

# A Comparative Evaluation of Requirement Template Systems (Summary)

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**Abstract:** Our publication at the 31<sup>th</sup> *International Requirements Engineering Conference* 2023 concerns the multiple semi-formal syntax templates for natural language requirements, that foster to reduce ambiguity while preserving readability. Yet, existing studies on their effectiveness do not allow to systematically investigate quality benefits and compare different notations. We strive for a comparative benchmark and evaluation of template systems to support practitioners in selecting template systems and enable researchers to work on pinpoint improvements and domain-specific adaptations. We conduct a comparative experiment with a control group of free-text requirements and treatment groups of their variants following different templates. We compare effects on metrics systematically derived from quality guidelines. We present a benchmark consisting of a systematically derived metric suite over seven relevant quality categories and a dataset of 1764 requirements, comprising 249 free-text forms from five projects and variants in five template systems. We evaluate effects in comparison to free text. Except for one template system, all have solely positive effects in all categories. The proposed benchmark enables the identification of the relative strengths and weaknesses of different template systems. However, overall effect sizes are relatively similar. Yet, the results show that templates can generally improve quality compared to free text.

**Keywords:** Requirement Templates; Readability; Quality Metrics; Guideline Rules; Natural Language Requirements

## 1 Summary

Natural language is often ambiguous and hard to process automatically, while formal methods can reinforce a “language barrier” between developers and other stakeholders that makes it hard to evaluate if the noted requirement is equivalent to the originally intended need [Mav+09; KC05]. To phrase requirements more precisely, various semi-formal controlled syntaxes or syntax templates can be used, e.g., EARS [Mav+09], *MASTER* [RJ14], or the simple syntax in ISO/IEC/IEEE 29148 [ISO18]. Yet, to select an appropriate template system matching the intended purpose is hard. Different evaluation objectives and methods of existing studies do not allow for a systematic comparison of performances. No common benchmark exists and to date, the authors are not aware of any study systematically comparing multiple template systems. Thus, in our paper [GRJ23] we investigate the following research question: *How do different template systems influence the quality of requirements?*

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We identify relevant quality factors to compare the phrasing quality achieved with different requirement template systems from ISO/IEC/IEEE 29148 [ISO18] as well as 39 guideline rules and present a respective metric suite and experimental setting. Experiments are conducted with EARS [Mav+09], MASTeR [RJ14], Adv-EARS [Maj+11], boilerplates [Far12], and SPIDER [KC05] applied to 249 requirements from five real-world projects. Re-phrased to the different variants, this leads to a dataset of in total 1764 requirements with five control and 25 treatment groups. It can be shown, that the usage of templates is generally an appropriate means to raise requirements quality in many facets and that the template systems perform different for various quality rules. MASTeR leads the field in terms of aggregated effect size for all six examined guidelines and 6/7 quality aspects.

## 2 Data Availability

A full replication package is available under <https://doi.org/10.5281/zenodo.8020672>.

## Bibliography

- [Far12] Stefan Farfeleder. “Requirements Specification and Analysis for Embedded Systems”. PhD thesis. Vienna University of Technology, 2012.
- [GRJ23] Katharina Großer, Marina Rukavitsyna, and Jan Jürjens. “A Comparative Evaluation of Requirement Template Systems”. In: *31st IEEE International Requirements Engineering Conference (RE’23)*. 2023, pp. 41–52. DOI: 10.1109/RE57278.2023.00014.
- [ISO18] *ISO/IEC/IEEE 29148: Systems and software engineering—Life cycle processes—Requirements engineering*. ISO/IEC/IEEE 29148:2018(E) (ISO/IEC/IEEE). Nov. 2018.
- [KC05] Sascha Konrad and Betty H. C. Cheng. “Real-Time Specification Patterns”. In: *27th International Conference on Software Engineering (ICSE’05)*. 2005, pp. 372–381. DOI: 10.1145/1062455.1062526.
- [Maj+11] Dipankar Majumdar et al. “Automated Requirements Modelling with Adv-EARS”. In: *International Journal of Information Technology Convergence and Services (IJITCS)* 1.4 (Aug. 2011), pp. 57–67.
- [Mav+09] Alistair Mavin et al. “Easy Approach to Requirements Syntax (EARS)”. In: *17th IEEE International Requirements Engineering Conference (RE’09)*. Aug. 2009, pp. 317–322. DOI: 10.1109/RE.2009.9.
- [RJ14] Chris Rupp and Rainer Joppich. “Anforderungsschablonen”. German. In: *Requirements-Engineering und -Management*. 6th ed. Carl Hanser Verlag München, 2014, pp. 215–246. ISBN: 978-3-446-43893-4.