

Botonomics: the influence of intelligent machines on economic behavior

In 2019, Google introduced Duplex, a bot that can make voice calls. A new feature of the bot was its ability to imitate the way that humans speak so well, that people were not aware that they were speaking to a machine and not a human. A year later, a computer based on a sophisticated natural language processing model (GPT-3) co-wrote an article published in *The Guardian*.

Along with the advancement of bots, the influence of machines on our society will be enormous and multidimensional. They will transform the way we use digital devices (mostly verbally), how we make decisions (e.g., by letting them give us advice on various issues like a holiday destination), or how we do our jobs or conduct business (e.g., by partnering with us in medical diagnoses). Therefore, it is crucial to uncover the behavioral intricacies of human and machine communication and collaboration, so that we may benefit from this technology as a society and not be harmed by it.

We still know little about how bots will influence decisions that have economic consequences. For example, the process of interaction with a sophisticated bot may determine investment decisions, similarly to what is currently happening with (less-sophisticated) robo-advisors (e.g., Betterment). In three themes, we will investigate many (similar) behaviors that have economic undertones. It is now possible to use the same algorithm that co-wrote the article in *The Guardian* (GPT-3), allowing researchers to look at how people will interact with bots in the future.

The first theme concerns the question of how to avoid an unfavorable reaction of a human to a machine. Earlier studies show that – in many cases – people dislike it when a machine (or an algorithm) tells them what to do (instead preferring human advice). This is a phenomenon known as algorithm aversion. Through our research, we will investigate if increasing the presence of a human in an interaction reduces this aversion. We will also explore whether economic behavior will change if people interact with a chatbot (instead of a static, non-conversational bot) or a bot that has been fine-tuned by a human with high expertise (e.g., by an economist), or if they currently have less mental resources (are under cognitive load).

The second theme concerns how machines can increase unethical or antisocial behavior. Existing research shows an interesting “double effect”. On the one hand, machines are generally not preferred as the agents that should handle issues that have moral undertones. On the other hand, machines are not judgmental, making it less mentally exhausting for humans to behave unethically in front of them. We will use methodological advancements to obtain a better understanding of how machines can increase our ability to behave unethically. Moreover, we will test whether people will be more likely to behave unethically if the bot has been fine-tuned by a person with a high moral standing (e.g., by an ethicist). Next, we will test whether people become less prosocial and less trustworthy if they have a bot at their disposal to guide their decisions, or if another person has such a bot. Finally, we will test whether interacting with machines instead of humans makes it easier for people to make moral judgments that are not socially desirable.

The third theme concerns the “affective leverage” that bots can use, while trying to promote desired behaviors. This is already happening. For example, in one company a machine listens to how employees interact with customers and suggests what they should say in any given moment. In our project, we will investigate how effectively bots can decipher what a person is thinking or feeling, in order to adjust how they will interact with that person (and thus increase desired economic behaviors). We will also see whether people find that it is socially acceptable for bots to behave this way.

We want to publish our most important findings in leading journals, e.g., *Nature Communications*, *Nature Human Behaviour* or *Science Advances*. Publications in these journals should be written in a way that is understandable by the society at large and scholars from other fields. We believe that this is important: it will help build bridges between various different fields, inspiring new, breakthrough ideas.