Computational Creativity: Improv Agents and Conceptual Blending

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ABSTRACT

Conceptual blending (CB) is a basic mental operation that plays a fundamental role in the construction of meaning in our everyday life. The core of CB is the partial matching of two input mental spaces and the selective projection from those inputs into a novel ‘blended’ mental space, which then dynamically develops an emergent structure. Improvisational acting is one specialized domain in which conceptual blending is heavily used; improvisers are required to co-create stories on the stage in real time based on how they continuously perceive their environment. The Digital Improv Project has been engaged in a multi-year study of the cognitive processes involved in improvisational acting and has led to a better understanding of human cognition and creativity. In this article, the authors provide a computational model for the conceptual blending of cognitive scripts that can help digital improv agents to select the two input spaces required in the blending process. The blend is an emergent structure that provides new interesting events that the digital improv agents can adopt in their acting.

Keywords: Cognitive Scripts, Computational Creativity, Conceptual Blending, Contextual and Semantic Retrieval, Digital Improvisation.

1. INTRODUCTION

Improvisational acting is a creative group performance where actors co-construct stories on stage in real-time based on their perceptions of the environment. In an improvised scene, each improviser starts to act and build an individual mental model based on how he perceives the world around him (Magerko et al., 2009) and is guided only by sets of game rules about how a scene should be functionally performed (Johnstone, 1999; Spolin, 1963). A mental model typically contains minimal information (i.e. not every single detail but the main salient points of a phenomenon or experience) described as a set of well-defined, highly organized knowledge (Fagin & Halpern, 1988). Improv actors gradually develop common beliefs about what is known in a scene as a shared mental model.

Shared mental models (SMMs) are a cognitive construct maintained through the process of reaching cognitive convergence, that incorporates the development of mutual beliefs from the team members’ individual mental models to a common mental model shared by the team members (Hodhod & Magerko, 2012). In fact, improv actors normally negotiate their shared mental model solely through performa-
tive actions in the ongoing scene rather than with explicit communication about the model (Fuller & Magerko, 2010). However, the main challenge in establishing a shared mental model lies in the ambiguity associated with the improvisers’ actions, where actions can be perceived and interpreted in many different ways (Fuller & Magerko, 2010). This ambiguity, present in any improvised scene, can be described as one reason actors may observe cognitive divergences (i.e. noticing there are conflicting mental models about some detail of the scene). When improvisers recognize divergences they aim to repair them (i.e. attempting to converge on a shared mental model), and accept the repair (i.e. seeing the result of the attempted repair) (Fuller & Magerko, 2010).

Human improvisers often use their knowledge and past experience to co-create a new scene (Magerko et al., 2009). This can be attempted via the recall of past narrative experiences from their memory and replaying any of them or, more commonly, by blending two or more experiences together to create a new scene/narrative piece. In other words, improvisers create complex narratives that would require the creation of a long sequence of entirely separate spaces (representations), in addition to the use of conceptual blending as a basic mental operation that leads to new meaning and global insight.

We have seen in our socio-cognitive study of improvisational actors that cognitive scripts are often employed in the co-creation of improvised scenes. Cognitive scripts are the symbolic basis for representing behavioral task and domain knowledge. They are defined as a recurrent spatial structure that gives coherence to our experience (Johnson, 1987). These scripts are not replayed verbatim, however, and often use other processes to vary, modify, and combine scripts to create new ideas and experiences for an improvised scene. This process of combining scripts, which happens across storytelling media, involves both the steps of mapping and retrieving scripts, and conceptually blending these scripts. Conceptual blending assumes the presence of two input mental spaces that share frame organizing structures. The input spaces get linked by a cross-space mapping by virtue of the more schematic frame called the generic space. Then partial projections from the two input spaces are combined into a fourth space, called the blended space are formed. The challenge appears in allowing AI agents to employ such cognitive abilities to enrich digital improvisation in general and enhances the human interactor’s experience in particular.

Consider the following story adopted from (Ritchie, 2004) that represents a couple of independent simple narratives (where each narrative represents a simple mental model) combined together to form a quite complex story: “He used what he thought was a fake gun in the holdup but it turned out that it really was a gun and the clerk behind the counter was an under-cover police officer so he was charged with armed robbery and assaulting a police officer.” Richie highlighted the fact that unless these independent mental spaces are dissolved as new ones are generated, the load on cognitive capacity would expand quite rapidly. So this particular story can be conceptualized as a form of multi activated cognitive scripts; the first script is the culturally-learned robbery script, then altered as the narrative progresses by adding or changing connections with other scripts (e.g., for fake gun and under-cover policeman) and finally with a criminal trial script. The above story also reflects an interesting blend in which the real bank robbery script is blended with other scripts where ‘fake gun’ was used instead of ‘real gun’ and ‘under-cover police officer’ was used instead of ‘real clerk’.

Retrieval of cognitive scripts from a corpus of scripts (can be the agent’s episodic memory) is a challenging task. The challenge appears in the temporal precedence of information held in cognitive scripts, which should be accounted for in the retrieval process in order to preserve the context of the cognitive scripts. Retrieval of a cognitive script is the main and first step in implementing a computational blending model.

Studies and analyses of blending have been carried out in areas such as sign language (Liddell, 2000), music theory (Zbikowski, 1999),
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