**////Title: Quantum Persuasion: Can Targeted Distractions Change Our Viewpoints?**

**////Standfirst:**

How our mind frames information, processes it and makes decisions is an active field of research in psychology, neurosciences and behavioural sciences. Recent research aims to quantify our cognitive processes by mapping them to mathematical theories. Professor Ariane Lambert-Mogiliansky’s work at the Paris School of Economics looks at how we can link cognitive processes, such as learning and decision-making, to the mathematics of quantum mechanics. She establishes and tests a quantum version of the persuasion problem, looking at how much one can alter a person’s cognitive state and orient their decisions through the smart use of questions and information. This research follows the steps of Niels Bohr, founding father of Quantum Mechanics, who wrote about essential similarities between Quantum Mechanics and the functioning of the mind.

**////Main Text:**

Persuasion theory deals with inducing changes in a person’s beliefs about the world, in order to persuade her to make a specific choice. The standard approach relies on the classical model of uncertainty, which assumes that there is one single objective truth and the decision-maker uses information to improve her knowledge of that truth. However, this approach cannot explain the extent of persuasion that we witness in human societies.

Therefore, Professor Ariane Lambert-Mogiliansky and her colleague Vladimir Danilov developed an alternative approach: the quantum persuasion problem. Its premise is that human reality is like a quantum object that has no independent existence. It is intrinsically contextual and depends on the perspective we use to address it. Perspectives can be incompatible in the sense that people cannot simultaneously consider both. For instance, the life insurance perspective is not compatible with the spiritual or emotional perspective on life. By exploiting these incompatibilities, Professor Ariane shows how a decision-maker can be distracted and eventually induced to believe almost anything.

These results were published in the *Journal of Mathematical Economics* in 2018, where a quantum theory of belief manipulation is proposed. In 2021, the theory was tested experimentally, using a creative survey technique, as published in *Symmetry.*

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In quantum theory, functions describe the state of quantum particles. These have the unique feature that we cannot know about all of a particle’s properties simultaneously. For example, the more we learn about the position of a particle, the less we know about its momentum. This is the uncertainty principle. As a fundamental consequence, measuring a property of a system alters its state, which implies intrinsic contextuality. A system, defined by its properties, does not exist *per se*, but only in interaction with its environment, such as with a measurement device.

These particles, and the various states they can be in, occupy a different space than what we typically consider. We usually think of objects occupying a space of three dimensions, but in quantum theory, we look at a space of more dimensions, called Hilbert Space. How the particles access various states in the Hilbert Space is defined by a set of functions called operators.

The analogies drawn between this theory and our cognitive processes form the basis for Professor Ariane’s work. Our beliefs or representation of an uncertain real-world feature is modelled as a quantum system in a multidimensional Hilbert Space. Questions and new information act on that system like operators to alter its state. Like quantum particles in a Hilbert Space, our cognitive system cannot have definite values along all perspectives simultaneously.

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In the case of the persuasion problem, the decision-maker is looking to act based on her beliefs. To influence her decision, we want to affect her belief state, her representation of the world.

In quantum theory, we measure properties of a system, for example: position or momentum. In our persuasion problem, perspectives on the represented reality are like properties. We can ‘measure’ the decision-maker’s belief state in terms of one specific perspective: for example, by asking ‘are you willing to pay X dollars per year for your life insurance, yes or no?’.

By appealing to a second perspective that the decision-maker cannot think about simultaneously – for instance an emotional one, ‘Should people be given the right to end their own life, yes or no?’ – we can change her views about the value of life in a way that is inconsistent with the classical ‘objective reality’ model of preferences.

Professor Ariane and her colleague Professor Danilov have shown that it is always theoretically possible to produce any cognitive state, but it may require an infinite number of questions. Practically, if one keeps trying to influence a decision-maker, she will stop listening. Therefore, Professor Ariane’s research also considered a limited number of questions and found that the persuasion power of a well-designed sequence of just two questions can be very significant. Most interestingly, she reveals the persuasion power of distraction: asking a question unrelated to the decision can overturn a decision-maker’s beliefs.

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In her experimental test of this theory, Professor Ariane gave participants a survey about two non-governmental organisations whose goals were to save endangered species, either elephants or tigers. The participants were asked whether trust in the organisation or the urgency of the cause was more important to them. The project helping endangered elephants aimed to incite trust, whereas the tiger cause aimed to create a sense of urgency.

The participants were divided into three groups: Group 1, Group 2 and a control group. Professor Ariane gave Group 1 a statement that gave a negative view of their priority. For example, if trust was their priority, they were then given a statement about corruption in NGOs. Group 2 was given a statement that addressed the other perspective. So, those who prioritised urgency were given the statement about NGOs’ corrupt practices. The statements did not provide information relevant to the choice, but worked as an invitation to question oneself along the introduced perspective.

The participants were then asked to choose which cause to support: elephants or tigers. Participants in the control group were simply asked to pick a project without receiving any additional statements. The results showed that those in Group 1 responded similarly to the control group. However, participants in Group 2, who had been given information that distracted them, gave different answers: a statistically significant share of people who would have supported elephants switched to tigers, and vice versa.

Within Professor Ariane’s quantum framework, trust and urgency are incompatible considerations, which she establishes in an auxiliary experiment. This explains why in Group 2, as the survey respondents are taken from the ‘urgency perspective’ to the ‘trust perspective’ through the second statement, this changes their decision as their belief state has been altered.

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Professor Ariane’s work highlights the relevance of the intrinsic contextuality approach in cognitive sciences. She demonstrates how we can use concepts from quantum theory, such as the impact of measurements on the state of a quantum system, to describe cognitive processes. Complex mental states cannot have definite values in all perspectives simultaneously. Therefore, a statement or a question affects our cognitive state in a way that goes far beyond the classical predictions.

The quantum persuasion problem is an application of quantum cognition, which is a recent field in psychology and social sciences that replaces classical uncertainty with quantum indeterminacy in the theory of decision-making. The approach has been successful in explaining a variety of systematic deviations from classical rational decision-making. The link between our cognitive states and quantum theories is an active topic of research, and provides an exciting new conceptualisation of our decision-making processes.

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This SciPod is a summary of the papers ‘Targeting in quantum persuasion problem’, doi.org/10.1016/j.jmateco.2018.04.005, and ‘Phishing for (Quantum-Like) Phools—Theory and Experimental Evidence’, <https://doi.org/10.3390/sym13020162>.

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