STIMULI MYTH

TO SEE YOU HAVE TO LOOK

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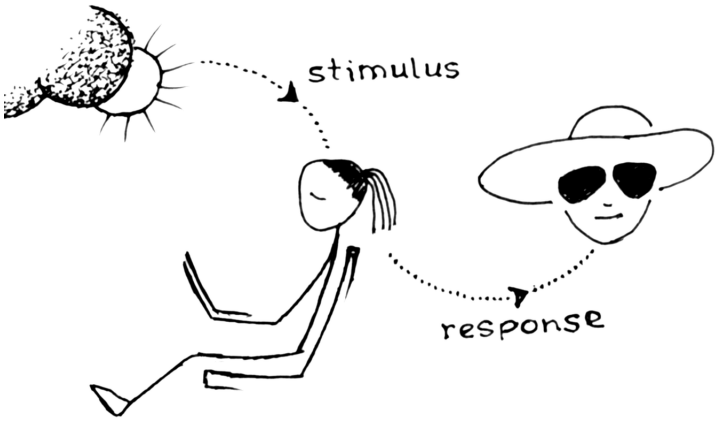
Mar 5 ♡ 5 💬 5

Most readers interested in artificial intelligence will be familiar with the picture below, illustrating how the brain and artificial intelligence systems work. The diagram shows the process, which consists in the fact that the environment generates specific signals, which, being perceived by sensors, are processed in a "reasonable way" by the brain or an artificial intelligence system and produces a particular "output" - it recognizes the cat in the picture, sends commands to the executive mechanisms, and so on. Looks quite logical, doesn't it?



As you know, the best way to make sure that the ideas about the essence of the matter

But on the other hand, the situation around the squirrel is stationary, and the actions are various! This means that it is not only the external stimuli that determine squirrel actions. And since there were such situations when what was happening corresponded to the scheme, we reasonably concluded that the explanation could not be considered either erroneous or perfectly correct - it is merely incomplete. The actual situation is more complicated: an external stimulus can initiate a response, but the absence of stimulation is not mean inactivity.

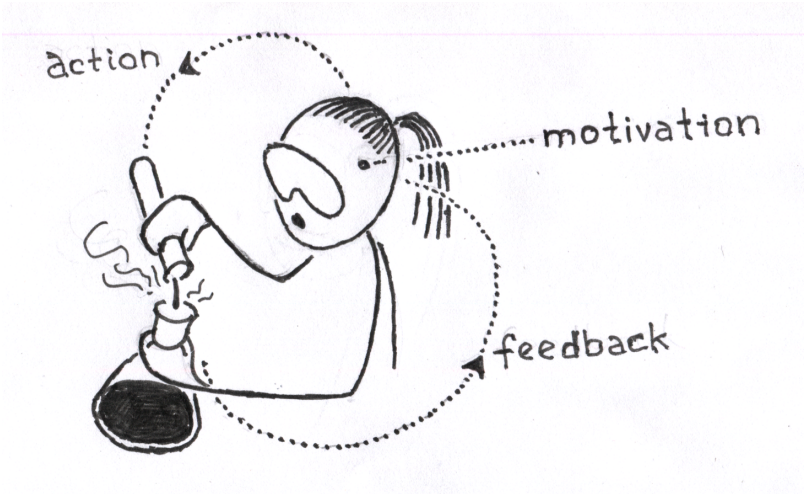
But perhaps the difference is insignificant? An external stimulus or an internal one must be analyzed by the brain or an artificial intelligence system in one way or another! However, in reality, this difference corresponds to the radical difference between animals with a nervous system and plants, which do not have a nervous system and functioning precisely under the original scheme (the sun rose - the flower opened its petals, the sun sets - the petals close). What's the difference? Obviously, to produce a response to ***internal stimuli***, something must be present that generates these stimuli. So far as we found out in the course of a thought experiment, internal stimuli are various in the same unchanging situation; their source cannot be sensors: a constant state around means the invariability of signals from sensors. In complete darkness in an empty room away from the walls, the mouse continues to move despite the sensors' constant signals. The only source of internal stimuli is the central element of the nervous system - the brain. And if the brain ceases to be active, the body begins to behave precisely like plants.

Let's go back to our thought experiment. If a nut stimulus appears not in front of the squirrel's eyes but behind, this does not mean that it will remain intact since the squirrel periodically examines the surrounding space. This is another essential difference between animals and plants: the sensory perception of the external world is active: to see a nut, a squirrel looks first in one direction, then in the other; to find nuts under the leaves, the squirrel rakes the leaves; to cross the road safely, we look left and right; to check if the tea has cooled down, we touch the cup. An external stimulus in the real world is found due to activity initiated by the brain; ***to see, we have to look.***

The sensors' signal is a response to the execution of the brain's decision to receive information. Therefore, situations are possible and regularly occur when we have not noticed something. This is a consequence of the impossibility to notice (see, feel) everything around; this "everything" is simply too much. Therefore, the brain controls sensors to collect information that is most useful and important to it, and the degree of intelligence is determined, among other things, by the quality of decisions about where

to look, what to touch, whom to listen to.

For those familiar with automatic control systems, the nervous system's similarity with the classical control system, which is permanently active, controls the sensors, giving them instructions on what and when to measure, where to direct the video camera, and so on, is obvious. After collecting the necessary information, it provides commands to actuators. At its core, the nervous system is a subsystem of the body, which controls the organism as a whole. It provides animals with opportunities that are absent in plants: to perceive the environment actively, to develop internal stimuli, and to do this much faster than processes in plants. An opportunity is provided to explore the world using sensors and actuators to move and influence the environment beneficial to oneself. And the original scheme turns into a classic loop of a feedback system: action - response - analysis - decision making – action...:



An interesting aspect is that there is essentially no apparent difference between sensors and actuators - both of them operate in a coordinated manner under common control. The muscles that control eye position are part of the visual sensor; the muscles that allow the ears to move are part of the acoustic sensor; the hand muscles are part of the tactile sensor, and so on. Further, we will use the term ***effector***, which combines sensors and actuators into a group of devices that return feedback in response to the received directive.

However, the most important thing is that only a system under the control of an internal motivation system can accumulate knowledge about the environment without having any initial (innate or transferred from another knowledge carrier) information due to the analysis of the results of its own actions. Experimenting is an autonomous way to study the world and one of three ways to gain knowledge; two alternatives are transferring knowledge from one person (system) to another and learning by repeating another

person or system's actions. Only experimentation can create new knowledge, including causal relationships in the world; the other two are only ways to convey what is already known to someone. Since the ultimate goal of AGI development is reaching the intellectual level of a person (or exceeding it), the ability to fully autonomous learning by analyzing one's own actions is an essential requirement for the system being developed to qualify for AGI status.

SUMMATION

Since the goal of developing Artificial General Intelligence is, by definition, to create a system capable of doing what a human can do, three key points follow from the above:

- *The primitive stimulus-analysis-decision scheme is not acceptable for AGI.*
- *An AGI system - even if the prototype cannot reach the intellectual level of a human - should be a kind of active control system, capable of exploring the environment (it doesn't matter if this environment is real or virtual), controlling sensors and actuators to collect the most important and valuable information.*
- *The production of internal stimuli is an essential function of the brain, and the AGI system must contain an appropriate component of motivation for action*

AGI architecture and design of the motivation components are the subjects of the following chapters.

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saty chary Mar 12 Liked by Mykola Rabchevskiy

Hi Mykola, nice! I think along similar lines - about direct, active physical experience (via embodiment), response, etc. Here is my writeup: https://www.researchgate.net/publication/346786737_Intelligence_-_Consider_This_and_Respond

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