The Design and Validation of an Artificial Psychology Dialog Player (first draft)

Faisal L. Kadri
www.ArtificialPsychology.com
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A US patent was granted for an artificial psychology dialog player with aging simulation. The embodiment of the patent is a software application called George and Mary (GaM). GaM uses two artificial four-dimensional personalities exchanging sentences and dynamically re-enforcing the motivational states of each other.
The theoretical model of personality is rooted in the cybernetic concepts of the law of requisite variety pioneered by Ross-Ashby. The model predicts a pattern of contextual age dependence, which when projected on humorous sentences describes age dependent humor type preference. The prediction was tested with on-line surveys; the results provide partial statistical validation of the patented model.

Introduction

On January 4, 2010 a US patent was granted for a software application of an artificial psychology dialog player (Kadri 2010). The application which implements the patent is called George and Mary (GaM) in which the two artificial personalities of George and Mary exchange sentences, with each exchange a motivational re-enforcement is added to the target personality and increments its state. There are four dimensions on which there are categories of sentences corresponding to states of motivation, all states decay exponentially to characteristic steady state values. The interactive mechanism of GaM simulates priming processes (Kadri 1992A) but age dependence is associated with homeostasis (Kadri 1992B). The duality of priming and homeostatic motivational processes is described in the block diagram of fig. 1 below (Kadri and Duncan 1995). Notice the two sources or information transmitters: The environment and the body of the living organism, and the multiplier element in the middle, which describes a regulator action in the sense of Ross Ashby, not a negative feedback loop such as in control systems theory (p. 185 in Conant (ed.) 1981).

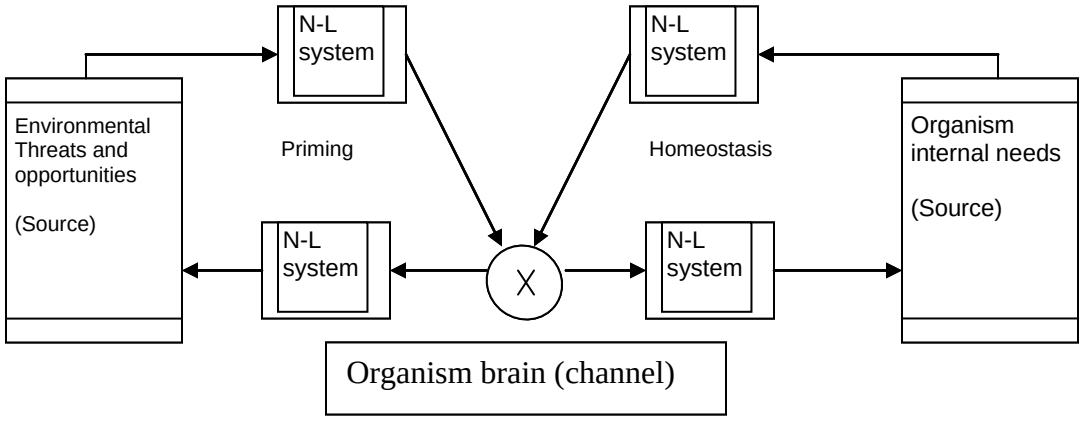

Fig. 1: Total information flow diagram (the brain as a channel).

The Useful Design of a Cybernetic Model

Referring to the environmental stimuli in Fig. 1 it is not unreasonable to assume that the occurrence of threats and opportunities around the living organism is relatively constant in comparison with changes within the lifetime of an individual; changes in the environment are relatively slow over the endurance of a specie, except for seasonal or daily cycles. I observed the various descriptions and types of what is known in psychological research as "the emotions" and could not avoid their identification with the need for self preservation. On the other hand, the internal needs of an organism depend on the stage of life, for example in animals food is strongly needed for growth in early life while only needed for sustenance and to feed the young after maturity. And in humans where the gestation period and development to adulthood are longer, fertility peaks at around 30 years of age, and caring for offspring or parenting as a focus of attention slowly rises with age.

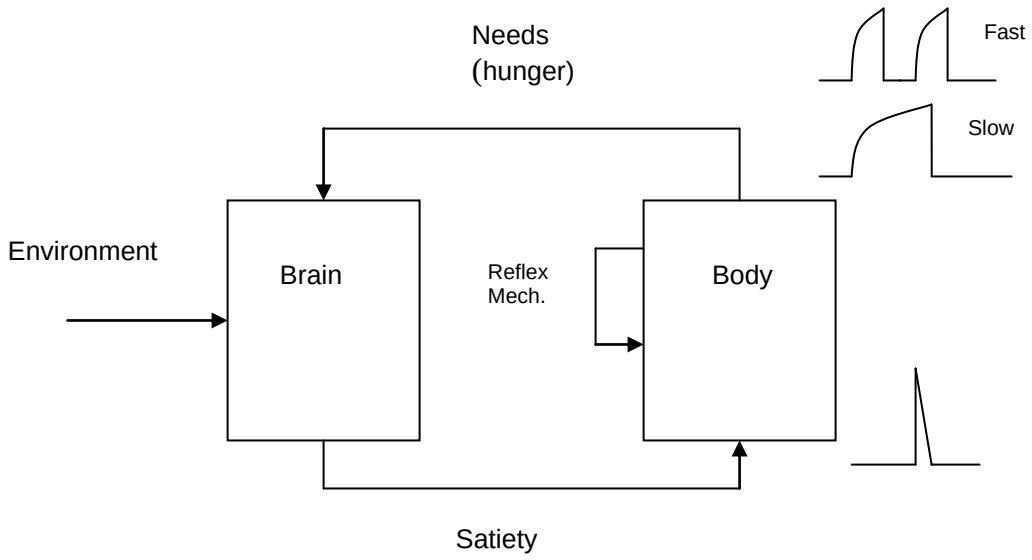

Fig. 2 Simplified homeostasis information flow – variable speed of need recovery.

Homeostasis is a process of regulation, where body needs rise or recover at slow variable speeds then sated, usually at relatively much faster speeds that their recovery, such as hunger, thirst and sexual drives. Information theory suggests that faster recovery, which means higher frequency or information bandwidth occupancy, requires more variety from a transmission channel in order to reach its destination without much distortion. Referring to Fig. 2, the argument suggests that higher speeds of recovery at the body requires wider variety of classification at the brain in order to produce a suitable diversity of behaviours for satiety, or there is or should be an information matching between the body and the brain in homeostasis.
Simple as it may, fig. 2 can address some arguments in a better way than current understanding, here are some examples:

- The claim that drives or motivations such as sexuality and hunger in humans and animals are caused by the brain (cerebral), not by the body (gonadal) as was thought before; fig 2 shows how the source of behaviour is not either/or the brain but both, if you break either one, such as in lobotomies or castration, then you break the homeostatic circle, therefore the conclusion of assigning the brain does not seem justified.
- An argument: what defines a motivation? Should sensory-motor mechanisms such as heartbeat and breathing be classified as motivation? The answer from the above is no because these mechanisms by and large bypass the cognitive brain and do not require variety in order to be sated, there is only one way to meet the need and

- as such the information flow is not challenged by requisite variety of the transmission channel (the brain) in Ross-Ashby's sense, as represented by the returning arrow.
- A question I found in a humor research group: Does tickling count as humor? Many humorologists classify tickling as a reflex similar to the knee tap by a doctor. If we use the definition of humor: A sudden falsification of a perceived threat, a definition which is not controversial but by no means universal, a tickle could be interpreted as a sudden realization that an intruder in close proximity is not a threat. I disagreed with the reflex view and pointed out to a group of researchers that tickling has a small but decisive degree of cognition, a tickle by a friend leads to laughter but will be considered a threat if done by a stranger. A child would laugh to a tickle by a friendly adult but would cry if (tickled) by an insect or a snake, on the other hand a knee tap will lead to the reflex kick reaction even if the patient hated the doctor. In my view there is always a binary friend-or-foe choice to make before a tickle, a challenge for variety of two by the brain.

Validating the Assumptions of a Cybernetic Model

Referring to fig. 2, the speed of recovery of cyclic body needs is a measure of frequency, and according to Shannon's information theory it is directly proportional to the information content (entropy); the faster the recovery the more the transmitted information content from the body, and the more requisite variety at the brain to produce matching categories of behavior. Observing the types of homeostatic needs I suggested a classification based on speed of recovery for humans, the fastest is feeding, then sociosexual then the slowest is parenting needs. If we assume that the brain starts with a good matching between the fastest needs and the brain's "bandwidth", or its ability to process information, at childhood, then steadily declines with age after adulthood, we can draw certain conclusions regarding related changes of behavior. We can expect the fastest needs to steadily decline in preference with age, the intermediate to rise until adulthood when the best matching occurs then begins to decline, and the slowest needs to increase in preference with age from the start. So the classification of needs and behavior evolved: The emotions or self-preservation as a priming class expected to stay relatively constant over age, feeding, sociosexual and parenting as homeostatic classes expected to decline, peak and rise steadily with age.
The four classes delineate behavior and lead to a classification of types of humor. Going back to the definition above: Humor is a sudden falsification of perceived threat, if the classes could reflect the type of threat then we would have four types of humor. In humor research literature one classification comes close to the above (Martin et al. 2003), the classes described as Self-enhancing, Aggressive, Affiliative and Self-defeating in relation to being good or bad for health. A more pliable classification comes from

animal behavior, where four animal aggression types are described as: self-defensive, predatory, social and parental (Brain et al. 1981). The latter classification suggests the interpretation of humor according to the type of threat: Emotional or self assuring, Feeding in defence of turf and resources, SocioSexual regarding meaningful or nonsense humor and Parenting either self defeating or defending wider society and morality. The proposed classification also divides each of the four into cognitive externalizing-internalizing, such as aggressive vs. defensive humor in all categories, but no age preference was predicted nor detected in association with this division. A comparison between the interpretations of the proposed classification and different personality models suggested similarities and possible correlations, GaM implements a cross reference with five well-known measures of personalities pending statistical proof.

Three on-line humor surveys were conducted where jokes were interpreted *a priori* and classified then presented to participants in order to score their preference. All surveys showed consistent age link to support the prediction. Fig. 3 shows the result from 40 humorous items survey.

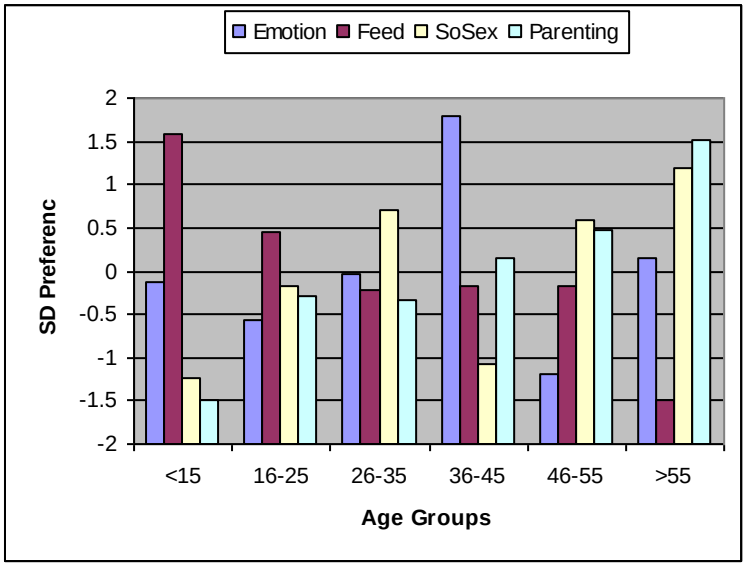

Fig. 3: *A priori* theory predicted humor age preference.

The question is: how to test the above results for validity? Or how can we tell if what we see in fig.3 is statistically significant? A standard for validation had to be defined. Here, I classified the scores of all items *a posteriori*, or after reading all scores, according to their age trend, falling, rising, peaking and the remainder which could not be classified in any of the above as relatively constant, then the matching between the *a priori* and *a posteriori* classes was computed.

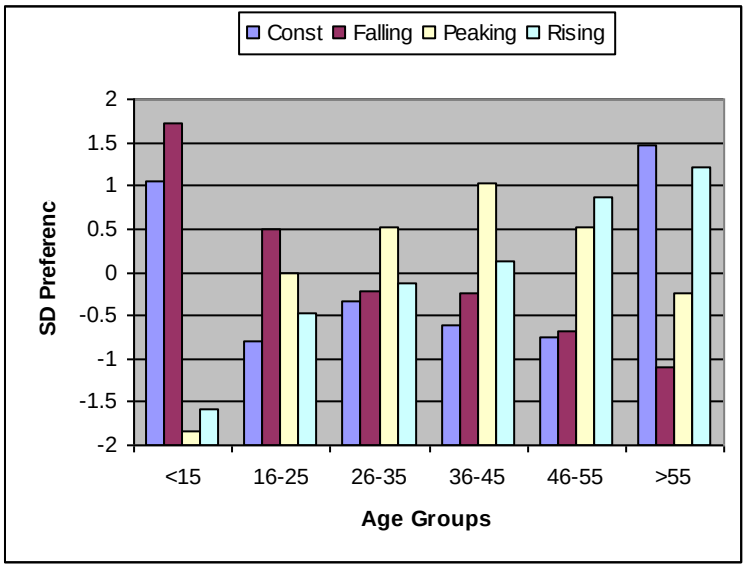

Fig. 4: *A Posteriori* classification of item age trend.

Match between fig. 3 and 4 was in 17 items out of 40. If all items were distributed totally at random then we would have only 10-item match out of 40. These results can be subjected to hypothesis test. Hypothesis consistency using Fisher's exact test (Fisher 1970) gave 85% likelihood that the distributions were the same, but Barnard's exact test (Barnard 1947) lead to p-value of 0.068 or 93.2% likelihood that the classifications match. In either case there is statistical evidence to validate the assumptions and support the predictions of the cybernetic model.

Conclusions

The old way of regarding the brain as the sole source of command and intelligence does not explain all the behavior of a living organism, body needs provide context to the brain and as such the body can be seen as an information transmitter. This mode of information processing can explain situations too difficult to explain by brain activity alone.
Statistical evidence support the validity of age dependence of humor type preference.
Cybernetics in the tradition of Ross-Ashby is alive and potentially useful to other disciplines.

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