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Biology (prenatal testosterone), psychology (achievement need) and entrepreneurial impact



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ABSTRACT

Entrepreneurship holds the key to poverty alleviation and economic development. We find entrepreneurial impact as indicated by the number of jobs created by an entrepreneur is predicted by a biological factor – prenatal exposure to testosterone and a psychological factor – need for achievement. In a sample of 64 male German entrepreneurs we find that the interaction between prenatal exposure to testosterone and need for achievement predicted entrepreneurial impact. This study supports the idea that biological and psychological approaches need to be combined to explain social phenomena.

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1. Introduction

Entrepreneurship holds the key to economic growth. Successful entrepreneurs not only create wealth for themselves, but also create employment for others. An empirical insight into the makings of a successful entrepreneur has broad implications for society at large. Recent work suggests that entrepreneurship may have a biological basis (Nicolaou and Shane, 2009; Zhang et al., 2009) and more broadly that biological markers may be important for job success (Coates et al., 2009). We examine whether prenatal exposure to testosterone in concert with need for achievement may predict entrepreneurial impact of small businesses as indicated by the number of jobs created by the entrepreneurs. To our knowledge, this study is the first to systematically examine this interaction between psychological and biological factors in the study of entrepreneurship.

Prenatal exposure to testosterone is measured using the relative length of the second (index) to the fourth (ring) finger (2D:4D) (Manning et al., 1998). Research suggests that prenatal testosterone is associated with many of the same individual characteristics that also distinguish entrepreneurs from non-entrepreneurs. Prenatal testosterone was positively associated with dominance (Neave et al., 2003), aggressiveness (Bailey and Hurd, 2005; Hönekopp, 2011), assertiveness and competitiveness (Wilson, 1983; Manning and Taylor, 2001), and risk-taking behavior (Garbarino et al., 2011; Coates et al., 2009).

Initial findings in entrepreneurship and related fields have yielded promising results concerning the predictive value of

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testosterone for entrepreneurial behavior. Levels of testosterone were shown to predict new venture creation and risk taking propensity (White et al., 2006); prenatal testosterone was positively related to risk taking and in turn to entrepreneurial intent (Bönte et al., 2015) and to an interest in enterprising professions (Weis et al., 2007). Surprisingly, reports concerning the relationship between testosterone and entrepreneurial success are still missing from the literature and little is known about possible effects of testosterone levels in existing businesses. Our study addresses this gap. First, we test the impact of prenatal testosterone on entrepreneurial success. We thereby go beyond previous studies which have examined the effect of testosterone on behavior relevant to entrepreneurship i.e. risk taking behavior (Garbarino et al., 2011) or on entrepreneurial intentions and founding a business (e.g. White et al., 2006). Second, we examine under which circumstances prenatal testosterone may impact entrepreneurial success. Specifically, we focus on the interaction between prenatal testosterone and need for achievement with regard to entrepreneurial success.

We base our study on an interaction model suggesting a combined effect of biology (prenatal testosterone) and psychology (need for achievement) on entrepreneurial success. We argue that need for achievement (nAch) provides direction, high goal orientation and achievement striving while prenatal testosterone provides drive, risk-taking, and aggressiveness.

nAch is a well-established psychological concept which has been directly related to economic outcomes and business performance (Collins et al., 2004; McClelland, 1961; Rauch and Frese, 2007). It refers to high standards, acceptance of challenges, independent thinking, and an interest to excel. A high nAch implies that one chooses tasks of moderate difficulty, accepts responsibility for results and seeks feedback on action outcomes.

A number of arguments suggest a positive effect of prenatal testosterone only in combination with a high nAch. First, risk-taking, as implied in prenatal testosterone may become a two edged sword: "To become an entrepreneur is risky but doing a business in a risky way might be dangerous" (Rauch and Frese, 2000, p.112). As the energetic ingredient to entrepreneurship, high prenatal testosterone may result in performance only if risk-taking is associated with attainable goals. Individuals with a high nAch show a preference for realistic, moderately difficult goals and thus, their likelihood of taking too many risks will be tempered by their interest to do a "good job". Second, high prenatal testosterone implies action orientation and a potential for impulsive and aggressive behavior (cf. Bailey and Hurd, 2005). Although in general an aggressive orientation towards running the business is positively associated with entrepreneurial success (Rauch et al., 2009) this may not always be the case. It may be detrimental when implemented without clear goal relatedness. nAch positively complements aggressive tendencies as implied by high prenatal testosterone by ensuring goal orientation, planning, conscious action regulation, and learning when nAch is high. Misdirected actions will be recognized more easily and minimized in the future.

Taken together, we predict an interaction effect of prenatal testosterone and nAch on entrepreneurial impact: Prenatal testosterone provides the energy and nAch provides the constructive direction. Thus, nAch is hypothesized to moderate the effects of prenatal testosterone. Specifically, higher nAch stimulates a positive effect of prenatal testosterone on firm success. In contrast, low nAch leads to negative effects of prenatal testosterone—a sort of "bull-in-the-china-shop"-effect of high energy without constructive direction.

2. Methods

We studied small entrepreneurs, as according to one industry report 98% of all entrepreneurs are small-up to 50 employees (Eurostat, 2005), and they often determine the fate of the firms they found. For this research, we approached participants of a representative study of four industries (information technology (25%), gastronomy (23%), car (13%), and construction (38%) (Koenig et al., 2007). The original stratified random sample of entrepreneurs from the wider Frankfurt area in Germany was drawn utilizing yellow pages and similar registers for recruitment. Inclusion criteria were that participants had to be owner and active managers, and firms had to have at least one employee (response rate first wave: 42%, $N=247$).

For the purpose of the present study we approached these 247 participants two years later. We received responses of 101 study participants (response rate 40.9%). Because of systematic variations of gender and ethnic origin with 2D:4D (e.g. Manning et al., 2004) we only included male German entrepreneurs in the current study. Multiple *t*-tests showed that these participants did not systematically differ from the original sample on all study variables, except that there were fewer participants from the car industry than in the original sample.

Ten additional participants needed to be excluded because there were technical problems in 10 of our scans (e.g., fingers were strongly scarred). A further 2 outliers in the dependent variable (more than 5 SD higher than M) were excluded. Finally, a number of missing variables led to a reduction of the final sample to 64 participants in our analysis (comparing the 64 participants against the original sample using multiple *t*-test also showed no significant differences except in the variable car industry). Since multiple *t*-test is a conservative test in this case, we assume that the original sample and this subsample are from representative samples.

Our research was based on standardized interviews, questionnaire and scans of ventral surfaces of owners' hands. In order to measure prenatal testosterone we computed the digit ratios (2D:4D) of the owners left and right hand. 2D:4D is a recognized biological marker of prenatal testosterone (Manning et al., 1998); the shorter the index finger relative to the ring finger the higher exposure to testosterone in the uterus. In our study, we scanned owners' ventral surfaces of both hands. Based on the scans two independent raters measured finger lengths at the basal crease of the digit proximal to the palm

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