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CRITICAL REVIEW OF MODELING INTERNAL RESPONSIBILITY MECHANISMS AND SELF-CONTROL A NEUROECONOMICS APPROACH

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Abstract: *The abstract presents the complex nature of the modelling internal responsibility mechanisms . However, the introductory chapter of the paper is slightly confusing and leads the reader to come to the conclusion that the paper discuss the issues of cognitive behaviour in Psychology rather that the saving and consuming patterns of the consumers in economy. Later, in the text the authors state that the based their innovative approach on the existing model, which makes us doubt whether the new model was really a new one or rather a modified version of existing models. Moreover, the background models chosen were developed a few years before the publication of the paper, which can be found questionable due to the fast-paced disciplinary of the cognitive science. It might have been considered whether the models were still credible and valuable to build the new model on.*

Keywords: Modeling internal, self-control, neuroeconomics approach.

1 INTRODUCTION

This critical review discusses a new model of the internal commitment mechanisms and self-control in the way the consumers make decisions to save or consume a product. In the Games and Economic Behavior Journal, the authors suggest that agents evoke the need to over-spend in the human brain or such processes that prevent the object from fall into such a temptation. It is worth mentioning that the model represents a new alternative to the standard models applied in behavioural economics which do not take account of the internal commitment mechanisms.

Value the assumptions covering the temptation the consumers are exposed to in the modern consume society as well as their utility for consumption. On the other hand, the authors did not clearly state the results obtained by the mathematical analysis for each of the assumptions and left it on the reader to decide. The propositions are well defined, but the conclusion and the outcome of the first is rather poor and it would deserve more room for discussion. Furthermore, it might have been interesting to add a proposition which would take into account the gender of the consumer and their inclination to the saving or rather spending or whether there was any difference in the tendency of the consumers to a specific type of behaviour based on their gender supported by psychological or mathematical dependencies. In addition to this, the height, regularity of income and some other factors might have been included in propositions and assessed in terms of cognitive agents. It would be interesting to know whether there are such links between the agents and the economic and social background of the consumer. In relation to proposition stating that the authors expected the consumption-saving plan, the agent must be organised and methodical for him to prepare such a plan. So, it negates any compulsive behaviour disorders as mentioned by the authors in the conclusion. Moreover, considering only one strategy leads to subjectivity and leaves open door for deeper understanding of the issue and captivating neglected valuables which might provide a better insight into the mechanisms that influence the patients with lesions in the frontal lobes showing odd and impulsive behaviour.

In the end, the authors admit that the relationship they drew from cognitive control to internal commitment and self-control can be speculated about in the present state. Even if the our cognitive model of self-control to the study of dynamic consumption–saving behaviour was characterised by a simple consumption–saving goal and a simple rule for invoking control processes to inhibit impulses of over-consumption and implement the consumption–saving goal, the individual consumption–saving data was not included in the paper and the model was rather supported by the available empirical references. This part contradicts that the model was of theoretical nature as indicated in the text.

2 A COGNITIVE MODEL OF DYNAMIC CHOICE AND CONTROL

In this section we introduce the notion of cognitive control and outline the theoretical and empirical literature in the cognitive sciences that will form the foundation of our analysis of dynamic choice. We rely on models of cognitive control in neuroscience which aim at developing a general integrated theory of cognitive behavior based on the function of the prefrontal cortex, as Braver et al. (1995); see also Miller and Cohen (2001) and O'Reilly and Munakata (2000) for surveys. The core of such models is the classical distinction between automatic and controlled processing, as articulated, e.g., in Shiffrin and Schneider (1977), Norman and Shallice (1980), Shallice (1988). Automatic processes are based on the learned association of a specific response to a collection of cues, and underlie 11 See for instance Baumeister et al. (1994), Gollwitzer and Bargh (1996), and Kuhl and Beckmann (1985). 464 J. Benhabib, A. Bisin / Games and Economic Behavior 52 (2005) 460–492 classical conditioning and Pavlovian responses.12 Controlled processes are instead based on the activation, maintenance, and updating of active goal-like representations in order to influence cognitive procedures, and possibly to inhibit automatic responses.13 Cognitive control is the result of differential activations of automatic and controlled processing pathways. An executive function, or supervisory attention system, modulates the activation levels of the different processing pathways, based on the learned representation of expected future rewards.14 Cognitive control might fail, as controlled processes fail to inhibit automatic reactions, because actively maintaining the representation of a goal is costly, due to the severe biological limitations of the activation capacity of the supervisory attention system of the cortex.15,16 As an illustration of the behavior and of the brain processes associated to cognitive control, consider a specific cognitive control task, the Stroop task, after the experiments by Stroop in the 30s. The task consists in naming the ink color of either a conflicting word or a non-conflicting word (e.g., respectively, saying 'red' to the word 'green' written in red ink; and saying 'red' to the word 'red' written in red ink). The standard pattern which is observed in this experiment is a higher reaction time for conflicting than nonconflicting words. Moreover the reaction time is higher, in either case, than the reaction time of a simple reading task; and the reaction time of a reading task is unaffected by the ink color. Cohen et al. (1990) have developed a 'connectivist' (loosely, biologically founded)17 12 Automatic processes are associated to the activation of various areas of the posterior cortex; see, e.g., Schultz et al. (1997). 13 Controlled processes are associated to sustained neural activity in the prefrontal cortex during cognitive tasks; see Cohen et al. (1997) and Prabhakaran et al. (2000). 14 The areas of the brain specialized in representing and predicting future rewards are the midbrain nuclei the ventral tegmental area (VTA) and the substantia nigra; see Schultz et al. (1995) for neural recording studies, Bechara et al. (1996) for clinical studied of patients with brain lesions, and Schultz (1998) for a survey.

The biological processes which constitute the supervisory attention system modulating the activation of automatic and controlled processing pathways rely possibly on the action of a neuro-transmitter, dopamine; see, e.g., Braver and Cohen (2000) for a model of one such process, the 'dopamine gating system.' These processes do not require relying on an 'homunculus'; see Monsell and Driver (2000). The process of activating and maintaining relevant representations in the prefrontal cortex is analogous to the process involved in working memory tasks; see Miyake and Shah (1999).

Brain imaging evidence has been proposed which supports the direct role of working memory and attention in the executive function's modulation of the interplay of automatic and controlled processes in cognitive control tasks; see, e.g., Engle (2001). Also, see Engle et al. (1999), Just and Carpenter (1992) on the limits of the activation capacity of the cortex. 16 The view that decision making arises from the interaction of automatic and cognitive processes, or visceral and rational states, is at least as old as the Bible. It has been exploited most notably in recent times in psychoanalytic theory where it takes the form of the Ego and the Id (see Freud, 1927). A formal model was introduced in economics by Thaler and Shefrin (1981). The related work of Loewenstein (1996) and Bernheim and Rangel (2004), like ours, is instead motivated by neurobiological evidence. The identification and the modeling of the neural processes responsible for cognitive control, and especially of the mechanism which modulates the differential activation of such processes, is the recent contribution of cognitive sciences which we are introducing to the study of dynamic decision making and which characterizes our approach. The foundations of our model of internal commitment and self-control lie in the explicit modeling of cognitive control processes rather than in visceral/rational dichotomy per se. 17 See McClelland and Rumelhart (1986); also, O'Reilly (1999) for a list of principles of 'connectivist' modeling. J. Benhabib, A. Bisin / Games and Economic Behavior 52 (2005) 460–492 465 cognitive control model of the Stroop task which generates the same pattern of reaction times that are observed in the experiments; see also Braver et al. (1995) and Braver and Cohen (2000). In their model, word-reading is a strong association encoded in the posterior cortex, which produces a rapid automatic response. The controlled processing aspect of the task is identified in naming the ink color: color-naming is a weaker association, but it can override the stronger word-reading process if it is supported by the activation of the prefrontal cortex to maintain the appropriate task-relevant goal by inhibiting the automatic reading association. Importantly, brain imaging data of subjects during Stroop show the sustained neural activity in the prefrontal cortex that is consistent with this interpretation; see Miller and Cohen (2001).18,19 The basic postulate of this paper is that internal commitment mechanisms and self control operate as cognitive control mechanisms in dynamic choice. We make the connection between cognitive control, internal commitment, and self-control more precise by illustrating a possible cognitive control mechanism which might induce self-control in a simple delayed gratification choice task. In the next section we will extend our model of delayed gratification choice into an analysis of a dynamic consumption–saving problem. Consider an agent planning his optimal consumption allocation between two periods in the future. In particular, an agent at time $\tau = 0$ must choose how to distribute a given income endowment w for consumption in the future at time $t > 0$ and time $t + 1$. An agent with preferences represented by utility function U (c) for consuming c units of the consumption good, and with exponential discounting at rate β < 1, would solve the following maximization problem.The neurobiological foundation of the basic postulate of this analysis, that self-control in delayed gratification choice tasks is a specific form of cognitive control has never been tested with imaging data.25 this would require developing a ‘connectivist’ model of delayed gratification choice, along the lines of Cohen et al.’s (1990) model of Stroop. The delayed gratification choice task could then be implemented experimentally to induce the subjects to exercise internal commitment mechanisms that override the impulse to reverse preferences.

Reaction time and imaging data from this experiment, when matched with data generated by the delayed gratification choice model, could be used to test whether cognitive control drives the operation of internal commitment mechanisms and self-control; see Fig. 1 for a more detailed representation of the delayed gratification choice task experiment. Some indirect evidence in favor of our analysis of the delayed gratification task has been collected by cognitive psychologists. Our analysis in fact, based on the limitation of the activation capacity of the supervisory attention system, predicts that self-control is harder to exercise when an agent is performing unrelated cognitive tasks simultaneously.

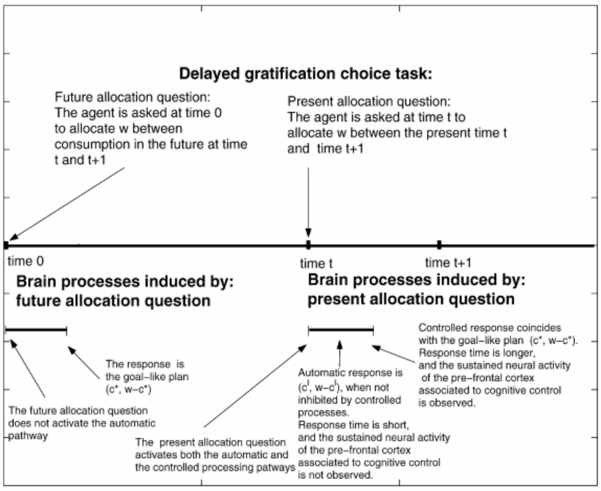

Fig. 1 Delayed gratification: timeline.

It is therefore consistent with Shiv and Fedorikhin’s (1999) and Vohs and Heatherton’s (2000) experimental data documenting a reduction of self-control in subjects asked to perform parallel working memory tasks. Experimental treatments of delayed gratification choice tasks under differential capacity utilization of working memory would generate additional behavioral and imaging data with the power of testing our model of internal commitment and self-control.

3 CONCLUSION

The model is connected to the contemporary issues due to the increasing trend in shopping addiction disorders. The model might be used to provide an insight into the brain mechanism reliable for the addictive behaviour of the patients.

The provided paper has at least one weakness. The most visible drawback of the paper is that it supports the theoretical background of the model by the obsolete references and mostly in relation to such a rapidly developing discipline as neuroscience, be it related to economy or medicine. On the other hand, the reference used in the paper are mostly credible and scientifically worth sources related to the issue discussed in the paper, that is economy, consuming, savings and neuroscience.

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