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Ontological Representation of Design Science Research Publications

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A search result provided by existing digital library and web search systems typically comprises only a prioritised list of possible publications or web pages that meet the search criteria, possibly with excerpts and possibly with search terms highlighted. The research in progress reported in this poster contributes to a larger research effort to provide a readable summary of search results that synthesise relevant publications or web pages to provide results that meet four C's: *comprehensive*, *concise*, *coherent*, and *correct*, as a more useful alternative to un-synthesised result lists. The scope of this research is limited to searching for and synthesising Design Science Research (DSR) publications that present the results of DSR, as an example problem domain.

This article describes the design of a formal ontology called the DSR Document Core Ontology, or DSRDCO, which provides a conceptualisation of the semantic content of DSR publications. DSRDCO is designed to enable automatic reasoning with DSR publications to provide single or multiple document summaries that fulfil the four Cs above. Figure 1 depicts only a portion of DSRDCO, including only the most important core DSR concepts and omitting (for example) a DSR article's thesis, significance claims, and argumentation. Besides the graphic representation in figure 1, DSRDCO is also implemented in OWL DL to support automated reasoning.

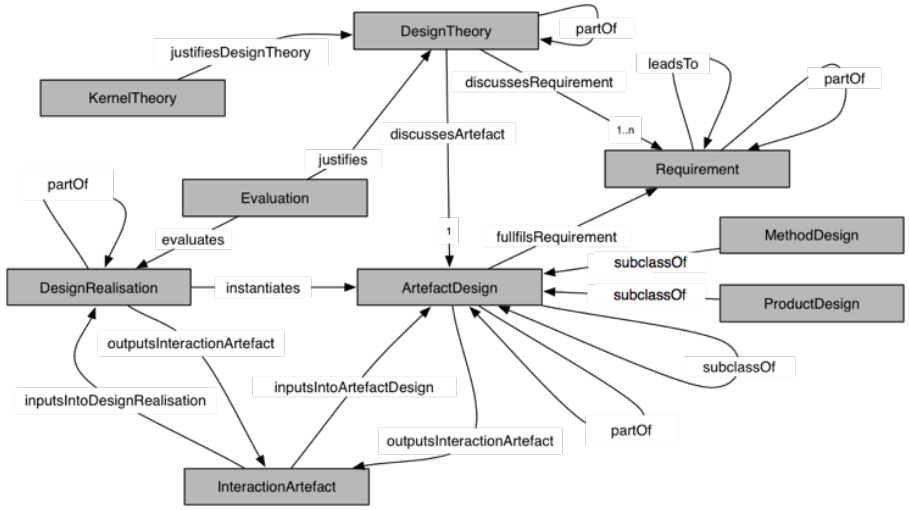


Fig. 1. Core Concepts of DSR in DSRDCO

DSRDCO conceptualises several aspects of DSR. As shown in figure 1, a design theory consists of one artefact design (or meta-design) that fulfils a particular set of requirements (or meta-requirements). An artefact design may contain component artefact designs and a requirement may contain sub-requirements. An evaluation justifies a design theory by evaluating a specific design realisation (instantiation) against its requirements. A design realisation must instantiate any components or other assertions that have been made concerning its corresponding artefact design.

Figure 1 omits other important semantic content components of a DSR article (or any scientific article) – e.g. its thesis, significance claims, and argumentation. The thesis or main claim of a DSR paper is usually that the focal artefact (meta-)design fulfils some (meta-)requirements (i.e. that a design theory is true). Significance claims includes theoretical and practical significance claims. The thesis and significance claims should be justified or supported by further claims and by providing evidence that the artefact design (when instantiated) fulfils the requirements through an evaluation argument (which is shown in figure 1). Other support includes an argument in which the artefact design is based on an earlier, established artefact design. Each support is itself a claim, which can be supported (or argued against).

One potential way in which instantiations of DSRDCO can be transformed into synthesised paper summaries or search result summaries is through plain text generated based on cloze sentences, which are filled in with values from the DSRDCO instantiation. An example of such a cloze sentence is given below.

```
The artefact design named ____ (Noun Phrase for <Arte-
factDesign>) is designed to fulfil the requirement/s ____
(VerbPhrase enumeration for <Requirement> (CARD >= 1))
```

A filled in example summary based on the above cloze sentence is given below.

```
The artefact design named "Annota" is designed to fulfil
the requirements "annotate and organise scientific publi-
cations on the Web" and "share publications with col-
leagues".
```

The data needed to produce the above example could be represented by instantiations of the following ontological relations (shown as triples) to represent part of figure 1.

```
<DesignTheory> <discussesArtefactDesign> <ArtefactDesign>
<ArtefactDesign> <fulfils> <Requirement>
<DesignTheory> <discussesRequirement> <Requirement>
```

Thus far in this research in progress, the feasibility of DSRDCO to produce synthesised summaries has been demonstrated by instantiating it manually into OWL DL for three DSR articles and by producing natural language summaries as above. Further, more rigorous evaluation is needed to demonstrate the hypothesised utility. Also remaining to be done in this research in progress is to ensure that the proposed ontology supports a shared understanding. The concepts this ontology is comprised of are used by many proponents of DSR and will be further evaluated in an expert evaluation. Ultimately, DSRDCO must also be integrated into the larger system envisioned.