[Column 68 Set 2] Exploring More Mysteries of Living: Many topics Remain Important to Both Humans and Robots

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Why these Columns? Because human behavior causes global problems, and solving these problems requires changes in human behavior… So *everyone* benefits from knowing something about the natural science of human behavior that these columns describe. See the 72 columns of the first set, in the *Explaining Mysteries of Living* book or on **BehaviorInfo.com**, for the *basics* of this science.

Unsurprisingly, many topics regarding robot life reflect human concerns. This column begins looking at some such topics of robot life. These topics include emotions and feelings, energy sources, reproduction, pre–installed experience, planned diversity, humor, social life, and quality of life considerations.

For starters, can designers engineer robots to experience emotions and feelings? Should robots even have emotions and feelings? Recall that humans, and to some extent other organic life forms, are hard wired for some stimuli to elicit a dump of certain chemicals into the blood stream.

That dump is an emotional response that humans detect, with the input of other kinds of stimulation present in the current circumstances, as one or another kind of feeling. Humans have many labels for such feelings. Those “other kinds of stimulation present in the current circumstances” determine which label gets applied in each particular case.

All that also happens when various additional stimuli pair (i.e., occur at the same time) with the original eliciting stimuli. We call this respondent conditioning, and these additional stimuli can then also elicit the emotional chemical–dump response and so produce feelings.

The most notable effect of the stimuli that elicit emotions and feelings, however, involves their more general arousal function. They exaggerate ongoing, current responding, for example by making it more intense. When your hiking path takes you around a boulder, only to find a big black bear on the path coming from the other direction, you experience a big chemical dump.

You may detect that dump as a feeling of fright, but the more notable effect is to make any immediately subsequent running more speedy than the running that occurs when your desk–clock stimulus shows the time for an evening jog. Also, check with your local forest ranger as running may not be the most recommended response in such a bear situation.

The question before us, however, concerns robot design and construction. Should the engineering specifications include finding, or designing, and installing an inorganic counterpart to the neural structures that mediate emotions and feelings in humans? Robots may indeed benefit from a capacity for certain kinds of stimulation to lead to arousal, that is, to exaggerate ongoing, current responding.

Robots also need energy sources to maintain their behavior. The assumption that electrical energy (e.g., from rechargeable batteries, or from arrays of solar collectors, or both) will always be the fuel of choice may not always hold.

Nevertheless, the design and construction of alternative fuel–processing systems would likely involve considerations quite removed from simply trying to replicate an inorganic counterpart of the human digestive and blood–circulatory systems. For example, the processing of food that provides humans with the fuel for their behavior also provides the fuel for the repair and maintenance of the human body. Repair and maintenance of robot bodies, however, would likely involve activities of sources *outside* the robot body.

In a similar vein, "reproduction" of robots would seem unlikely to require a comparable but inorganic process as a counterpart to organic pregnancy, even though such processes have appeared in well crafted science–fiction stories. The lengthy period of postnatal development required of humans would also seem relatively unneeded for robots.

Instead, for robots, reproduction and developmental outcomes result together from assembly protocols applied during a construction period. The resulting robot individual would, upon completion of the construction process, evidence a fairly optimized structural form for the kind of activities in which the robot will engage. This represents one planned avenue for expanding robot body diversity.

Indeed, design plans may call for the availability of several different basic robot body structures to exist. For example, one structural body design may form the basis of a number of individuals, structured to a range of specifications, who, upon completion, are immediately optimized for such activities as handling or manipulating the materials needed to build or assemble a range of products, perhaps including other robots.

Meanwhile, another structural body design might appear basically of humanoid shape. This design could form the basis of a number of individuals, structured to a range of specifications, who, upon completion, are immediately optimized for such activities as interacting either with humans in general, or with humans of particular ages in different specialized environments (e.g., schools).

Each of those specialized environments could require a separate, specialized skill set. Any particular robot individual might have only one of these skill sets installed (e.g., by inputs that reconfigure the neural counterpart). More likely, each robot individual would have several skill sets, or even many skill sets, installed.

The robot individual's "model designation," which could be part of its name, such as its last or "family" name, might imply the number or types of skill sets in its repertoire. This begins to address the notion of "pre–installed" experience. Updating any skill set, and expanding the number of skill sets in the individual's repertoire, might merely involve uploading the updated or new programming.

The range of initial and additional installed skill sets enables another avenue to expanding robot body diversity in some planned ways. Furthermore, for any skill set, the basic programming *structures* (i.e., the inorganic counterparts of organic neural structures) that involve *changeable* repertoire–mediating components, provide a basis for inorganic respondent and operant conditioning equivalents to produce additional adaptable repertoire changes and expansions in real time.

Note that all the conditioning results, and skill–set program components, likely occur in an electronic or some comparable form. Thus they become storable, downloadable, transferable, and uploadable into a new robot body, or into a repaired robot body, or into a different style of robot body.

And any or all of those robot bodies, with their varying, activity–related structures, can then exhibit a wider range of enhanced response potentials. However, depending on basic body structure, each robot individual may or may not be structurally optimized for the wider range of enhanced response potentials. Some robotics designers may need to consider this conundrum carefully.

The last concern that we consider here, of some importance to humans, is humor. By understanding humor robotics engineers should face less difficulty in designing structures or programming that provide robots with a "sense of humor." Designers of robots, however, may require some rationale to justify the effort to "provide robots with a sense of humor."

What is humor? Humor involves a kind of elicited emotional reaction. Some responses, especially verbal responses, happen under the control of *multiple,* and sometimes even incompatible, stimulus variables. These stimulus and response combinations induce smiles and laughs. Verbal "puns" provide classic examples. In cartoons the variables are visual.

Humans seem to need no rationale to justify a sense of humor. Perhaps the best initial rationale for designers of robots is that "having a sense of humor" may enable robots to get along with their human neighbors more easily.

You can find more robot topics in Fraley's robotics chapter (see the reference). The next column considers the new topic of different kinds of evolution.

The BOOKS page of www.behaviorology.org provides a full description of Dr. Fraley's 2008 book, *General Behaviorology: The Natural Science of Human Behavior.* Chapter 30 (pages 1525 thru 1571) describes robotics in detail.

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