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A Framework Proposal to Evaluate Conceptual Models Framing Wicked Managerial Concepts

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A FRAMEWORK PROPOSAL TO EVALUATE CONCEPTUAL MODELS FRAMING WICKED MANAGERIAL CONCEPTS

Research Paper

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Abstract

Visual and collaborative canvases named visual inquiry tools have emerged as a powerful design science research (DSR) artefact to address wicked managerial problems. According to the design theory for visual inquiry tools, designing such a tool entails the development of a particular type of conceptual model, namely a parsimonious and simple conceptual model. Although the theory lists design principles that the conceptual model must abide by, it unfortunately remains silent regarding how one evaluates it in regard to them. Given that, coupled with the fundamental position evaluation holds in DSR, this research paper builds on existing prescriptive knowledge to develop a framework that supports designers in the evaluation of their conceptual model. The framework is composed of four evaluands, evaluation criteria, and guiding questions which depict, at a high-level, the questions to ask to evaluate the conceptual model. The framework is then applied to evaluate an existing conceptual model.

Keywords: Design Science Research, Wicked problem modelling, Visual inquiry tool, Artefact evaluation

1 Introduction

Rapidly evolving contexts and greater awareness of societal issues have brought forth both the number of ill-defined problems and the need to consider them thoroughly. These unique, complex, and intangible problems are referred to as "wicked" (Buchanan, 1992). Strategic management issues (Clegg et al., 2011) relating to sustainability would be an example of a wicked problem. Due to their ill-defined nature, these problems cannot be addressed by solely employing analytical methods, rather, they require to be approached with social-oriented practices (Hawryszkiewycz, 2014). Such issues can be addressed within the Design Science Research (DSR) paradigm (Hevner et al., 2004), where the objective is to solve real-world problems (vom Brocke et al., 2020) through design. A particular type of DSR artefact founded on design thinking techniques (e.g., visual thinking, storytelling, prototyping and ideation), termed visual inquiry tool (Avdiji et al., 2020), has been developed to tackle wicked problems in an innovative, engaging, and social way as opposed to a linear and rigid one (Boland et al., 2008). A visual inquiry tool is a canvas with empty design spaces that allows its users to visually and collaboratively address a wicked managerial problem (Avdiji et al., 2020). Given the growing number of such tools and their usefulness to managers, Avdiji et al. (2020) have theorised the design knowledge acquired through the development of three well-known visual inquiry tools – namely, the Business Model Canvas (Osterwalder and Pigneur, 2011), Team Alignment Map (Avdiji, 2018), and Value Proposition Canvas (Osterwalder et al., 2014) and established the design theory for visual inquiry tools.

According to the design theory, in order to design a visual inquiry tool, one must first frame the underlying wicked managerial concept (e.g., brand identity or team coordination) by means of a conceptual model. Conceptual models can be understood as a visual representation of a static or dynamic real-world phenomenon (Wand and Weber, 2002; Milton et al., 2012) and serve to communicate the represented domain (Hadar and Soffer, 2006) to the different stakeholders (Shanks et al., 2003). The objective of the conceptual model is to provide a sound conceptual underpinning to the visual inquiry tool, thus serving as an intermediary, but essential step in the design of the tool. However, in contrast to traditional conceptual models that typically aim for completeness (Shanks et al., 2003), conceptual models developed as a basis for visual inquiry tools aim to represent the key elements of the wicked managerial concept and must accordingly be kept parsimonious and simple (Avdiji et al., 2020). This will enable the conceptual model to subsequently be instantiated into a visual inquiry tool. Therefore, given that they strive for a parsimonious representation, we name conceptual models framing wicked managerial concepts, *lightweight* conceptual models.

In this research paper, we concentrate on lightweight conceptual models developed for the design of visual inquiry tools. Because the conceptual model serves as the basis for subsequent design cycles, its rigorous development and evaluation are critical in the design journey of a visual inquiry tool. However, although the design theory provides three sub-design principles that the conceptual model must abide by (i.e., frame, rigour and relevance & parsimony), it remains silent concerning how one evaluates the conceptual model in regard to them. This lack of guidance is of particular concern since not only are the evaluation activities key aspects in the conceptual modelling field (Becker et al., 2008a; Milton et al., 2012), but they are a dominant concern in DSR (Hevner et al., 2004; Venable et al., 2016).

Given the gap, coupled with the rise in visual inquiry tools (e.g., Möller et al., 2021), and the consequent need to build conceptual models to design them (Avdiji et al., 2020), this paper aims to answer the following research question: *how to evaluate conceptual models framing wicked managerial concepts?*

To answer this research question, we build on existing prescriptive and descriptive knowledge, such as already existing evaluation criteria (Shanks et al., 2003; Avdiji et al., 2020) and the Framework for Evaluation in Design Science Research (FEDS) (Venable et al., 2016) to develop a first proposition of a framework. The framework helps the designer build, structure and run the evaluation of the lightweight conceptual model. To do so, the framework proposes a way to decompose lightweight conceptual models into four evaluands, lists the evaluation criteria against which the evaluands must be evaluated, and offers guiding questions that support the evaluation.

We hope that by offering further guidance to evaluate lightweight conceptual models, designers will be better supported in the design of visual inquiry tools developed with and for practice to address wicked problems in view of possibly reaching a brighter tomorrow (Young et al., 2021). By doing so, we participate in the accumulation of prescriptive knowledge (vom Brocke et al., 2020) and contribute to the knowledge base in terms of methodology (Hevner et al., 2004).

The remainder of the paper is structured as follows: in section 2 we provide a theoretical background regarding conceptual modelling, introduce lightweight conceptual models, and provide an overview of evaluation in DSR. We conclude the section by highlighting and motivating the identified gap, namely the lack of concrete guidance available for evaluating conceptual models framing wicked managerial problems. In the third section, we present how, by using the existing literature, we developed the framework to address the gap. Subsequently, in section 4, we apply the framework in a naturalistic setting to evaluate an existing conceptual model designed in an ongoing DSR project. Finally, sections 5 and 6 discuss the findings, draw implications for future research and present the limits of this paper.

2 Background literature

2.1 Conceptual modelling

Conceptual models are a visual representation of someone's (or a group's) conception of a static or dynamic real-world phenomenon (Wand and Weber, 2002; Milton et al., 2012). They illustrate how specific individuals perceive a real-world domain and serve to communicate the represented domain to different stakeholders (Hadar and Soffer, 2006; Shanks et al., 2003). Having emerged in the 1970s, conceptual modelling traditionally served to depict requirements for an IS project (Lukyanenko et al., 2017). However, conceptual modelling is now at a turning point, due to, for example, the digitalisation of today's environment (Recker et al., 2021) or the need for specific conceptual models framing wicked managerial concepts (Avdiji, 2018). Regardless of the nature of the conceptual model, the process of creating one still entails observing reality and then translating it into a model (Hadar and Soffer, 2006) using a modelling grammar (Wand and Weber, 2002). Once the focal domain has been conceptualised via, most of the time, a graphical model (Shanks et al., 2003; Milton et al., 2012), an evaluation must subsequently be performed. Rigorously evaluating the conceptual model is an essential part of its development (Becker et al., 2008a; Milton et al., 2012; Recker, 2005), and thus should not be overlooked. Conceptual models are often evaluated in regard to their quality (Moody et al., 2003) and specifically, to their syntactic, pragmatic, and semantic quality (Lindland et al., 1994). Rested on the semiotic theory (i.e., theory of signs, Morris (1938)), Lindland et al. (1994) describe syntactic, pragmatic, and semantic quality as being the key quality attributes that must be held by a conceptual model.

Syntactic quality refers to the correspondence of the model and the used modelling grammar (Siau and Tan, 2005). In this respect, the quality of a conceptual model would, for instance, be assessed based on the characteristics held by the modelling grammar used to build it (i.e., how well the grammar allows the concept to be framed) (Becker et al., 2008b). Pragmatic quality refers to the stakeholder's interpretation of the model, and the primary objective is their comprehension of the said model (Lindland et al., 1994). Finally, semantic quality addresses the relation between the focal domain and the conceptual model. Thereby relating to how well the model represents the domain. Semantic quality has two objectives: validity and completeness. While the former ensures that the elements of the model are both correct and relevant to portray the domain, the latter refers to how exhaustively the model depicts the domain. Concerning the semantic quality, Shanks et al. (2003) list four attributes that the conceptual model must abide by to be faithful to the focal domain. Namely, it must (1) accurately and (2) completely describe the concept under consideration and the different parts of the model need to be (3) conflict and (4) redundancy free.

2.1.1 Lightweight conceptual models for visual inquiry tools

We set apart lightweight conceptual models from "traditional" ones. A clear distinction between the two is essential because, while they do bear some similarities such as their common objective to visually represent a phenomenon (Wand and Weber, 2002; Milton et al., 2012), they do not serve the same purpose, and thus cannot be evaluated in the same way. As discussed below and illustrated in table 1, the two vary regarding their (1) context of use, (2) objective, (3) conceptualised phenomenon, and (4) evaluation criteria.

Traditional conceptual models, on the one hand, describe "things", their properties, events, or processes (Wand and Weber, 2002). Amongst others, they support requirements analysis (Wand and Weber, 2002) by, for example, supporting the identification of requirement errors (Moody et al., 2003). According to a survey performed by Fettke (2009), the main three uses of conceptual models are to support the subsequent design and management of databases, software development, and business process improvements. They can be evaluated with respect to their syntactic, pragmatic, and semantic qualities (Lindland et al., 1994) and aim to formally and exhaustively represent the phenomenon.

Lightweight conceptual models, on the other hand, describe wicked managerial concepts and are developed as a basis for the subsequent design of a visual inquiry tool (Avdiji et al., 2020). Visual inquiry tools are canvases that allow their users (e.g., managers) to visually and collaboratively address wicked managerial problems. In their paper, Avdiji et al. (2020) propose a design theory to develop such type of tool. For that matter, they extracted the knowledge created from the design of three visual inquiry tools (Business Model Canvas, Value Proposition Canvas and Team Alignment Map) and condensed that knowledge into a set of three design principles that guide the design of a visual inquiry tool. The three design principles are: 1) to develop a conceptual model that frames the concept of interest, 2) to instantiate the conceptual model into a shared visualisation (i.e., a canvas with empty design spaces) and, 3) to elaborate direction of use. In this paper we specifically concentrate on the first design principle, that is – the conceptual model. Indeed, according to the authors, because of the ill-defined nature of wicked managerial problems, tools addressing them ought to be built on solid conceptual foundations. Thus, building a rigorous and relevant conceptual underpinning of the wicked managerial problem is the first step required when designing such a tool (Avdiji et al., 2020). For example, a conceptual model of team coordination (Mastrogiacomo et al., 2014) was built as an intermediary and elementary step in the design of the Team Alignment Map (Avdiji, 2018). We name conceptual models framing wicked managerial concepts: *lightweight* conceptual models because they do not aim to be exhaustive. Indeed, how would one exhaustively represent a wicked managerial concept such as team collaboration, for example? Rather, their objective is to provide the main building blocks of a wicked managerial concept in a simple and parsimonious manner. Thus, helping its users understand the concept and lending itself to be instantiated into a visual inquiry tool (Avdiji et al., 2020).

In light of those two objectives, namely simplicity and parsimony, the lightweight conceptual model ought to be evaluated with respect to the validity of its semantics and its pragmatic quality. Appropriately evaluating the conceptual model ensures that the visual inquiry tool is built on solid foundations and that potential issues or mistakes are minimised and are not transferred into subsequent design cycles. However, although the design theory for visual inquiry tools does propose sub-design principles that the conceptual model must adhere to, no further indication regarding how to concretely apply them is unfortunately provided. The sub-design principles state that the lightweight conceptual model must (1) frame the concept, (2) be parsimonious, and (3) be relevant and rigorous (Avdiji et al., 2020).

	Traditional conceptual models	**Lightweight conceptual models**
1) Context of use	Database design and management, software development, improvement of internal business processes (top three uses according to Fettke, 2009, p.575)	Design of visual inquiry tools (Avdiji et al., 2020) Example: Business Model Canvas (Osterwalder and Pigneur, 2011)
2) Objective of the conceptual model	Support requirement analysis (Wand and Weber, 2002). E.g., identify requirement errors (Moody et al., 2003)	Provide main building blocks of the concept to: (1) be instantiated into a visual inquiry tool, (2) to help understand the wicked managerial problem (Avdiji et al., 2020)
3) Conceptualised phenomenon	« Things » and their properties, events, and processes (Wand and Weber, 2002) Examples: Mobile checklists (Boillat and Legner, 2015), Electrocardiogram process (Schlieter and Esswein, 2011)	Specifically: a wicked managerial concept (Avdiji et al. 2020) Examples: Brand identity (Elikan and Pigneur, 2018), team coordination (Mastrogiacomo et al., 2014)
4) Evaluation criteria	Syntactic, semantic (validity and completeness), pragmatic quality (Lindland et al., 1994)	Semantic quality (validity), pragmatic quality (Lindland et al., 1994), parsimony, frame, rigour, and relevance (Avdiji et al. 2020)

Table 1. Traditional vs. lightweight conceptual models.

2.1.2 Linguistic interpretivism

Becker et al. (2008a) propose linguistic interpretivism to evaluate conceptual models. With such a stance, a conceptual model is considered as a *linguistic construction of a real-world phenomenon* (Becker et al. 2008a, p.96). Linguistic interpretivism rests on the philosophical assumption that conceptual models represent real-world components and problems. In light of that, and according to Becker et al. (2008a), conceptual modelling can thus be understood as being part of a design science research process whose objective is to resolve real-world problems (Becker et al., 2008a; Gregor and Hevner, 2013; Maedche et al., 2019). This assumption bridges conceptual modelling to the design science research paradigm (Becker et al., 2008a).

The use of linguistic interpretivism (Kamlah and Lorenzen, 1984) to evaluate the conceptual model is suggested by Becker et al. (2008a) in the case where no or if any – insufficient, domain ontologies are available to guide the conceptual model evaluation. A domain ontology can be understood as "*a data dictionary that provides formal and informal definitions of the terms used in the domain and the concept they denote, and that describes precisely the relationships between those concepts*." (Uschold and Gruninger, 1996, p.61). Ontologies are common understandings of the domain/concept of interest (Uschold and Gruninger, 1996), and when available, can be employed to develop and evaluate the conceptual model (Becker et al., 2008a), by for instance offering guidance to the modeller regarding the meaning of the used terminology (Uschold and Gruninger, 1996). Employing such ontologies when designing a conceptual model reduces the degree of subjectivism held by the modeller (Becker et al., 2008b). In this particular paper we focus on the case discussed by Becker et al. (2008a) where domain ontologies are not available and thus, linguistic interpretivism can be used to evaluate the conceptual model. According to linguistic interpretivism, the notion of truth is reached once the conceptual model is agreed upon within the inquired linguistic community (Becker et al., 2008a), and thus the evaluation comes to an end. Members of a linguistic community are stakeholders who share the same language about the focal domain. This common agreement is reached with speech artefacts which, for example, can be transmitted through interviews or experiments (Kamlah and Lorenzen, 1984). Becker et al. (2008a) refer to this means of evaluation as *interpersonal verification.* However, although interviews are cited as a way to conduct the evaluations (Milton et al., 2012; Kamlah and Lorenzen, 1984), no further guidance is offered regarding how to do so.

2.2 Evaluation in design science research

There is a general agreement in the existing literature that evaluation is a dominant feature of design science research (Peffers et al., 2012; Venable et al., 2016; Hevner et al., 2004; March and Smith, 1995). So much so, that a lack of rigorous evaluation could hinder the publication of the DSR paper (Peffers et al., 2012). As a matter of fact, as noted by Venable et al., (2012), DSR is a science *because* of the evaluation activities that take place. Provided the iterative nature of DSR, the insights gained from the evaluation subsequently inform the building of the artefact (Hevner et al., 2004; Peffers et al., 2007).

Whether qualitative and/or quantitative (Venkatesh et al., 2013), the evaluation method spectrum is broad and can, for example, include: interviews (Bhattacherjee, 2012), focus groups (Tremblay et al., 2010), case studies (Myers, 2009), expert evaluations, subject-based experiments, and technical experiments (Peffers et al., 2012). The best-suited evaluation method depends on the type of artefact under consideration for the evaluation (Peffers et al., 2012; Venable et al., 2012; Strassburg et al., 2021). Artefacts range from purely technical to socio-technical and may be products or processes (Venable et al., 2016), methods, constructs, instantiations or models (March and Smith, 1995). Regardless of the type of artefact, the purpose of the evaluation must be decided upfront, along with the properties to evaluate (Venable et al., 2016). On that note, Venable et al. (2016) provide an in-depth Framework for Evaluation in Design Science Research (FEDS) which guides the researcher through the several steps required to build an evaluation strategy for a DSR project. An evaluation *strategy* is composed of one or more evaluation *episodes* and an evaluation episode refers to the actual, individual evaluation. Although the fourth step included in the FEDS relates to the individual episode(s), it does not provide further detail regarding how to concretely design it. In fact, despite that several studies have examined

and discussed evaluation in DSR, in a recent literature review conducted to uncover the lingering issues in DSR evaluation, Strassburg et al. (2021) stressed that only little guidance is available regarding how to concretely evaluate artefacts.

Overall, previous research in both the conceptual modelling and DSR literature has established the importance of evaluating the designed artefact – or conceptual model in this case. Additionally, there is a rise in contributions relating to visual inquiry tools (vom Brocke and Maedche, 2019), and a consequent need to develop lightweight conceptual models for their design (Avdiji et al., 2020). Yet, although the design theory for visual inquiry tools proposes three sub-design principles for the design of the conceptual model (i.e., frame, parsimony, and rigour & relevance), it does not provide further guidance regarding how designers can verify that the conceptual model does, in fact, abide by them. Provided that, along with the importance of tailoring the evaluation process to the artefact under evaluation, we concentrate on how to concretely evaluate lightweight conceptual models that frame wicked managerial concepts. To that extent, because of the elusive nature of the conceptualised phenomenon (i.e., wicked managerial concepts), we believe that the linguistic view of conceptual models provided by the linguistic interpretivism approach is particularly well-suited to evaluate lightweight conceptual models.

3 A framework proposal to evaluate lightweight conceptual models

Given the gap identified in the previous section, our objective is to develop a solution that offers concrete guidance to designers regarding the evaluation of their lightweight conceptual model. By doing so, we aim to engage in the accumulation of prescriptive knowledge regarding the evaluation of conceptual models. We do so by relying on the existing prescriptive and descriptive knowledge presented in section 2. Specifically, we use linguistic interpretivism (Becker et al., 2008a) as an overarching approach because it brings sensible clarity as to how a conceptual model can be evaluated. For example, the linguistic interpretivism stance offers guidance regarding how (via interpersonal verification) and with whom (the linguistic community), the evaluation of the conceptual model can take place. Additionally, although it focuses on evaluation at a higher-level within DSR, (i.e., the design of an evaluation strategy, as opposed to the specific evaluation episode in itself), we decided to, when suitable, follow the steps and heuristics proposed by the FEDS (Venable et al., 2016).

The resulting solution takes the form of a framework (figure 1) with concrete guidelines to apply it. This first version of the framework is composed of four frames (from A to D) and each frame holds three elements: an evaluand (section 3.1), evaluation criteria (section 3.2) and one or two guiding question(s) (section 3.3). The proposed framework is intended to help build and conduct the evaluation episode of a lightweight conceptual model. It is to be read the following way: frame A corresponds to the evaluand "components" and in that frame, evaluation criteria are listed. Each component of the lightweight conceptual model must be evaluated in regard to its accuracy, and whether or not it conflicts or is redundant with another component of the model. A guiding question that illustrates how the components and evaluation criteria fit together is additionally included in the frame. The same logic applies to frames B, C, and D.

In the remainder of this section, we further describe how we leveraged the knowledge presented in the background literature section to develop the framework and accompanying guidelines to apply it.

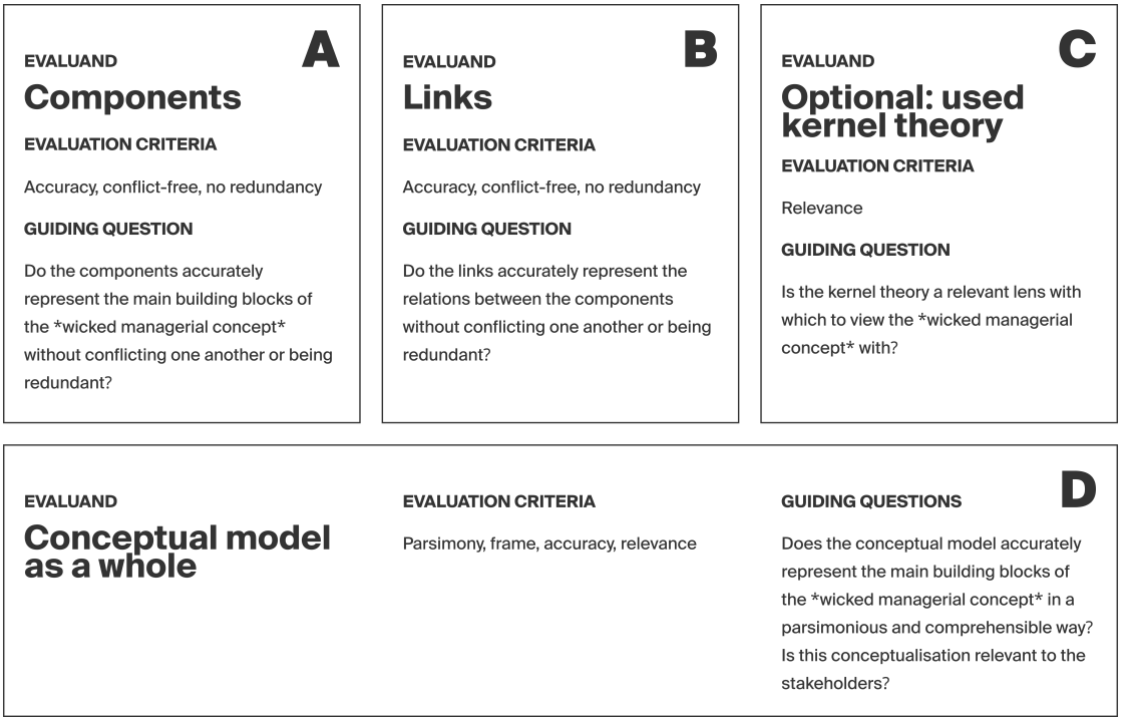

Figure 1. A framework to evaluate lightweight conceptual models framing wicked managerial concepts.

3.1 Decomposition into evaluands

Along the lines of the FEDS, we consider what in the conceptual model must be evaluated (i.e., the evaluands) during the evaluation episode. While discussing the scope of the evaluation, Shanks et al. (2003) suggest that either specific parts or the entire model could be evaluated. As discussed in the background literature section, with a linguistic interpretivism positioning, interpersonal verification can be adopted to evaluate conceptual models, and for that matter, the conceptual model must be logically decomposed (Becker et al., 2008a). We therefore suggest that lightweight conceptual models can be logically decomposed the following way: first, by zooming into the model (first row in figure 1) to individually view each component (A), each link (B) and if applicable, the kernel theory (C) used to help frame the concept (Gregor and Hevner, 2013). And second, by zooming out to consider the conceptual model as a whole (D) (second row in figure 1). We argue that the conceptual model as a whole must be considered as an evaluand in itself, because even if the individual elements (i.e., frames A, B, and C) are deemed appropriate, the big picture might not.

Figure 1 depicts how, as per linguistic interpretivism (Becker et al., 2008a), we propose to decompose a lightweight conceptual into evaluands for evaluation purposes. The decomposition is represented as frames, labelled from A to D, and each frame corresponds to an evaluand.

3.2 Selecting evaluation criteria

The goal in evaluating a conceptual model is to minimise the risk that it does not correctly represent what it is supposed to represent (Shanks et al., 2003). The prominent risk is that the conceptual model does not reflect what it was built to reflect and thus, is not appropriate for the situation it was developed for (Venable et al., 2016). If it does not appropriately frame the wicked managerial concept, the resulting visual inquiry tool would be built on shaky grounds. Its users (e.g., managers) would consequently be addressing the wicked problem based on a faulty conceptualisation of the concept. And thus, might not be addressing it at all. Because the conceptual model serves as the basis for the further design of a visual inquiry tool (Avdiji et al., 2020), this is a prominent risk to cover. We therefore consider that the risk of

inadequately designing such a tool is reduced – or at least controlled, if the conceptual model correctly represents the stakeholders' perception of the phenomenon (Milton et al., 2012). Which, as illustrated in table 1, pertains to the semantic (validity of the model) and pragmatic (comprehensiveness of the model) quality of the model (Lindland et al., 1994).

In this respect, we consider that the conceptual model is valid (semantic quality) if it adheres to the sub-design principles proposed by the design theory for visual inquiry tools (Avdiji et al., 2020). The first sub-design principle states that the conceptual model must appropriately *frame* the concept of interest by identifying its components and combining them. The second sub-principle refers to the *rigour and relevance* offered by the conceptual model. Finally, the third sub-principle, *parsimony*, argues that the conceptual model must be kept simple and clear to guarantee its accessibility and understandability to the different stakeholders. The sub-design principles do not however suffice to guide the evaluation of the conceptual model. The *frame* sub-design principle, for example, remains too nebulous to concretely guide the evaluation of the conceptual model. We therefore decided to additionally consider the attributes of a faithful conceptual model proposed by Shanks et al. (2003) (i.e., accuracy, completeness, conflict-free and no-redundancy). We selected those criteria because, as discussed in the background literature section, they apply to the semantics of the model as opposed to the model's syntax. We however decided to dismiss the criteria of completeness proposed by Shanks et al. (2003). Indeed, a conceptual model could for example accurately and completely represent a phenomenon, thus abiding by the criteria proposed by Shanks et al. (2003), and yet be so complicated that it cannot be further designed into a visual inquiry tool. Therefore, because of the sub-design principle of parsimony (Avdiji et al., 2020), we disregard the element of completeness that the conceptual model must behold (Shanks et al., 2003). The pragmatic quality held by the conceptual model is covered by the parsimony sub-principle because, according to Avdiji et al. (2020), maintaining the model's parsimony ensures that it remains comprehensible to the stakeholders.

Once the evaluation criteria identified and selected, we subsequently mapped them against the different evaluands. First, the components (A) and links (B) are to be evaluated against the criteria proposed by Shanks et al. (2003), and if applicable, the kernel theory (C) is evaluated in regard to its relevance to the stakeholders. To assess the model as a whole (D), we followed the design theory and included the sub-design principles (Avdiji et al., 2020). We however decided not to map the rigour sub-design principle to any evaluands because it relates to how the model was developed and evaluated (Hevner et al., 2004), and not to how rigorously it represents the focal domain.

3.3 Guiding questions

The framework also includes guiding questions that illustrate how the evaluands and evaluation criteria fit together. These questions act as research questions when building the evaluation episode and were developed while keeping in mind the evaluation criteria for each evaluand. They aim to provide further guidance when formulating the interview questions (Castillo-Montoya, 2016). Developing interview questions against such guiding questions additionally helps ensure that no information gap remains (Castillo-Montoya, 2016).

3.4 Guidelines to use the framework

These guidelines refer to how the framework can be put into practice to build and conduct the evaluation episode of the lightweight conceptual model.

Conducting interviews has commonly been suggested as an evaluation method (Becker et al., 2008a; Milton et al., 2012) to assess the faithfulness of the conceptual model in regard to the phenomenon it aims to represent (Shanks et al., 2003). Additionally, given that conceptual models describe a phenomenon that takes place in a specific application domain (Pfeiffer and Niehaves, 2005), the evaluations must be carried out in the environment it is supposed to portray (Pfeiffer and Niehaves, 2005) with the people (i.e., stakeholders) whose perspective is intended to be represented (Shanks et al., 2003). We consequently suggest applying the framework using interviews with domain experts. Selecting the proper respondents (i.e., domain experts) is important because if the evaluators do not

possess sufficient knowledge regarding the concept of interest, they will not be able to evaluate the suitability of the conceptual model in representing the said concept (Becker et al., 2008b). Becker et al. (2008b) term this *perceived evaluability*, where the evaluator must have enough domain knowledge to both understand the conceptual model and be capable of evaluating the conceptual model against his/her mental model of the phenomenon. Although the evaluator ought to have sufficient domain knowledge, it is not, however, necessary for he or she to have been included in the development of the conceptual model (Shanks et al., 2003). Finally, given the linguistic interpretivism approach, the evaluation ends when the interviewed domain experts collectively agree on the contents of the conceptual model (Becker et al., 2008a). This is the case when the experts, all being part of the same linguistic community, commonly agree on the representation of the wicked managerial concept. This refers to the notion of truth attained via the exchange of speech artefacts (Becker et al., 2008a) presented in the background literature section.

4 Applying the framework

In this section, we illustrate how the proposed framework can be applied to evaluate a lightweight conceptual model. For that matter, we use the framework to build and conduct an evaluation episode in an ongoing DSR project. It is worth noting that this application serves to demonstrate and test the proposed framework. Thus, the actual content of the lightweight conceptual model, which in this case, describes an agile culture, is not of interest in this paper. Rather, by applying the framework in a naturalistic setting, the objective is to demonstrate how the framework can be put into practice and gather whether – or not, the framework actually guides the evaluation of the conceptual model.

To do so, in the remainder of this section, we first present the agile culture conceptual model which serves as an illustrative lightweight conceptual model (section 4.1). We then describe how the evaluation episode was built and conducted using the framework (section 4.2) and finally, we discuss the findings brought forth by the evaluation episode (section 4.3).

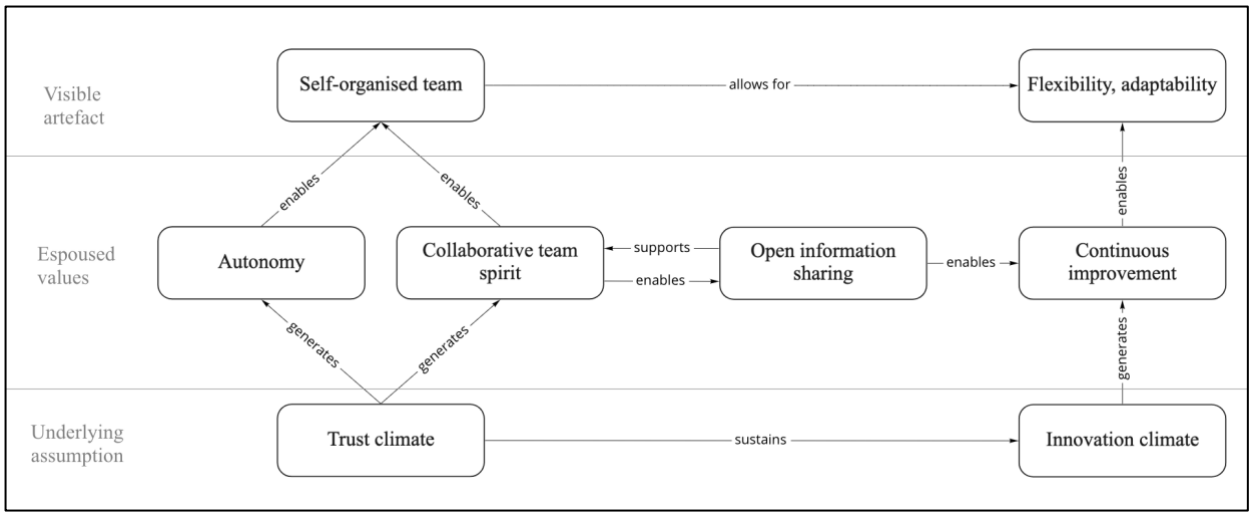

Figure 2. Agile Culture Conceptual Model (ACCM) adapted from Roschnik and Missonier (2021)

4.1 The Agile Culture Conceptual Model – ACCM

To apply the framework, we selected an ongoing DSR project addressing a wicked managerial problem (Roschnik and Missonier, 2021). The DSR project aims to develop a visual inquiry tool to drive the introduction and growth of an agile culture in traditional companies. For that matter, a lightweight conceptual model framing the concept of agile culture named the Agile Culture Conceptual Model (ACCM) was built. It was deductively developed by drawing upon the existing literature (figure 2), and

as per the DSR paradigm and followed DSR process (Peffers et al., 2007), the first evaluation of the ACCM subsequently takes place. The objective of the ACCM evaluation is to ensure that it appropriately frames the concept of agile culture. To that end, an evaluation strategy was developed following the FEDS (Venable et al., 2016) and accordingly, we now apply the proposed framework to build and conduct an ex-post evaluation episode of the ACCM in a naturalistic setting.

4.2 Evaluating the ACCM with the proposed framework

We used the framework to build and conduct the evaluation episode of the ACCM. Accordingly, as per the framework, we first decomposed the ACCM (figure 2) into the proposed set of evaluands (frame A to D): frame A – Components: the 8 components in the ACCM: self-organised team, trust, autonomy, etc.; frame B – Links: the 12 links between the 8 components; frame C – Kernel theory: the three levels of organisational culture (Schein, 1988): visible artefacts, espoused values and underlying assumptions, and frame D – As a whole: the ACCM in its entirety.

Once decomposed, we subsequently used the guiding questions to develop the interview questions that will be asked to assess the evaluands (i.e., components, links, kernel theory and as a whole) against the evaluation criteria depicted in the framework. To that extent, we declined the guiding questions into smaller and more digest ones. The objective was to develop interview questions that contributed to answering the guiding questions (Castillo-Montoya, 2016). The declination of guiding questions into interview questions is necessary because, according to Castillo-Montoya (2016), directly asking the guiding questions to the respondents is not feasible. By nature, the guiding questions are indeed either too long and specific (e.g., Do the components accurately represent the main building blocks of *the wicked managerial concept* without conflicting one another or being redundant?) or on the contrary, too vague (e.g., Is this conceptualisation relevant to the stakeholders?). For space reasons we can unfortunately not include the entirety of the developed interview questions. But we can nonetheless provide an excerpt: for example, to answer the guiding question corresponding to the components (figure 1, frame A), the following interview questions were, amongst others, drawn up: *In your opinion, do the 8 components represent the core building blocks of an agile culture? Why? Why not? In your opinion, are there some components missing to accurately describe the building blocks of an agile culture? If so, which one and why?* We consider that the components of the ACCM accurately describe the concept of agile culture if – or when, all the respondents answer that no component is missing and that none ought to be removed from the model. In this situation, the number of components (either missing or in excess) corresponds to the evaluation metric (March and Smith, 1995) which helps assess the extent to which the evaluand fulfils the criteria. To gather richer insights, we additionally decided to ask the participants to justify their answers by asking them *Why? or why not?*

Once was had decomposed the model and drawn up the interview questions, we had to decide on the respondents. In the case of the ACCM, the members of the same linguistic community are individuals that work with agile. The respondents must be considered domain experts and hence, be agile experts. We considered experts people who had at least been working the equivalent of 2 years full time with agile in the industry. We conducted 7 interviews with 7 different agile experts. Each interview was held via Zoom and lasted approximately 45 minutes. The interviews were semi-guided and as per the framework, we conducted them by focusing on one frame, thus evaluand, at a time. Insights gathered from the prior evaluation fed into the subsequent one. For instance, when one respondent noted that a component was missing from the model to correctly represent their idea of agile culture, we asked the next participants what they thought about it. By doing so, not only was the model being evaluated in regard to its semantic and pragmatic qualities, but it was being further built on. The interviews were subsequently transcribed and coded. In that regard, we performed conventional data analysis by manually coding the interview transcripts bottom-up (Hsieh and Shannon, 2005).

4.3 Results of the ACCM evaluation

During this first evaluation episode of the ACCM, no common agreement amongst the agile experts was met regarding the links and components. It is however important to note that our objective in applying the framework was not for the ACCM to be validated during the 7 interviews (which is beyond the scope of this paper). Rather, the objective was to demonstrate and test the framework's applicability and utility in a naturalistic setting. As a reminder, the framework aims to provide concrete guidance regarding how the evaluation of lightweight conceptual models can be performed. Regarding that, applying the framework allowed us to build and conduct an evaluation episode that uncovered contention points regarding the ACCM. It helped us to systematically identify the elements of the ACCM that require further evaluation and refinement. Thus, filling its purpose to guide the evaluation of lightweight conceptual models.

Therefore, the fact that the ACCM was not fully validated (i.e., common agreement reached amongst the agile experts) in this first evaluation episode, does not dismiss the utility of the framework – rather the contrary since we now know what ought to be addressed in the subsequent evaluation episodes of the ACCM.

The next steps in the evaluation journey of the ACCM would be to conduct additional evaluations concentrating on the uncovered contention points relating to the components and links. For that matter, the framework can be re-used to build and conduct the subsequent evaluations. Given that a common agreement was reached regarding the relevance of the kernel theory (frame C), the subsequent evaluation could, for example, concentrate on frames A and B. This would allow to further investigate the evaluands that seem to require the most attention, since the first evaluation episode surfaced points of disagreement regarding them.

5 Implications for the framework

We hereunder discuss the insights gathered from having developed and applied the framework to evaluate the ACCM.

First, due to the decomposition into four frames (A-D), we were able to avoid falling into the cognitive murder trap which happens when the model is unveiled all at once, leaving the respondent confused and unable to make sense of the model – or at least with a decent amount of energy. With the frames proposed by the framework, we were able to reveal and consider each evaluand of the model, each in its own time. First introducing and addressing the components, then the links, then the kernel theory, and finally the model as a whole. Conducting the evaluation episode as such allowed us to gently unveil the conceptual model and kept the agile practitioners onboard the evaluation because no cognitive murder had been committed. The framework also helped bring structure regarding how the evaluation was both constructed and conducted. Concerning the former, developing the interview questions against the guiding questions ensured that no knowledge gap persisted during the evaluation. The guiding questions indeed allowed us to define the interview questions while bearing in mind the focus of the evaluation and not losing sight of the goal of the evaluation. Concerning the latter, the framework, and in particular, the proposed decomposition into frames was beneficial in terms of structuring the evaluation. Viewing the conceptual model as a set of evaluands helped us focus on one evaluand at a time, while still having an overview of what was yet to come. This also ensured that we did not overlook any evaluand. We did however realise that the frames overlapped and that respondents would naturally overflow to another frame. For example, when asking about the components (frame A), respondents would at times start discussing the components in relation to one another. Thus, overflowing onto frame B. Although this is not bad per se, it highlights the possibility to adapt the frames in future iterations of the framework.

Additionally, while the framework offers concrete guidance for the evaluation of conceptual models framing managerial concepts, it nonetheless remains adaptable. In fact, we aim for the proposed knowledge to be reusable for future DSR projects (vom Brocke et al., 2020) and for it to guide future designers in the evaluation of their lightweight conceptual model. Therefore, although we used the ACCM for evaluation and illustration purposes, we expect a broader utilisation of the framework. The

framework could for instance be used to evaluate the conceptual model of Brand Identity (Elikan and Pigneur, 2018) where the kernel theory used by the authors would be the theory of organisational identity (Hatch and Schultz, 2002).

Furthermore, depending on the resources available to conduct the evaluations, or on the specific situation of the conceptual model, one could spend more or less time evaluating certain evaluands. For instance, if a designer wished to dive deeper into the evaluation of the links between the components, further interview questions could then be drawn up to do so. Because we decided not to integrate the specific interview questions to the framework, and because of the frame display of the decomposition, the framework remains intuitive and transposable. Both the depth (i.e., number of interview questions) and width (i.e., number of evaluands) of the evaluation can therefore be adapted to the situation. The adaptability of the framework in terms of width, also suggests that, although a conceptual model is not finished per se, a specific evaluand could preliminarily be evaluated before further designing the model (i.e., ex-ante evaluations, Venable et al., 2016). By "finished" we refer to a model that has at least links and components which are visually organised. These ex-ante evaluation episodes would enable smaller and faster design-evaluation iterations.

This comment on shorter design-evaluation iteration loops is also applicable at a higher level and in this regard, we argue that solely evaluating the final artefact is not sufficient. The final artefact opposes itself to a preliminary one. The final artefact is the objective of the DSR journey, whereas the preliminary artefact is developed as an intermediary stepping stone for the design of the final one. In the context of this paper, the final artefact is the visual inquiry tool designed to address wicked problems, and the preliminary one is the conceptual model which frames the managerial concept. As highlighted in the literature section of this paper, evaluation is important – if not critical in DSR. Given the weight evaluation holds in DSR, we suggest that any preliminary artefact designed to reach a final artefact, ought to be evaluated with rigour. This would allow to course-correct along the DSR journey and fundamentally, to ensure that the final artefact is built on both rigorous and relevant foundations.

6 Conclusion

In today's rapidly evolving environment wicked managerial problems are on the rise, along with the need to address them. For that matter, the use of visual inquiry tools has gained in popularity. To such an extent that Avdiji et al. (2020) have theorised their design. According to the design theory, such tools must be founded on rigorous, relevant, and parsimonious conceptual models that frame the wicked managerial concept in question. We term these *lightweight* conceptual models. Rigorously evaluating the designed artefact is crucial in both the DSR paradigm and the conceptual modelling literature. Yet, no concrete guidance relating to how the evaluation episode can be built and take place seems to be available (Strassburg et al., 2021). Widening the gap, is the fact that the design of the evaluation episode depends on the type of artefact to be evaluated (Peffers et al., 2012; Strassburg et al., 2021).

By proposing a way to conduct evaluations based on linguistic interpretivism, the present study adds to the rapidly expanding topic of visual inquiry tools. Specifically, to the evaluation of their preliminary conceptual model. Hence, we contribute to the existing knowledge base in terms of methodology by proposing the creative development and evaluation (Gregor, 2006; Hevner et al., 2004) of an evaluation episode for lightweight models. Specifically, by adding on to them, the proposed framework contributes to both the design theory for visual inquiry tools and to the FEDS. Concerning the former, the framework concretely helps designers evaluate the conceptual model in relation to the sub-design principles proposed by the theory. Because, as previously noted, although the design theory suggests sub-principles that the conceptual model must abide by, it does not however mention how one concretely evaluates the conceptual model in relation to them. Concerning the latter, namely the contribution towards the FEDS, the proposed framework may help the designer in the elaboration of either ex-ante or ex-post evaluation episodes depending on the situation in question. The proposed framework is therefore embedded in a larger DSR context and enters the fourth step of the FEDS, namely the design of the individual evaluation episode.

For that matter, the designed framework proposes a way to decompose lightweight conceptual models into four evaluands (frame A to D) that can be evaluated against a set of selected criteria. The framework is completed with guiding questions that illustrate, at a high level, the questions to be asked to evaluate the conceptual model. The application of the framework remains adaptable in terms of both width and depth. A specific evaluand could, for instance, be evaluated with greater interest depending on the objective of the evaluation episode. In this research paper, we additionally suggest and demonstrate that the framework can be applied via interviews with domain experts. Other application strategies of the framework, such as focus groups, may however be relevant to explore in future research. In agreement with the literature (e.g., Hevner et al., 2004; Venable et al., 2016), we also argue for the importance of evaluation in DSR. We however tailor our comment to emphasise the need for evaluation efforts to be applied to preliminary artefacts (such as conceptual models) as opposed to them only being concentrated on the final artefact.

The main limitation of this paper is that the proposed framework has been put into practice to evaluate only one conceptual model and would need additional applications to further determine its usefulness. This is the first iteration of the framework and in the future, we aim to further test and adapt the framework as more evaluations are conducted. Specifically, to assess the level of guidance offered by the framework, we will ask designers having to evaluate their lightweight conceptual model to apply and test the framework proposed in this paper. Another limitation is that the efforts of this research paper have concentrated on conceptual models developed as a basis for visual inquiry tools. We however argue that the value of the framework may be extended to help evaluate other lightweight conceptual models regardless of the nature of the final artefact. By nature of the final artefact, we refer to it either being a visual inquiry tool as discussed in this paper, or any other form of managerial tool built on a wicked managerial concept. These two limitations in conjunction call for further research, and in particular, additional evaluations and applications of the framework.

Overall, we do not aim for the framework to be static and consequently fall out of favour due to its inapplicability or irrelevance. In fact, we invite future designers to evaluate their conceptual model with the proposed framework and encourage them to update and further build on it accordingly.

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