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# On the Declarative Paradigm in Hybrid Business Process Representations: A Conceptual Framework and a Systematic Literature Study (Extended Abstract)<sup>1</sup>

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## 1 Context and Motivation

Process artifacts provide a key instrument to support the enactment and management of business processes. Besides providing a blue-print for process enactment and facilitating several types of analysis and verification techniques, process artifacts can be used for requirement elicitation and process improvement. These activities, in turn, require models that are interpretable by machines but also comprehensible to humans.

In the literature, a wide array of *process artifacts* have been used to describe business processes (e.g. textual descriptions, formal process models, simulation tools). These artifacts are usually expressed using *imperative* or *declarative* languages [Fa09]. The choice of either class of languages depends on the process specifications. Imperative languages are typically used for representing rigid processes where the possible execution paths can be easily elicited and represented in the model. Conversely, declarative languages are commonly used to describe flexible processes as they allow to abstract the individual execution paths and rather emphasize the constraints guiding the overall process [Fa09]. Previous research has shown that an individual modeling language cannot deliver a concise and precise process representation. Indeed, in many processes, some aspects can better be described in an imperative way, while other aspects can better be captured in a declarative way. [RSS13]. Moreover, it has been suggested that the use of a unique artifact (e.g., formal process model) can challenge the comprehension of process stakeholders (e.g., domain experts) who are not familiar with that kind of artifact [An20b]. To address these gaps, authors in the literature have proposed several “*hybrid*” representations combining languages or artifacts. However, there is no conceptual framework allowing to identify, classify and discuss all these hybrid representations in a uniform way. This shortcoming is addressed in this work through a new *conceptual framework* and *systematic literature review* (SLR), setting the building blocks for defining and characterizing hybrid representations.

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## 2 Conceptual Framework and Literature Review

The proposed conceptual framework provides a unified terminology allowing to distinguish *hybrid languages* and *hybrid artifacts*. The former combines existing imperative and declarative languages into a hybrid language used to express a single process artifact, while the latter combines a set of interrelated process artifacts each expressed using a different language [An20a]. Following the definition of hybrid languages and hybrid artifacts, the SLR is conducted to delve further into the characteristics of these two kinds of hybrid representations.

Thirty articles are identified following an extensive literature search. The findings show that existing hybrid representations have emerged within two research lines. In the first research line, hybrid languages are used to provide a concise modeling of the flexible and rigid aspects of business processes, while hybrid artifacts are proposed to facilitate the modeling, comprehension and maintenance of process models. With regards to the second research line, hybrid artifacts are suggested to support the integration of business rules (represented textually) into process models (represented graphically). Moreover, based on the findings, different types of hybrid languages and hybrid artifacts are identified and synthesized into a taxonomy. Therein, hybrid languages are divided into languages providing process models with a *hierarchical structure* (i.e., a different language is used for each sub-process of the model) or process models with a *mixed structure* (i.e., one language combining the syntax of existing imperative and declarative languages is used to represent the entire process). Hybrid artifacts, in turn, are organized into representations *combining a process model and textual annotations* and representations *combining a process model and guided simulations*

Overall, in this study, we have proposed a conceptual framework for defining, classifying and discussing hybrid process representations. This framework was developed based on an SLR and taxonomy meant to provide an overarching understanding of hybrid representations and help researchers to better identify and position their contributions. The outcome of this work will pave the path for new hybrid approaches and offer a sound basis to be systematically updated with up-coming studies.

## Bibliography

- [An20a] Andaloussi, Amine Abbad; Burattin, Andrea; Slaats, Tijs; Kindler, Ekkart; Weber, Barbara: On the declarative paradigm in hybrid business process representations: A conceptual framework and a systematic literature study. *Information Systems*, 91:101505, 2020.
- [An20b] Andaloussi, Amine Abbad; Zerbato, Francesca; Burattin, Andrea; Slaats, Tijs; Hildebrandt, Thomas T; Weber, Barbara: Exploring how users engage with hybrid process artifacts based on declarative process models: a behavioral analysis based on eye-tracking and think-aloud. *Software and Systems Modeling*, pp. 1–28, 2020.
- [Fa09] Fahland, Dirk; Lübke, Daniel; Mendling, Jan; Reijers, Hajo; Weber, Barbara; Weidlich, Matthias; Zugal, Stefan: Declarative versus Imperative Process Modeling Languages: The Issue of Understandability. In: *Proceedings of EMMSAD*. Springer, pp. 353–366, 2009.
- [RSS13] Reijers, Hajo A; Slaats, Tijs; Stahl, Christian: Declarative modeling—An academic dream or the future for BPM? In: *Business Process Management*, pp. 307–322. Springer, 2013.