

The Complexity of Two: Dyadic Processes and Evolving Social Aggregations

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Abstract

Computational models of aggregated social agents have two major faults: (1) inter-individual entrainment is ignored; and (2) rule-sets governing behavior are invariant to history. Together these shortcomings impede our ability to generate realistic models of complex evolving social processes. To illustrate how even simple couplings within an established dyad generates unexpected outcomes, we present our findings from two computer models (agent-based, particle filter) of married couples.

With the use of computational modeling, especially when attempting to capture and articulate trajectories of socially aggregated agents, numerous implicit assumptions are made and yet, many if not most, are without an empirical foundation. For example, the standard protocol for creating agent-based behavior is to initially delineate a feature set associated with each agent, distribute those features across a hypothetical landscape, and then have the agents implement the features according to a static rule set.

This is inadequate on at least two levels: (1) intra-individual propensities rather than inter-individual exchanges are assumed to be the primary determinant of social behavior; (2) rules and rule sets are allowed to be static and invariant to local history.

In the first case, there is ample social and behavioral evidence that behavioral propensities vary as a function of context; here context refers to relationship history as well as temporal-spatial dynamics. In the second case, most investigators in the area of computational social science would agree that interaction rules probably change as a function of history, uncertainty, and local objectives. Yet, because these features are difficult to articulate and codify, they are typically ignored in most models. Consequently, computationally generated non-evolving inter-individual interactions allow local errors to accumulate and produce an error space minimally proportional to the number of

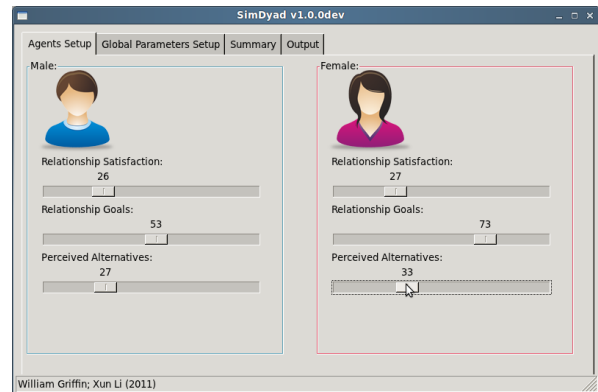


Figure 1: User interface showing parameter sliders that modify interaction characteristics.

coupled interactions and time frame.

We propose to illustrate this dilemma by demonstrating the difficulties we have encountered in modeling the interaction of a simple, yet entrained, dyad: the marital couple. Using a particle filter, we developed a data driven model that allows the viewer to examine how small changes in relationship quality shift the trajectory of the interaction.

Additionally, we developed an agent-based model, also using extant data, of dyadic interaction where behaviors, acting as agents, reflect a rule-set constructed to reflect the social propensities of a dyad. The model interface is shown in Figure 1; sliders allow the user to vary relevant parameters of the putative process. These models illustrate how the observable features of an evolving interaction can vary in real-time depending on each individual's self-report of relationship quality, aspirations, and goals. A typical output is shown in Figure 2; as expected, given the aforementioned suppositions, each instantiation generates a different, yet probabilistically constrained, behavioral series.

From this work we argue that dyadic interaction, the simplest of all social processes, is itself complex. For example,

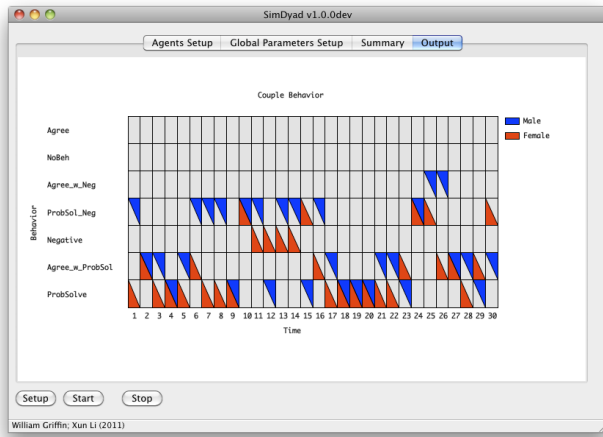


Figure 2: Model output showing a sex coupled sequence over 30 time units.

early forming dyads behave differently than those taking longer to form; likewise, behavioral propensities differ as shifts in relationship quality occur. Generally, among aggregating individuals, prolonged interaction constrains behavioral variability by modifying levels of reciprocity and contingency — thereby increasing uncertainty about collective behavior.

This suggests that unless, and until, better algorithms are developed that accommodate the aggregation of multiple sub-units, most principally, dyads and probably triads, models of collective social action will be inadequate.

Credits

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