The logic of modesty—why it pays to be humble

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Why do people make anonymous donations, and why does the public perceive this as admirable? Why do we downplay our interest in a potential partner if we risk missing out on a relationship? A team of scientists, consisting of Christian Hilbe, a postdoc at the Institute Science and Technology Austria (IST Austria), Moshe Hoffman, and Martin

Nowak, both at Harvard University, has developed a novel game theoretic model that captures these behaviors and enables their study. Their new model is the first to include the idea that hidden signals, when discovered, provide additional information about the sender. They use this idea to explain under which circumstances people have an incentive to hide their positive attributes.

People often take actions that may be costly at first, but lead to reputational benefits in the long run. However, if good reputations are important, why are there numerous situations in which people hide accomplishments or good characteristics, like when we donate anonymously? Similarly, we often emphasize subtlety in art or fashion, avoid appearing over-eager, or otherwise obscure something positive. Why do others consider this behavior commendable? The team's key insight into this societal puzzle is that "burying" a signal (i.e. obscuring information) is a signal in and of itself. This additional signal can have several interpretations: for instance, the sender may be unconcerned with those who might have been impressed, but who miss subtle messages (like an artist disregarding the philistine masses). Alternatively, the sender might be confident that those who matter to them will find out anyway (for instance, only those who have the taste and/or necessary wealth will recognize a designer bag without an obvious logo).

The scientists succeeded in formalizing these ideas in a new evolutionary game theory model they call the "signal-burying game," which they detail in a paper published today in *Nature Human Behaviour*. In this game, there are different types of senders (high, medium, and low), and different types of receivers (selective and unselective). The sender and the receiver do not know the other's type. To convey their type, senders may pay a cost to send a signal. Signals may be sent clearly or be buried. When a signal is buried, it has a lower probability of being observed by any kind of receiver. In particular, buried signals entail the risk that receivers will never learn that the sender has sent a signal at all. After the

sender has made his signaling decision, receivers decide whether or not to engage in an economic interaction with the sender. The game has an element of risk, and therefore, senders and receivers must develop strategies to maximize their payoff.

"We wanted to understand what strategies would evolve naturally and be stable," explains Christian Hilbe, co-first author of the paper and postdoc in the research group of Krishnendu Chatterjee at IST Austria. "In particular, is it possible to have a situation where high-level senders always choose to bury their signals, mid-level senders always send a clear signal, and low-level senders send no signal at all?" This would correspond to situations that come up in real life, and is one of the key distinguishing features of their model: They allow for strategies that target specific receivers at the risk of losing others. In their simulations, players started off neither sending nor receiving signals. Then, with some probability, a player either selects a random strategy (representing mutation) or imitates another player (representing a learning process biased towards strategies with higher payoff). In their simulations, the scientists found that populations quickly settled at the strategy described above.

The team also developed several extensions to the model, enabling them to cover more general scenarios. First, they added different levels of obscurity: senders could choose from several revelation probabilities. "We found that in this case, high senders tend to be modest... but not too modest," adds Hilbe. "Even if you're humble, you don't try to be holier-than-thou." It is moreover possible to increase the number of types of senders and receivers, as well as introduce subtleties in the preferences of the receivers.

Using their new model, Hilbe, Hoffman, and Nowak were able to put a different perspective on various common situations: a donor giving anonymously, an academic not disclosing their degree, an artist creating

art with hidden messages, and a possible partner hiding their interest, among others. Evolutionary game theory shows that, in the end, these puzzling social behaviors make sense.

More information: Moshe Hoffman et al, The signal-burying game can explain why we obscure positive traits and good deeds, *Nature Human Behaviour* (2018). DOI: 10.1038/s41562-018-0354-z

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