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Dynamics of Applause: Modeling Group Phenomena Through Agent Interaction

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Unlike many social conventions that proved to be passing fads, applause appears to be a remarkably stable facet of human culture. Although its manifestations have varied from the fluttering of fans of Victorian ladies, to hearty overhead clapping and catcalls of less "refined" concert-goers, the desire to express approval through a culturally-specified display has been in existence for millennia. Demonstrating the perceived importance of applause, French theater and opera companies of the 1800s hired claques, professionals who led others in applause to secure encores and educate audiences on the finer points of the performance. Using a dynamic game theory model, the present work looks at how applause dynamics emerge from the interaction of individual desires. What are the benefits that drive applause? What are the costs that work to end it? How do the costs and benefits of an individual interact with those of others in the audience? Despite some simplifying assumptions made in the present model, it offers robust predictions of applause in audiences of varying sizes responding to events of varying levels of "impressiveness." More generally, this work demonstrates how a complex social behavior can be modeled with few assumptions and free parameters.

Procedure The benefit of applause was taken to be the emotional benefit of expressing appreciation. This benefit was proportional to the impressiveness of the event. The costs were twofold. An embarrassment cost was calculated based on randomly-generated "embarrassment thresholds" assigned to each agent. This was based on the intuition that some individuals are more easily embarrassed than others and will hesitate to applaud unless others are also clapping. The embarrassment cost at a given time was inversely proportional to the percentage of audience members applauding. The second cost was the physical cost of applause, which built up proportionately to the time spent applauding. An agent clapped when the desire to express their appreciation outweighed the embarrassment and physical costs, and ceased clapping when the costs outweighed the benefit.

A typical sequence of events in response to an event is as follows:

1. An event of a particular impressiveness value occurs.
2. People with low embarrassment thresholds (those not easily embarrassed) begin to applaud and lower the embarrassment cost for others in the audience.
3. If the decrease in the embarrassment cost is not enough to cause other agent to clap, the clapping quickly dies down due to an increase in physical costs.
4. Otherwise, the decrease in embarrassment causes other agents to begin clapping, which in turn causes a cascade of applause.
5. As the physical cost of continued applause begins to outweigh the benefit of showing one's appreciation, individuals stop clapping raising embarrassment costs for others in the audience, eventually causing everyone to cease applauding.

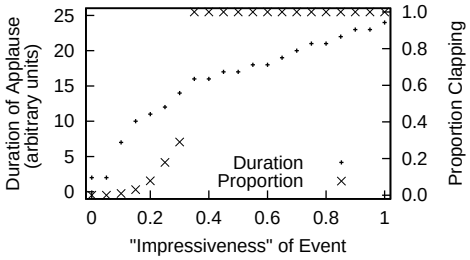

Figure 1: Effect of impressiveness on proportion of audience clapping and duration of applause.

Results We started out with two basic hypotheses: Applause starts quicker than it ends. If an applauder is not joined by others, they typically stop clapping. These hypotheses come from observations of audiences; the first is also supported by analysis of digitized recordings of actual applause. Both hypotheses were accurately supported by the model. The model furthermore made predictions regarding effects of event impressiveness and audience size on applause dynamics. Events of low impressiveness predictably result in few individuals clapping for a short time. Beyond a certain "impressiveness threshold," virtually everyone starts applauding. Further increases in impressiveness yield longer applause times of the whole audience (see Fig. 1). The effect of audience size is more subtle. For events of high impressiveness, audience size proved to have no effect—everyone applauds in all audiences. For events of lower impressiveness, however, smaller groups behaved more erratically, occasionally breaking out into universal applause, while at other times not breaking the 50% mark. These predictions have all been confirmed through observation of applauding audiences.