

Letter to Editor:**Does the Ability to Make a New Business Need More Risky Choices during Decisions? Evidences for the Neurocognitive Basis of Entrepreneurship**

Dear Editor, As we know, individual differences play an important role in entrepreneurship ability (Zhao & Seibert, 2006). Some studies have found significant correlations between individuals' personality and entrepreneurship (White, et. al., 2006, 2007; Furnham and Nederstrom, 2010). Personality characteristics such as tolerance for risk, preference for autonomy, and innovativeness are important factors in the selection of entrepreneurs (White, et. al., 2007). Recently the study of personality as a concrete psychological concept has concentrated on brain cognitive functions (Michalski & Shackelford, 2010; Prabhakaran et. al., 2011). Hence, it has been argued that understanding entrepreneurial behaviors require understanding entrepreneurial thinking. The identification of entrepreneurship behavior requires the codification of neural base of entrepreneurial thought at a deeper level (Prabhakaran et. al., 2011). Some studies have shown that attitudes toward risk, entrepreneurial ability, preferences for autonomy, and locus of control are important in determining who starts and operates businesses (Caliendo, Fossen, & Kritikos, 2010; Zhao & Seibert, 2006).

A whole new field of neuroeconomics has made important progress in studying economic behavior at neural level (Glimcher et. al., 2009). This field has attempted to link aspects of economics such as finance (Knutson and Bossaerts, 2007), marketing (Plassmann et. al., 2007) and entrepreneurship (Krueger, 2007) with neuroscientific research methodology. Studies have identified neural mechanisms underlying the representations of value, reward, and risk, which are important factors affecting economic behavior (Platt and Huettel, 2008; Rangel et al., 2008; Schultz, 2006).

Risk-taking in some studies has been considered as a deficit in the cognitive system so that it has been linked with violence related to addiction, drug and alcohol use, and sexual risk-taking (Blum & Nelson-Mmari, 2004; Williams, Holmbeck, & Greenley, 2002; Fridberg, et. al., 2010). However, some researchers have shown that

risk-taking behavior may serve some positive functions in adulthood (Dworkin, 2005; Hendry & Kloep, 2003).

Reyna and Farley (2006) suggest that evaluating a particular situation in an obsessive manner, may increase the risk of making errors on the part of the evaluator. In other words, if the individual spends too much time and energy evaluating the various possible costs and benefits when making a decision, he or she may increase the risk of making mistakes. Hence, intelligent risk taking may actually be a positive action, adapted by entrepreneurs as a skill. The skills which may be required by entrepreneurs include the ability to react well in highly unpredictable, uncertain, and rapidly changing environments (Picot et al. 2005). For an entrepreneur to be successful, it may be necessary to divert from certain well-learned or routine actions or protocols and show risk taking behavior (Baron 2004). For example, in a hypothetical job opportunity, an entrepreneur may be more successful if he or she uses intuitive skills more than simply analyzing the situation cognitively (Mitchell, et. al., 2007). Based on our review, there is no evidence from risk taking of entrepreneurs and similarly risk taking is considered as a negative cognitive function. In the present study, a simple neurocognitive task was used to measure risk taking behavior in entrepreneurs.

In a pilot study, we have recruited 20 entrepreneurs (17 male and 3 female, mean age = 24.04± 5.76 years). They were Directors of Business Incubators based at Shahid Beheshti University and the University of Tehran in December 2011. The Incubator system was adapted in Iran by Ministry of Science, Research and Technology (2001), based on the support system for entrepreneurs offered in Europe, United States and South and East Asia. The incubator is defined as: "an organization designed to accelerate the growth and success of entrepreneurial companies through an array of business support resources and services that could include physical space, capital, coaching, common services, and networking connections" (Jones Christensen, et. al., 2010). A group of 20 participants were matched for sex and age from

among postgraduate students in Shahid Beheshti and Tehran Universities.

The Balloon Analogue Risk Taking Test (BART) was used for evaluation of risk taking in the present experiment. This test was first used by Lejuez et al. (2003) in the University of Maryland to show "actual risk taking behavior in real circumstances".

In this task, participants engage in a computer simulation where a balloon is pumped in order to collect money. Each click on the pump inflates the balloon and

makes it look bigger. With each pump, 50 tomans (monetary unit in Iran) is collected by the participant and the collected amount is shown on the screen. If the balloon explodes, all the money is lost, and the next uninflated balloon appears on the screen. At any point during the trial, the participant has the choice to stop pumping the balloon and click the collect money button. Clicking this button would transfer all the money to a permanent box. After each balloon explosion or money collection, the trial ends and a new trial begins with a new balloon appearing on the screen. A total of 30 balloons were inflated (Figure 1).

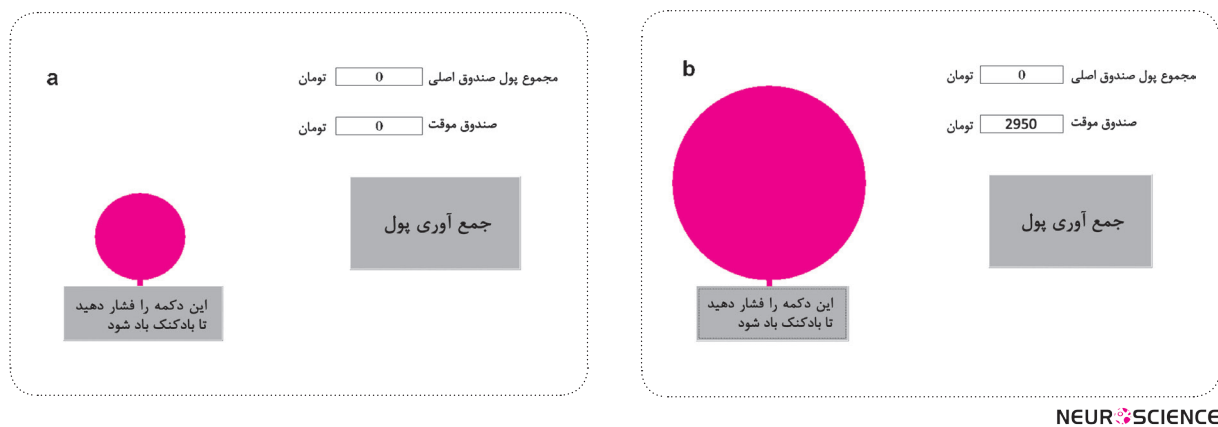


Figure 1. Screen of BART task, a; starting position, b; risk taking position

NEUR SCIENCE

Participants were told that at some point each balloon would explode and that this explosion could occur as early as the first pump all the way up to the point at which the balloon had expanded to fill the entire computer screen. The BART was designed to provide a context in which actual risky behavior could be examined (Vigil-Colet, 2007; Ravenzwaaij, Dutilh & Wagenmakers, 2011; Khodadadi, Dezfouli, Fakhari & Ekhtiari, 2010).

The result of various studies indicated that the BART may be a useful tool in the assessment of risk taking. In fact, there is a high correlation between Zukerman's sensation seeking test and risk taking test in real life situations (Lejuez et al., 2003).

Results are shown in table 1. As can be seen, the number of pumps exerted by participants on the exploded balloons is significantly higher in the entrepreneurs group. On the other hand, the non-entrepreneurs showed a higher tendency for saving money. Number of pumps exerted on the whole balloon was marginally significant

so that entrepreneurs have higher grade in this variable. Other dependent variables, including maximum and minimum number of pumps were not significantly different between the two groups.

To our best knowledge, present study is the first study that used BART in entrepreneurs. The results of the current study indicate that the number of pumps exerted on the exploded balloons was higher in the entrepreneur group and the number of attempts to save money was higher in the non-entrepreneurs group. Hence, it may be concluded that the level of risk taking tendency is higher in entrepreneurs. Furthermore, non-entrepreneurs inclined to save more money (i.e. take less risks) as compared to entrepreneurs who were likely to collect money by taking more risks.

It is interesting to note that some researchers have tried to explain entrepreneurial behavior by pointing out to certain personality correlates. For example, Zabel et al. (2008) argued that sensation seeking, defined as the tendency to experience new situations, may be a salient

Table 1. Comparing results of BART between entrepreneurs and non-entrepreneurs

Test Variables	Entrepreneurs Mean (SD)	Non Entrepreneurs Mean (SD)	T- Ratio	P- Value
Number of pumping on the exploded balloons	10.76 (5.83)	7.15 (3.28)	3.36	0.024
Number of pumping on the whole balloons	32.84 (11.42)	25.44 (11.09)	1.99	0.054
Number of decisions to save money	20.11 (5.01)	23.20 (2.87)	-2.33	0.025
Maximum number of pumps exerted	71.29 (29.87)	56.80 (22.83)	1.67	n.s.
Minimum number of pumps exerted	4.35 (4.03)	2.45 (3.36)	1.566	n.s.

NEURSCIENCE

part of the personality profile of entrepreneurs. Sensation seeking has also been correlated with risky decision making.

Entrepreneurs some times have to make decisions under extreme uncertainty and ambiguity and this characteristic may partly explain entrepreneurial success (McVea, 2009). A new theory of entrepreneurship, states that entrepreneurs are less likely to avert risks and are inclined to face up to or indeed welcome various situations which may elicit risky behaviors (Newmann, 2007). This is in contrast to regular workers who may avert risky situations in favor of the status quo (e.g. assurance that wages are maintained). This theory is supported using an experimental paradigm in the present study.

Mullins and Forlani (2000) studied the possible risky situations in entrepreneurial ventures and found that entrepreneurs tend to choose various ventures and projects on the basis of the amount of risk involved in these ventures and projects rather than relying on purely logical situational and/or perceptual analyses. In other words, the greater risk potentials of a situation, the more likely that the person would select that particular situation.

Some researchers have suggested that intuition may play an important part in entrepreneurial thinking (Dijksterhuis, Bos, van der Leij, & van Baaren, 2009). It is argued that in rational thinking we may lose a huge amount of information which is available in the form of intuitive and subconscious (i.e. impressions and hunches which are gained through experience) thinking. An example is creative thinking during sleep when rational thinking is "switched off", and the unconscious informa-

tion may have greater freedom and may be used for creative thinking (Chavez-Eakle & Sanchez, 2011). Future research on entrepreneurship should address the possible role played by intuitive thinking in decision making of entrepreneurs. Indeed, Khatri and Ng (2000) have already shown that intuition may play a role in strategic decision-making. Furthermore, Levander and Raccuia (2001) have shown that in entrepreneurial personality, rationality may have a lower priority than instinct in shaping entrepreneurs' behaviors.

In the current study, risk taking tendency was found to be higher in entrepreneurs than non-entrepreneurs and thus risk taking behavior may be a key factor in the screening and selection of entrepreneurs. One limitation of the present study is lack of an objective test for evaluation of entrepreneurship that should be considered in future studies along with a larger sample size.

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