

# The Invisible Hand of the Context: Authoring of Context-Aware Mixed Reality Labels

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## Motivation & Basic Idea

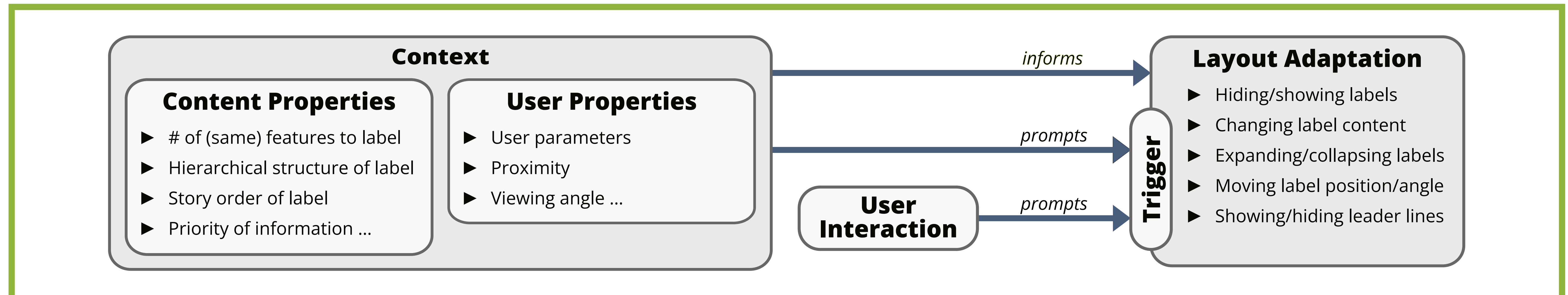
Labels play a crucial role in Mixed Reality (MR) by providing guidance, instruction, and additional information [1]. However:

- Often, label placement is static and does not adapt to the user or the specific situation.
- The process of creating MR (labeling) applications is complex and inaccessible to novices [2].

We lay a foundation for more accessible, adaptable, and interactive MR labeling systems, introducing:

1. Considerations and concepts for context-aware labeling, incorporating interactive and dynamic label behaviors.
2. An intuitive authoring tool that enables users to configure and deploy MR labeling experiences without specialized programming knowledge.

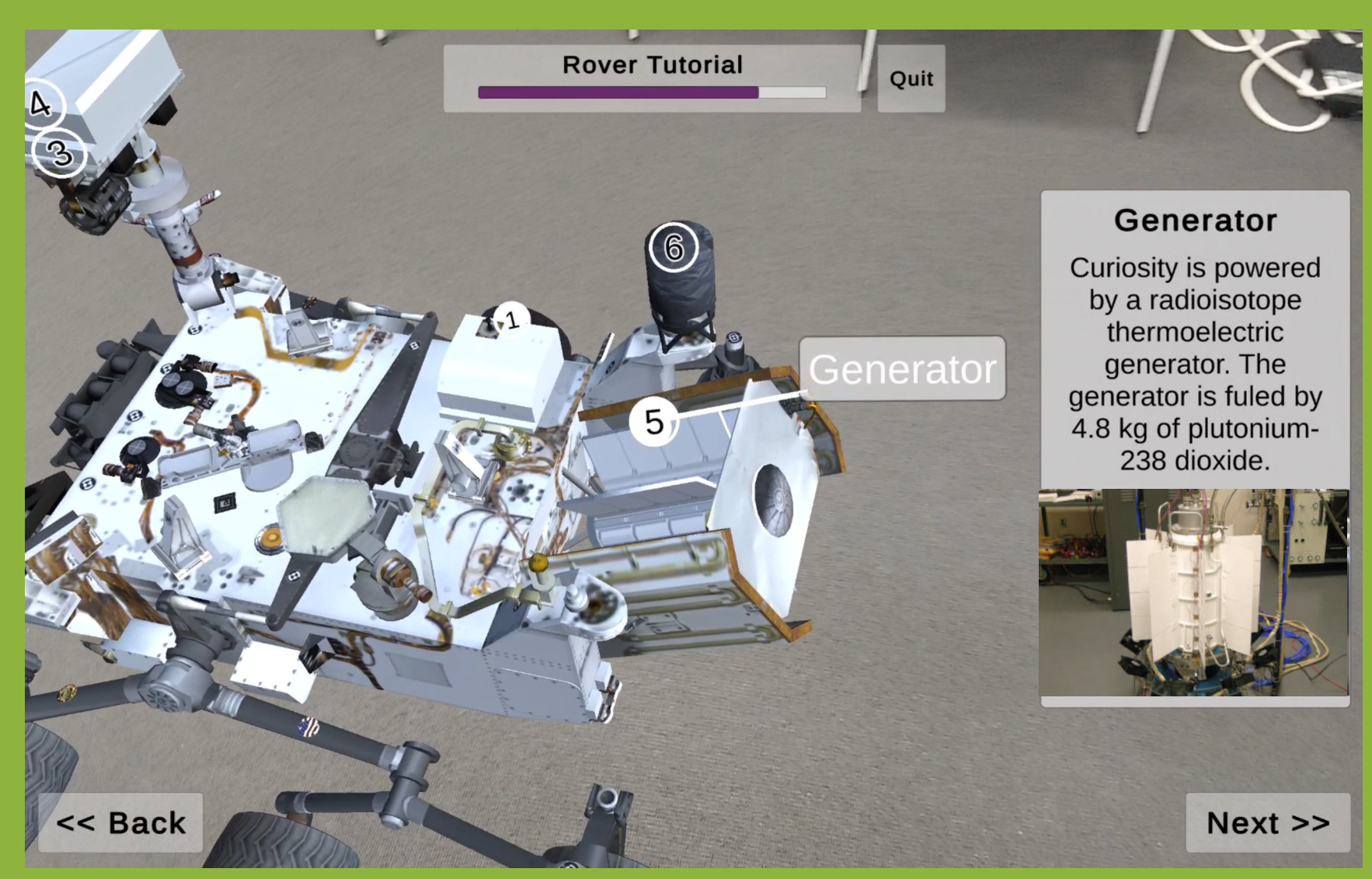
## Adaptive and Context-Aware MR Labels



**Fig. 1:** An overview of the relation of context and layout adaptations. In general, the appearance of a label can be informed by the context the labeled model is currently in, including the content and the user properties. Furthermore, both the context and specific user interactions can be used to trigger a dynamic adaptation of the currently visible layout.

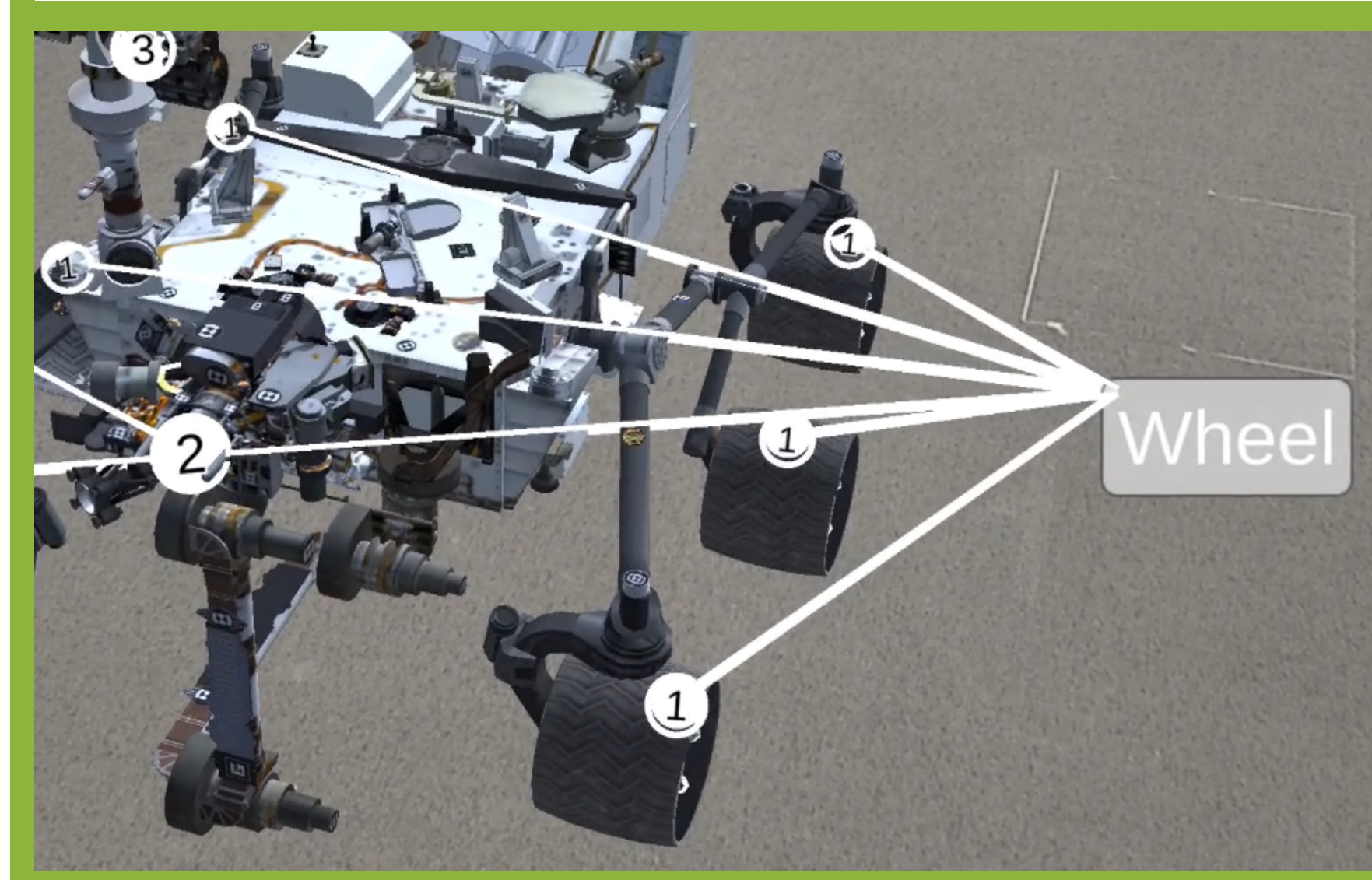
### Concept 1 Narrative Sequence

Labels unfold one after another in a logical order. As the user interacts with the scene, more detailed information is revealed in an additional panel.



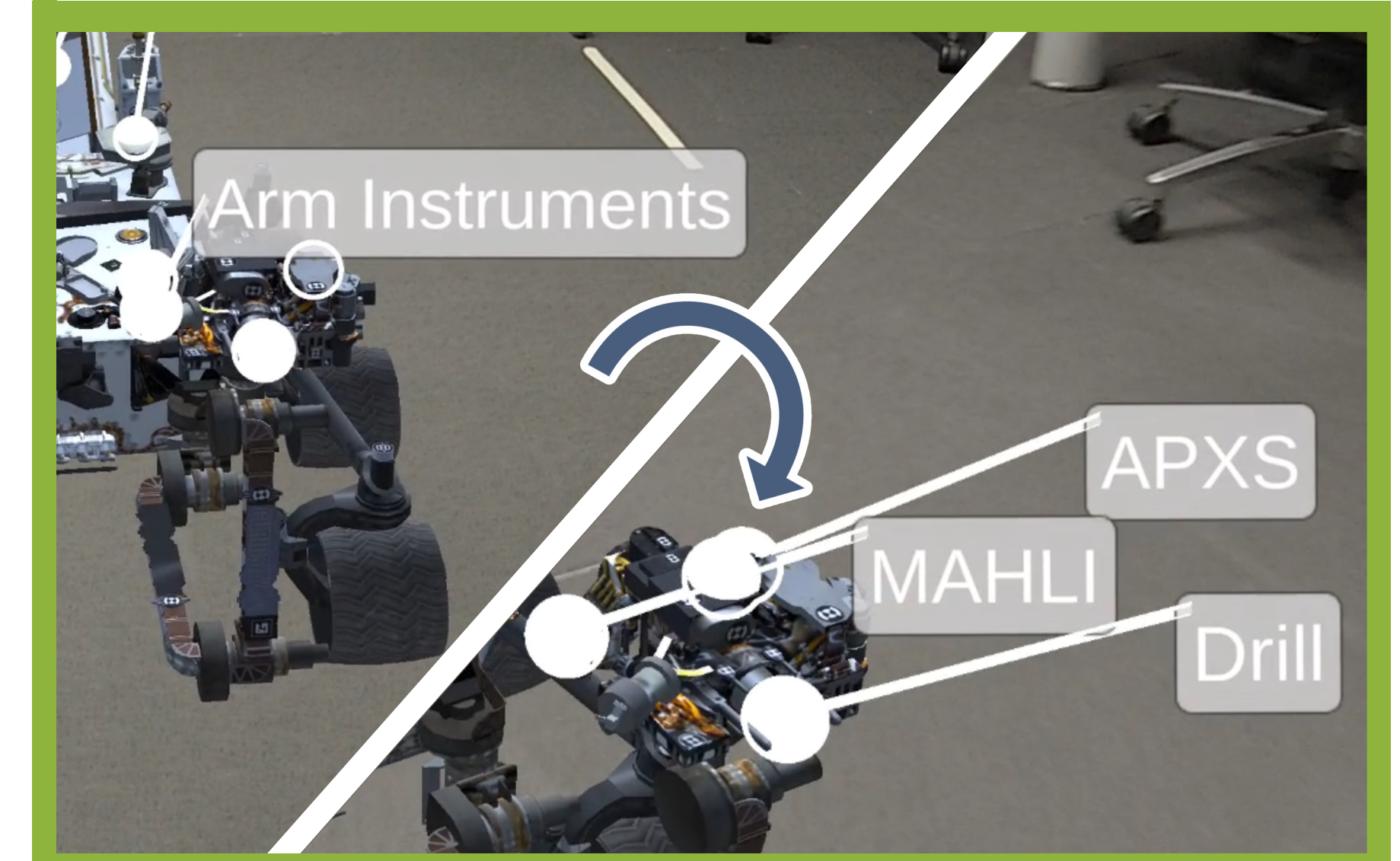
### Concept 2 Multi-Anchored Labels

A single label is attached to one of several repeated features, updating its connection based on the user's view, while interaction reveals all associated leader lines.



### Concept 3 Semantic Label Grouping

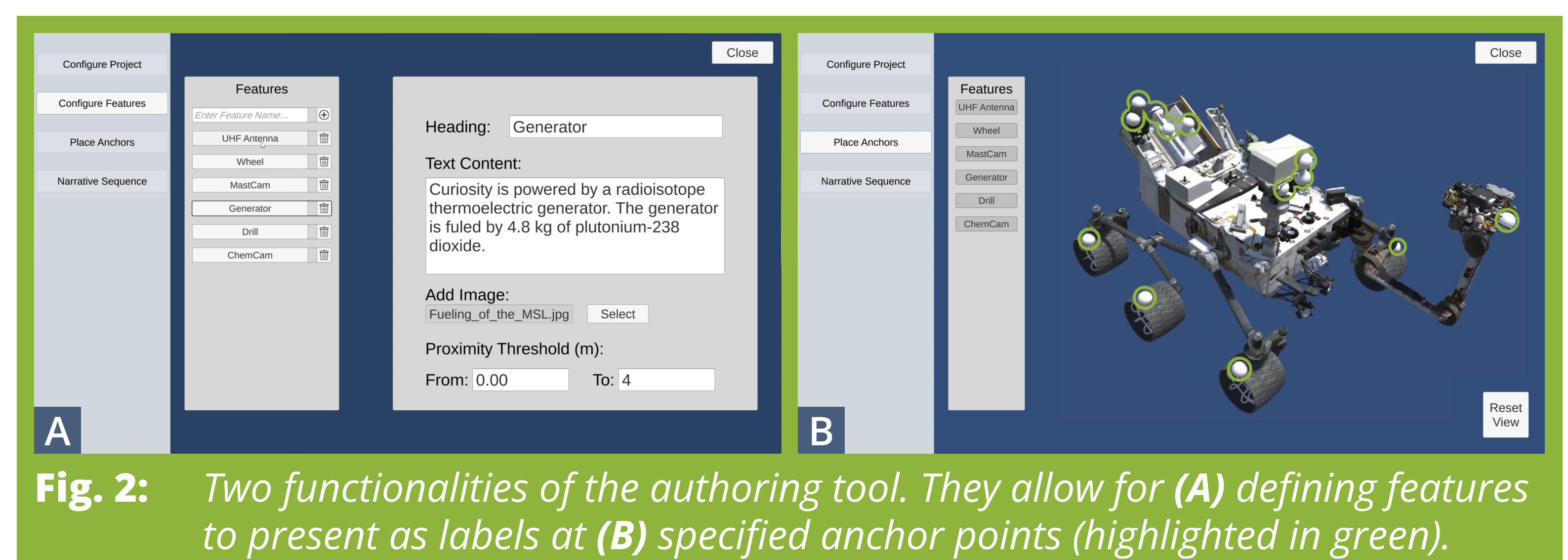
Displays only high-level group labels from a distance to reduce clutter, progressively revealing more detailed component labels as the user moves close.



## Authoring of MR Labels

Our openly available prototype consists of:

1. A desktop-based authoring tool for coding-free content creation.
  2. An experience application for two target devices (Meta Quest 3, Android tablet).
- Authored projects are saved in a device-independent format for easy transfer to target devices without compilation.
  - The experience application interprets this data, allowing users to explore labeled virtual models.



**Fig. 2:** Two functionalities of the authoring tool. They allow for (A) defining features to present as labels at (B) specified anchor points (highlighted in green).

## Limitations & Outlook

While our prototype shows promise, we recognize several areas for improvement and future exploration:

- Further evaluations with content creators and end-users are essential to assess usability, cognitive load, and learning outcomes.

- The current prototype lacks the ability to track real-world objects, which limits its applications to virtual models only.
- We provide an open-source prototype as a foundation for further research into adaptive MR labels and context-driven interactions.

### References

- [1] Borhani, Z., Sharma, P., & Ortega, F. R. (2023). Survey of annotations in extended reality systems. IEEE Transactions on Visualization and Computer Graphics, 30(8), 5074-5096.
- [2] Nebeling, M., & Speicher, M. (2018, October). The trouble with augmented reality/virtual reality authoring tools. In 2018 IEEE international symposium on mixed and augmented reality adjunct (ISMAR-Adjunct) (pp. 333-337). IEEE.

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