

You Had To Be There: Cognitive Insights from an Embodied Storytelling System

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Creativity is perhaps our most complex cognitive phenomenon. It is a subject of investigation in many fields, from Neuroscience to Artificial Intelligence [1, 2]. Research in the latter has even given rise to a dedicated sub-field of its own, Computational Creativity (or CC), which focuses primarily on the generation and appreciation of creative artifacts by machines. These artifacts range from paintings and songs to theorems, jokes, poems and stories. Here we report on work concerning the latter, automated story-generation, to show that the telling of stories with the appropriate use of voice, sound and gestures is itself a creative act.

While story-generation is typically modeled as a symbolic process [3], embodied narration requires a degree of interpretative freedom that is best served by a distributed, sub-symbolic model. We present a multi-level architecture to unify these different layers and needs, hypothesizing that the combination is necessary for effective storytelling.

We fuse the symbolic *Scéallextric* story-generation system [4] with a robotic story-teller [5] that transforms tales of discrete words into continuous voice and gesture outputs. By using declarative knowledge structures, *Scéallextric* offers a degree of explainability for its choices, thereby shedding light on its creative process. The robot's gestural choices are likewise explained by a mix of surface pantomime (iconic gestures) and deeper spatial schemas.

Spatial schemas do for gesture what conceptual schemas do for verbal language, namely, simplify, connect and support a degree of intuitive metaphoricity [6]. The embodied aspects of our multimodal storytelling system, implemented with on a NAO robot, allow us to investigate image-schematic patterns in narrative. When image schemas are used in an apt and timely fashion, they naturally enhance the actions of the story. Our current study therefore focuses on the perceived effects on story appreciation when image-schematic gestures are used coherently, randomly or not at all in the telling.

Dimensions of interest include *humour* (does meaningful embodiment add to the wit of a performance) and *understandability* (do meaningful gestures enhance the comprehension of a narrative). As we double-down on physical embodiment, by adding an additional robot teller, the performance goes from one of narration to one of true enactment, insofar as the embodied agents can now assume the role of story characters and physically act their roles.

We benefit greatly from working with a symbolic story-generation system of our own design. For the embodied storytelling system to work with arbitrary stories from arbitrary sources, we shall need to give it robust classifiers for inferring which vocal and gestural effects are appropriate at different parts of the story. For this we plan to use distributional methods that can be trained on corpus evidence and offer graceful degradation if needed.

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