SEMpro Model Communications Documentation

This document contains information explaining the operation of the SEMpro model. Listed below are the key parameters used by the current version (11/29/10) and a qualitative description of what the minimum and maximum values of each parameter signify. All parameters discussed are continuous and can take any value between the minimum and maximum. The relevant social science theories that our parameters and model concept are derived from are discussed below each parameter.

Tolerance: How different an agent a given agent will communicate with.

Rogers and Bhowmik (1970), drawing together a range of sociological research on relational communication, find homophily promotes the exchange of messages between individuals (Rogers and Bhowmilk 1970, p. 526). Homophily is the tendency for people to associate with other people who are similar to themselves; heterophily is the tendency for people to associate with those who are different from themselves. Homophily promotes communication, because communication between similar people is both more frequent and "more effective" than communication between people with many differences. One reason advanced in the literature is that sharing many things in common with another person leads to "greater credibility," understood as the reliability and trustworthiness of a given source of information (Rogers and Bhowmilk 1970, p. 529).

We instantiate this concept in the model as the *Tolerance* parameter, which measures how different an agent a given agent will communicate with. A minimum value creates an agent that will only talk similar agents as measures by their preference for the project; and a maximum value creates an agent that will talk with all other agents regardless of their opinion within an

area set via the *Talk-span* parameter.

Opinion-Stability: This parameter represents how stable a given agent's opinion is when they communicate with another agent regarding their project sentiment.

Social judgment theory (SJT) is a socio-psychological approach to understanding how individuals change their attitude when confronted by another position. SJT envisions the attitudes of any two individuals as separated by a certain distance. Depending on how distant a message is in relation to a person's sentiment, the message falls in to a certain "latitude" or region of acceptance, indifference or rejection. SJT theory finds that people are most strongly influenced by messages "at a moderate distance" from their own position (Siero and Doosje, 1993, 542). In computational simulation, agents can be conceived as having a certain level of "confidence" regarding the subject at hand. As they interact, more confident individuals are more likely to maintain a stable belief because they are harder to persuade and thus create a higher bar for advocates of the counter position (Bennett, 2010, p. 145). Agent-based simulation has shown that social networks also play a role in the dispersion of attitudes through a given population (Jager and Amblard, 2005), however this version of the model assumes non-structured interaction.

We instantiate this concept as *Opinion-Stability*, with the minimum value creating an agent with an opinion that is very easy to move, and the maximum value creating an agent with an opinion about the project that is very difficult to change.

Talk-Span: The geographic distance an agent will look to communicate with other agents.

Although most of the agents we are modeling (citizens of the US) can communicate with people around the country or world easily and cheaply using electronic means, there is evidence

in the social science literature that even given these technologies, communication is more frequent with people who are physically proximate to you. According to McPherson et al. (2001) geographic proximity is the most "basic source" of homophily, as physical closeness encourages more frequent contact and communication. And although new technologies have "loosened the bounds of geography" they have not eliminated the importance of geography in building ties (McPherson et al., 2001, p. 430).

We instantiate this in the model as *Talk-Span*, which is the geographic limit in the simulation environment an agent will go to communicate with other agents. At the minimum, an agent will only communicate with those adjacent to them; at the maximum, an agent will communicate with anyone in the most proximate two-thirds of the simulation space.

Utility-Message: This parameter represents the strength of the utility's pro-project message.

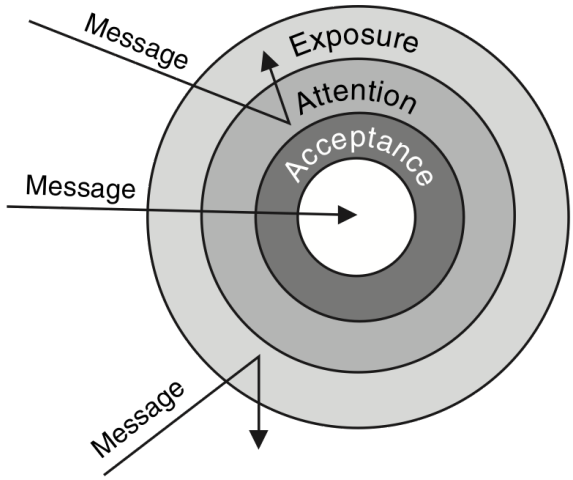
Shannon and Weaver's early attempt to model the communications process conceptualized it as beginning with a "source" that is generating a "message" or communication and sending it via a "channel" or a means of communication to the "receiver" or target audience (Corman et al., 2007, p. 4). Messages can be subject to "noise" and "distortion," which can degrade their intelligibility and interfere with communication. This "message influence model" was implicit in the development of Berlo's (1960) Communication Penetration Theory (CPT). According to the CPT model, messages can fail to reach an intended audience because the audience is not exposed to the message, because they are not be paying attention, or because they do not accept the sentiment as depicted in *Figure 1* below (Bennett, 2010, p. 141).

To overcome these various barriers, "messages can be repeated" multiple times and in a wide range of mediums (Corman et al., 2007). A stronger message level represents a more

frequent repetition of the campaign message and a higher-profile media placement. Although there is disagreement in the marketing research literature regarding the exact number of message it requires to entice a consumer to purchase a product, there is agreement among advertising practitioners that at least 3 and as up to a dozen or more repetitions may be required.[1]

We instantiate this concept in the model as *Utility-message*, which measures the strength of the message being broadcast by the utility. A value at the minimum represents the absence of any media or public information efforts; a value at the maximum represents a forceful campaign message.

Figure 1: Berlo's Communications Penetration Model (Bennett, 2010, p. 142)



Utility-Credibility: This parameter represents the perceived credibility of the Utility's message.

The ability of a source to persuade an audience is related to the audience's perception of the source's credibility—in other words 'who said it' matters in communication (Belo et al.,

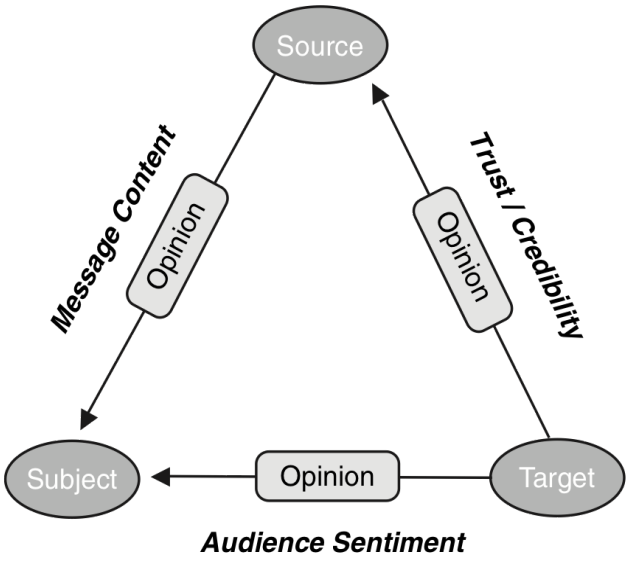
[1] See discussion of relevant research in Tellis, G.J. (1997) Effective Frequency: One Exposure or Three Factors. *Journal of Advertising Research*. July/August.

1969 p. 564). The more credible a person perceives a source to be, the more likely they are to accept the message that the source is sending. The Source-message-channel-receiver model of Berlo et al. (1969) builds on the message influence model of Shannon and Weaver by attempting to account for the impact of source's credibility on the subject's understanding of a message about a given subject. A "target" audience opinion on a given subject is shaped by the subject's perception of trust in the source as well as their existing sentiment, and by how the message is encoded and transmitted, as depicted in *Figure 2* below (Bennett, 2010, 143).

We instantiate this concept as Utility-Credibility, which at the minimum value represents a source that is perceived as deceptive and untrustworthy and at the maximum value represents a source that is perceived as highly trustworthy and credible.

Drawing from CPT theory discussed above, the higher a source's credibility, the less likely an agent is to negatively react to a strong message. Regardless of the source (NGO or utility), the agent can essentially accept, ignore or reject the message. If it accepts the message it updates its preference to be more like the utility or NGO. If not, it either ignores or rejects. If it ignores, nothing happens. If it rejects the utility message, it updates its preference in opposition to the utility position; if it rejects the NGO message, it becomes less likely to accept future messages, but doesn't update its preference. The likelihood of rejecting the message, given that the agent has not accepted it, is based on the utility or NGO credibility.

Figure 2: The Source-message-channel-receiver model of Berlo (Bennett, 2010, p.143).



NGO-Message: This parameter is akin to Utility-Message and represents the frequency and prevalence of a media message.

Although the level represents the same minimum and maximum prevalence as in the Utility-Message, *NGO-Message* is instantiated in the model differently. Drawing on SMCR and and SJT theory, and because NGOs are usually perceived as having higher credibility than utility sources of information, if the agent rejects the NGO message, the agent become less likely to receive a future message, but their opposition to the project does not necessarily change.

NGO-Credibility: This parameter is akin to Utility-Message and represents the credibility of a message from an NGO. It is instantiated in the model identically to the *Utility-Credibility*

parameter with a minimum value representing an absence of credibility and a maximum values representing a totally credible source.

CBO-Reach: This parameter controls how far agents representing Community Based Organizations (CBOs) will assess public sentiment against or in favor of a project.

CBO-Reach, like *Talk-Span*, is based on sociological research (McPherson et al., 2001) showing that people are more likely to draw support from individuals who are physically proximate to them.

Bibliography

Berlo, D. K. (1960). *The process of communication: an introduction to theory and practice*. New York, NY: Holt, Rinehart and Winston.

Berlo D. K., Lemert, J. B., and Mertz, R. J. (1969). Dimensions for evaluating the acceptability of message sources. *Public Opinion Quarterly*, 33(4) 563–576.

Bennett, W.H. (2010). Media and Influence. In A. Kott and G. Citrenbaum (eds.), *Estimating Impact*, Springer.

Corman, S.R, Tretheway, A, Goodall, B. (2007). A 21st Century Model for Communication in the Global War of Ideas. *Communication*, 761.

Jager, W & Amblard, F. (2004). Uniformity, Bipolarization and Pluriformity Captured as Generic Stylized Behavior with an Agent-Based Simulation Model of Attitude Change. *Computational & Mathematical Organization Theory*, 10, 295–303.

McPherson, M, Smith-Lovin, L, Cook, J.M. (2001). Birds of a feather: Homophily in social networks. *Annual review of sociology*, (27), 415-444.

Rogers, E., & Bhowmik, D. (1970). Homophily-heterophily: Relational concepts for communication research. *The Public Opinion Quarterly, 34* (4), 523–538.

Siero, F.W., & Doosje, B.J. (1993) Attitude change following persuasive communication: Integrating social judgment theory and the elaboration likelihood model. *European journal of social psychology*, 23 (5), 541-554.

Tellis, G.J. (1997) Effective Frequency: One Exposure or Three Factors. *Journal of Advertising Research*. July/August.