NLP Challenge in Building Revelator Game of Complex Adaptive Reasoning

Revelator is a game of *complex adaptive reasoning* (CAR), conceived to serve as a self-correcting methodology for *knowledge emergence* in dialogue and narrative contexts of collaboration. Inspired by J. Holland's *complex adaptive systems* research, Revelator's CAR methodology is designed to model the complex logical relations among conjectures (represented in "If ... then" rule form) that players articulate in game plays. The game's agent-based representation of these rule-form plays gives them adaptive capability, making it possible for "argument colonies" to emerge as possible knowledge to be tested. The imposed linguistic constraints on the form of plays function somewhat as do those in the game of bridge, resembling a laboratory experiment in which experts carry out a dialogic, goal directed, and limited but intellectually complex activity [Keeler 2007].

Our current work in Revelator-building focuses on natural language processing (NLP) query support for controlled natural language (CNL) formulation of game plays. We seek prototypes of two-player versions of gameplay for editorial use to reveal knowledge formation in the conversational contexts of news blogs and research wikis. Revelator is a framework for representing knowledge as continually emerging, not simply to be captured but to advance in a recursive process that improves human reasoning skills with appropriate support from technology.

Revelator improves the skills of ordinary everyday reasoning, by extending players' sensory and cognitive limitations and their normally limited commitment to thorough investigation. Reasoners can evaluate each play for: what it implies, what other conjectures are consistent with it, what others are inconsistent, and how it stands up to the evidence (that is, what consequences should follow from its truth, to what degree it is confirmed by any consequences that do follow, how it is false if the consequences do not follow) [Haack 1993]. Unlike many classic games, in which each player chooses a strategy once and for all, Revelator players dynamically develop new strategies, in the form of more general conjectures that can incorporate other players' conjectures. Determining progress in the nonlinear, interconnected character of complex reasoning is like determining the reasonableness of the pervasive mutual support among entries in a crossword puzzle. Revelator distinguishes error- from ignorance-related aspects of fallibility, to reveal their pervasive interdependence [Haack 1993; Keeler 2007].

Revelator reveals the complex relations among players' conjectures, in an evolving inferential

network, which determines justification in the same way that rules determine the correctness of moves in any game. As do players in a game, researchers in collaborative reasoning often jointly uncover possibilities unsuspected by any one participant. And like regular players of a game, investigators begin to recognize certain kinds of conceptual patterns that become "building blocks" for longer-term, subtle strategies (something like "forks," "pins," and "discovered attacks" in chess). But plays in Revelator are players' "logical agents" created by the rules (conjectures) contributed, which must attempt to adapt within complex "conceptual environments." Winning involves strategically selecting and combining those agent-rules to formulate meta agents that reveal adaptive, higher-order behavior hidden in the complexity of their conceptual environment.

Analogous to the children's game of building blocks, Revelator uses propositional "building blocks," with logical (more accurately, semiotic) constraints rather than physical ones. These conditional-proposition agents (as "if ... then" rules) establish the "dimensions," in place of the dimensions of physical blocks. Geometrical and gravitational (forceful) constraints are replaced with inferential and evidential (factual) constraints. These conditionally-related building blocks must "behave" as complex systems adapting to a conceptual environment, in which fallibility would serve as gravity does in physical systems, within the "dynamics of conjectures." Players can explore future possibilities and continually bring the state of their conceptual model up to date as new claims are contributed, to improve the faithfulness of the conceptual relations they construct. Revelator is explicitly a game, so players remain aware that: "uncertainty lies in the model's interpretation, the mapping between the model and the world" [Holland 1998: 44-48].

Please see Anand Agarawala's "A Beautiful Mess" -- a demo of his BumpTop,

http://www.ted.com/index.php/talks/anand_agarawala_demos_his_bumptop_desktop.html

using the "physical" context of a virtual desktop metaphor. A possible Revelator interface would use the same Dynamic Object Engine, adapted from his physical constraint context to a domain with relational logic constraints. We are pursuing this idea.

Taking the physical building-block analogy further, we could eventually have "GIS" and "GPS" technology for virtual exploration of the a "semiotic game terrain." Such a virtual terrain with "global scope" could provide for the continuity of inquiry, as C.S. Peirce foresaw it: "there is no real reason why there must be a limit to the size of our hypotheses ... to maintain a single proposition tentatively should be no easier than to maintain a consistent set" [CP 6.277 (c. 1893)].

Haack, S. (1993). Evidence and Inquiry. Blackwell.
Holland, J.H. (1998). Emergence: from Chaos to Order. Basic Books.
Keeler, M. (2007). "Revelator Game of Inquiry: A Peircean Challenge for Conceptual Structures in Application and Evolution." In U. Priss, S. Polovina, and R. Hill (Eds.): Lecture Notes in Artificial Intelligence, Vol. 4604. Springer, 443-459.