Blending to Create Human-Robot Common Ground

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Computers & robots on the one hand and human beings on the other hand do not at present share robust ways of communicating that are intuitive to the human being. Human cognition occurs in a human body, embedded in shifting relevant environments, motivated to create and manufacture the environments it both imagines and desires, and constantly deploying the affordances and material anchors of those environments, many of which were conceived and manufactured for just such deployment. Human cognition is distributed across social networks and environmental affordances. Human communication inherits all of this embeddedness and fluidity.

Consider spatial navigation. The navigation computer has spectacular abilities, and its computer vision can produce quick recognitions. In many ways, it is superior to its human teammates. But the human being has creative, imaginative, schematic, conceptual capacities for spatial communication, and these are the basis of its interactions with its human teammates. We have not invented the same abilities for the robot. Human language and co-speech gesture, for example are exceptionally powerful for conveying an overall organization of the scene. By contrast, giving the human teammates all the robot's coordinate details for the elements in the pattern is almost useless.

Communication presents a fundamental problem: conceptual systems are vast and rich and open-ended, while linguistic systems, impressive though they be, are relatively quite thin. How can a linguistic system be used to convey the products of conceptual systems, and how can these products find expression in language, given the stark mismatch in their respective infinities? If forms of language had to represent complete meanings, language could communicate very little. Language is possible only if it allows a limited number of blendable language forms to cover a very large number of meaningful situations. The evolutionary solution to this problem is to have systems of forms prompt for the construction of meanings that go far beyond anything like the form itself. Accordingly, despite these limits on linguistic structure, language can be put to use in any situation. The resulting availability of language to be deployed in all situations is known as its "equipotentiality."

The key to linguistic equipotentiality is blending (Fauconnier & Turner 1996, 2002; Turner 2014). Consider the "cyclic day." No day repeats, but we can blend an indefinite number of days, all analogical and disanalogical to each other, to a single day. Now, in the blend, there is emergent structure: the day *repeats.* And we can refer to this emergent structure directly: "when dawn *comes round again*," "this park closes at *dusk*," and so on. Getting the idea across now becomes easy, but only for an agent that can

understand blends. Consider also the 18-month-old who sees the lion in the zoo and points and squeals "Kitty!" Consider the parent explaining to the 7-year-old that wood is "termite food." Human language depends fundamentally on such blending operations.

This talk will explore possibilities for developing blending abilities for human-computer communication to begin to improve common ground, and to chart some possible development paths for robots who are designed to interact with human teams.

References

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