social experiences[11]. It is subsequently applied through case-based reasoning: the present setting is compared – typically unconsciously – with similar prior experiences and a line of action is chosen on the basis of the effects of the actions in these previous experiences. This makes that this mode of personal learning is limited by the scope of one's personal experiences: outside this scope the competence of predicting human behaviour is much less, as can be seen when acting in a very different culture than one's own.

Personal experiential social learning is the basis for the social behaviour of any person. However, experiential social learning can also be done in a scientific way: *systematic and objective experiential social learning*. By 'objective' I mean that the strategy includes the use of methods to eliminate as good as possible personal biases in the articulation of the results of experiential learning (like is done in rigorous case-studies). Through this research strategy one can learn what the effects of certain types of interventions in various social settings can be.

Research as systematic and objective experiential social learning is learning on the basis of series of rigorous case-studies with detailed descriptions and analyses of problem, context, interventions and effects, giving deep insight in these elements and in their interrelations. This approach has been called 'Action Design Research' by Sein et al. (2011) or 'Technical Action Research' by Wieringa and Morali (2012).'Thick' descriptions, as opposed to the strongly reductionistic models of quantitative research, are needed to make the reading of case-studies into 'real' social

[10] This 'lesser extent' is due to the fact that in testing interventions medical doctors deal with living material of which there are never exact copies in other times and places, so they need RCT's or other sophisticated research designs to generalize test results.

[11] See e.g. Kolb (1984) on the power of experiential learning.

experiences. So the experiential learning strategy involves series of rigorous case-studies on a certain type artefact in various contexts within the intended application domain. These case-studies can be executed in 'Action Research mode', in which case the researcher is involved in developing and testing the intervention, but the researcher can also take a more observer role, observing how others develop and use interventions to address the field problem.

The research is to be made 'objective' by using the various methods of rigorous case-studies, like controlled observations, triangulation, 'thick' descriptions, careful cross-case analyses and member checks and by alfa- and beta-testing of the developed interventions or systems.

Scientific experiential learning through series of case-studies involves working alternating in the *practice stream* and in the *knowledge stream* (Andriessen, 2007). In the practice stream one operates in the swamp of practice on a specific instantiation of the generic artefact to be studied, interacting with the various local stakeholders. In the knowledge stream one operates on the high ground of generic theory to generalize the findings of the various individual case-studies through careful cross-case analyses. While interacting with other researchers and with practitioners interested in developing generic theory, one tries to establish what is case-specific on the one hand and what can be learnt from these cases for use in other settings on the other.

Like in personal experiential learning the application of what has been learnt is done through case-based reasoning. System performance is predicted on the basis of a qualitative comparison with interventions in similar settings, somewhat like judges using case-law in determining verdicts.

Experiential social learning is for the researcher the basis strategy to develop generic design models. It is also the basis for the application of generic design models in the field. On the basis of rich case material (the basis of social learning) the practitioner *learns* to understand the system to be redesigned and how variations in context can influence performance.

6 The Second Hurdle; the Nature and Development of IS-Design Science Research Contributions

The thesis of this article is that the iconic product of DSR in the IS-field can be a well-analysed and validated generic design model, just like in engineering research. To explain this well to editors, reviewers and readers is the first hurdle to take for realizing maximum impact.

The second hurdle to take is to deal with understandable objections, based on the differences between engineering research and IS-research. Or, in other words, the differences between material system and social system design and design research. As discussed, these differences are caused by human agency and by the differences between strong material mechanisms and weak social ones. Above the ways to deal with this in social system design and in social system research have been discussed. The main element of taking the second hurdle may be the acceptance that the social world needs another type of science than the material world and that systematic and objective experiential social learning can be the rigorous way to develop generic design models for the social world.

7 Discussion

This article is about design science research. Non design science researchers may call it prescriptive or normative research. This is, however, a misnomer. Researchers cannot and should not from the high ground of theory tell people in the swamp of practice (to use the terms of Schön, 1983) what to do. DSR-publications seldom use the words 'should' of 'ought'. The key product of DSR, the generic design model, is not a normative statement nor a prescription but only a well analysed and validated option, presented to practitioners to be used in their variant designing.

The strategy of systematic and objective experiential social learning may look unfamiliar to researchers with a sound training in research methodology, not in the least because it is not (yet) discussed in methodology textbooks. However, this possible unfamiliarity only exists at the level of research strategy with its design orientation (hurdle one) and its strategy of systematic and objective experiential social learning (hurdle two). It does not exist at the level of execution: in principle in DSR one can confine one's methods for data gathering and analysis to well proven ones. Furthermore, for the well-trained researcher the strategy may look unfamiliar, but it is a very naturalistic approach. It is what everybody does who wants to realize desired effects by a new intervention in a possibly new context: he or she applies the intervention a few times and learns by doing how to realize these desired effects. Finally, for DSR in the IS-field the strategy may even look fairly familiar, because of the publications on e.g. Action Design Research (Sein et al., 2011) and Technical Action Research (Wieringa and Morali, 2012). Using the term 'systematic and objective experiential social learning' is, however, not a semantic issue. This term is used because of its emphasis on rich descriptions to allow social learning and because of the nature of the intended products of this research strategy: not formulae or instructions, but deep insight in the complexities of the relations between information systems and effects and of the various contextual influences on these effects.

My background is in management research and design science research. My interest in IS-research is to a large extent driven by the combination in IS-design and research of hard material systems and soft social ones. This makes it possible to research and show the power of material system design, in particular in engineering design, and the fundamental differences between material and social system design.

Finally I would like to suggest that the idea of the double hurdle is not only applicable in DSR in the IS-field, but also in DSR in most social sciences: the first hurdle of understanding the differences between classical explanatory research (like in physics) and intervention, or improvement or design oriented research (like in engineering and medicine) is present in most social sciences. But the second hurdle is also present in most social sciences. This is the hurdle of understanding that intervention or design oriented research in the social world demands a kind of science, differing from the kind of science possible in the material world. This demand is caused by human agency and by the differences between the strong mechanisms of the material world and the weak mechanisms of the social world.

8 Conclusion

Behaviour in the intangible, fluid and indeterminate social world of human agency and human relations is not governed by the strong mechanisms of the material world, but by the weak mechanisms of the social one. As said, this necessitates a different type of science. Instead of measuring, mathematical modelling and application of mathematical (causal) models through logical deduction, one has systematic and objective experiential social learning.

For editors, reviewers and readers DSR in the IS-field is getting more and more an accepted place, but it's fundamental differences with explanatory research are still too little understood (the first hurdle to take), as well as the differences between the design of material systems (engineering design) and social system design, and the associated need for a different type of science[12], the second hurdle to take. So, in order to realize full impact of DSR in IS, it is important to follow the call of Gregor and Hevner (2013) by explaining in full detail the above-mentioned differences.

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[12] At least for prospective design science research, where human behavior is non-determined. In retrospective explanatory research there is no longer an impact of human agency: one can treat past human action as fixed.

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