Let the games begin:
The relationship between video gaming and entrepreneurial mindsets

Abstract

This article addresses the need for further conceptual development of the factors that influence the development of the entrepreneurial mindset. It focuses on finding a link between the classic mental models of entrepreneurship and those that are employed during video game play to explore if similarities exist. Using theories of entrepreneurship and opportunity recognition, the study examines a sample of 217 self-reported gamers. The results of this study suggest that an individual who exhibits a high level of entrepreneurial orientation has an enhanced opportunity recognition capability when the intensity of playing video games is also high. Various genres of games were controlled for; however, it was found that shooting games have the highest effect on the emergence of opportunity recognition. Thus, the study reveals that some game activities can be linked to entrepreneurial cognitions and potentially also development; which has implications for the entrepreneurial intent literature, as well as practical implications for game-designers and managers.

Keywords: Entrepreneurial Orientation, Opportunity Recognition, Entrepreneurial Cognitions, Video Games

1. Introduction

Entrepreneurship has shaped our world (Carlen, 2016). Commonly defined as the ability to craft new ventures or markets, entrepreneurial activity creates wealth and economic vitality (Davidson et al., 2006; Mason and Brown, 2013). There is a large and well-established body of literature which identifies it as a fundamental source of business continuity, growth, and competitive advantage (Schumpeter, 1946; Merrifield, 1993; Porter, 1990; Tushman & Nadler, 1986; Chesbrough, 2003). The innovative outcomes of entrepreneurship create value, whether it be through the development or improvement of products/services or process improvements (Pettigrew & Fetton, 2000; Ye & Kanknhalli, 2013). While it is evident that entrepreneurship is essential to social vitality, there continues to be a very active debate of the factors that enable and influence this behavior to manifest in individuals and firms.

On an overarching scale, scholars generally agree that entrepreneurship is defined as the ability to recognize, react, and exploit new opportunities; yet there remains a lack of consensus on how to best foster, enable, and optimize individuals and firms for sustained high-growth entrepreneurial outputs. While various streams of research have greatly advanced our knowledge about the influence various attitudinal, psychological, and social developmental constructs that have an impact on the emergence of entrepreneurs and entrepreneurship (Shane and Venkataraman, 2000; Hughes and Perrons, 2011), there remains questions about how individuals perceive and process their environments to enact this behavior. For instance, there are streams of research that focus on uncovering the psychometric profile (Shane and Venkataraman, 2000), various motivational drivers (Krueger and Brazeal, 1994), pedagogic considerations (Lent et al., 2002), and cognitive processing abilities (Chen and Yang, 2009; Christensen et al., 1989). Each of these perspectives had initially formed as distinct streams within the entrepreneurship literature, with authors often acknowledging that the complex and multifaceted nature required variations in perspectives and levels of analysis. Yet, scholars were generally unified in setting a common definition to entrepreneurship as unique ability for individuals to define and exploit opportunities.

A metacognitive theory of the entrepreneurial mindset has emerged to explore the potential relationships between the attitudinal and cognitive abilities individuals employ when identify opportunities and convert them into action; however the body of work is still in its infancy. It is

generally defined as a set of skills, attitudes, and beliefs that enable individuals to perceive and react to new opportunities within their environments ((McGrath & MacMillan, 2000); Endres and Woods, 2007). Primarily, it focuses on the various cognitive skills and attitudes necessary for individuals to sense and seize business opportunities (Ireland et al., 2005), but the concept has been applied to understanding a range of developmental and behavioral activities such as academic performance and employability skills (INSERT REF). It is thought to be the embryonic ingredient for new venture creation (Wiklund and Shepherd, 2003), which can be view as a developmental skill that can be fostered and optimized. However, there still remains a lack of consensus on how psychological and cognitive determinants form and are enacted. There is also further evidence that individuals have varying degrees of mindset characteristics that allow them to be more effective in entrepreneurial organizations and influence firm-performance (Kreiser et al., 2013). There remains questions about the underpinning and nascent conditions that are embedded within individuals; and if there are evident in other forms of contextual processing. While research has developed an understanding entrepreneurial cognitions on this level, more conceptualization work is needed to understand if and how this range of cognitive and attitudinal constructs are cultivated in a broad range of situational and contextual settings.

Studies into the entrepreneurial mindset are often met with methodological challenges, as data collection methods are framed to capture the mindset of entrepreneurs in the post-initiation phases of their successful ventures. As such, much of the research on the individual entrepreneur focuses on collecting data following successful instances of entrepreneurship (Goktan and Gupta, 2015). When attempting to collect data on the factors leading to entrepreneurial outcomes, they are met with a research design challenge as the entrepreneurs simply self-report their perceptions of factors that resulted in the emergence of their success. Not only does this mode of collecting data pave the way for a variety of different self-reporting biases, but the accuracy of retrospective accounts might be diluted with inaccurate memory retrieval (such as primacy and recency effects). The nascent conditions, in which the entrepreneur possessed before they engage with new ventures, will still likely have an ‘attitude’ towards entrepreneurship and some of the cognitive skills. However, most of the work in this area focuses on active entrepreneurs, and thus their attitudes within the process of planning a current venture (Langkamp and Lane, 2012). This is surprising, because a temporal and developmental perspective is implicit within the notion of

this mindset. Understanding the post-initiation phases of entrepreneurial development is only one piece of the puzzle.

The higher-order mental processes involved in the identification and comprehension of complex environments are not exclusive to only entrepreneurship. Developmental psychologists have a long history of examining the strategies that individuals employ in various forms of problem-solving and information processing; and across the vast scope of human intellectual development. Cognitive theory has been used to describe the ways individuals consciously and unconsciously engage in various forms of information processing to drive their behavioral outputs across a broad scale of human activity, with metacognitive skills being linked as essential to overarching and inclusive intellectual performance. While entrepreneurial mindset literature has considered the learning context (e.g., studies into entrepreneurial education), there has been few studies that have examined if entrepreneurial cognitive skills and the mindset manifest in other contexts. Examining the aforementioned conditions within the nascent phases of this process could advance our understanding of the conditions necessary to foster and further develop potential new instances in individuals; thus providing a broader and a more abstracted view of the impact the entrepreneurial mindset impacts performance and activities across contexts. Therefore, this study addresses this gap and explores if a connection between other cognitively focused activities and the entrepreneurial mindset can be established.

Playing video games engage individuals in a range of different cognitive processing abilities; including analogy, processing speed, deductive reasoning, and mathematical intelligence (Hisam et al., 2018). While gaming is are a popular form of entertainment for most demographics (Entertainment Software Association, 2015), there have been studies to suggest that gamers may possess a distinct set of attitudes and psychological profile (Scott et al., 2019). In fact, several game developing firms have integrated some of these information processing concepts into the product design. For instance, games have integrated a series of notifications and task to address issues of cognitive load and absorption to allow players to more effectively learn how to navigate and manage complex environments. The cognitive processes of gaming may possess similarities to over forms of information processing.

Therefore, this study explores if entrepreneurial mindset is evident in video gamer. It asks if there is a cognitive link or similarity between the video gaming mindset and the entrepreneurial mindset. However, it also acknowledges the dual need for the entrepreneurial mindset literature to examine aspects of information processing and attitudes. Therefore, it further asks two inter-related but distinct questions: 1.) Does the intensity of playing video games lead to better manifestation of certain cognitive skills associated with entrepreneurship; specifically, opportunity recognition? 2.) Does the intensity of playing video games increase the likelihood for entrepreneurial psychometric profile to emerge in individuals (specifically the entrepreneurial orientation constructs of risk-taking, proactiveness, innovativeness)? To explore these questions, the study uses theories of entrepreneurial opportunity recognition and orientation as the conceptual backdrop for the investigation and to formulate the hypotheses.

2 Learning the Entrepreneurial Mindset with Games

Over the past 10 years, there has been an explosion of interest into the potential for gamifying behaviors. Organizations have been keen to adopt an approach to engaging individuals through various game-like activities (Ferreira et al., 2017). Most authors on the subject agree that game-based learning and work processes have the ability to transform the typically mundane and extrinsically regulated behaviors to more self-directed and intrinsically motivated activities (Roos and Victor, 1999; Ryan et al., 2006). However, trends within the literature has largely focused on the motivational draw and how design elements can be integrated to encourage continued engagement within a given platform or activity (McAllister, 2004; Vesa and Harviainnen, 2019). Understanding the psychological elements of continued engagement within a given platform and the use of play mechanics are essential to understanding how to design the activity, but this is only one aspect of the puzzle (Hamari et al., 2014). Questions still remain as to what extent the overarching and intended lessons are being achieved, and how certain organizational behaviors or cognitive skills can be enabled in such an environment.

There has been an increasing interest to embed motivational games in firms (Hotari and Hamari, 2017; Vesa and Harviainen, 2019) by using various activity design mechanics that mimic play behaviors into non-game contexts (Deterding et al., 2011). The premise is that the mundane non-game activities can be transformed into a more playful and self-directed activity to encourage the

development of desirable skill sets and behaviors (Raftopolous, 2014). The transition to this 'playful' process has been lauded by a variety of outlets for motivating changes in human behavior across varying contexts; including healthcare, consumption, consumer engagement, and a range of training/pedagogy activities (Argawal and Karahanna, 2000; Hurley, 2013). This is because the conversion to a new contextual environment provides the opportunity for task designers to draw on theories of self-determined motivational draw to encourage sustained engagement, as individuals (users) are more likely to enjoy the pursuit of self-directed performance optimization and mastery than they are to be externally mandated (Jeno et al., 2017; Suh et al., 2017). As a result of the engagement, players may be intrinsically motivated to engage and can gather iterative learning opportunities across contexts (Siegel et al., 1997). As such, the opportunity to strategically employ the design principles of gaming offers a promising new mode for driving positive outcomes (Ruhi, 2015). Of interest, is how organizations have begun to use this to embed behaviors and skill sets within the training of their employees (McAllister, 2004; Statler et al., 2011) and, thus, to enhance organizational productivity (Roos and Victor, 2004). Yet, the research on these organizational processes and how games can be designed to drive a certain set of outcomes remains relatively fragmented within the literature (Vesa and Harviainen, 2019).

The ability to behave entrepreneurial is desirable skillset that many managers hope to foster within their organizations and employee base (Guerrero and Pena-Legazkue, 2013; Gupta at al., 2015). Firms are keen to develop programs the enable individuals to identify and create new markets (Covin and Slevin, 1989). However, the design features of such a game are likely to be a challenge. As an example, authors frequently debate if the entrepreneurial mindset is even a learnable skill (Dai et al., 2014; Neck and Greene, 2011; Langkamp and Lang, 2012; (Krueger & Sussan, 2017)). To be entrepreneurial requires the individual/firm to be innovative, creative, proactive, and risk-taking (Kollman et al., 2007; Kreiser et al., 2013), which are often associated as soft skills that can only be established through experiential learning. On that account, using strictly forward methods and rote learning modes to embed entrepreneurial skills may not be appropriate. However, this requires further exploration. Notwithstanding that entrepreneurial skills may be trained by games in the long-term, establishing a theoretical and empirical link between gaming and entrepreneurial skills are related to each other. For instance, is it possible

that entrepreneurs may be more prone to gaming and can this be a first prerequisite to investigate this link in causal manner?

Using games to develop work processes is still an emerging topic within organizational studies (Vesa and Harviainnen, 2019) but there has been some evidence that it can provide positive conditions to develop certain organizational behaviors; including enhanced administrative control, processing speed, attention control, and spatial ability (Green and Bavelier, 2003; Schutter and Abeele, 2010). Similarly, other studies, in associated research domains, also suggest that playing video games influences personality development and overarching academic performance (Ventura et al., 2015; Wilson et al., 2009). When applied within the business pedagogy setting, a recent experiment using game-based computer simulations suggests that 'gamifying' specific contexts provide opportunities for players to conceptualize concepts that are difficult to grasp; such as organizational culture and as the practical usage of strategic resources (Padilla-Melendez et al., 2014). Further studies have applied a variety of game attributes to many different games, as evidenced in a recent meta-analysis of game research and impacts on cognitions (Wilson et al., 2009).

As gaming platforms are increasingly being used as an outlet for human resource development or for the promotion of broader organizational behaviors (Deterding, 2014), there remains a significantly grey area within our understanding on how these activities can be designed to effectively disseminate soft skills and/or organizational normative behaviors that influences long term work processes and productivity (Garris and Ahlers, 2001). The motivation to sustain engagement is well debated within the realms of motivational research. However, it is well recognized that this engagement typically wains after a short period of time (Statler et al., 2011). Some authors suggest that benefiting from gamified work processes requires an understanding of individualistic perceptions and the meanings they ascribe to the experience (Suh et al., 2017) yet, there are less studies that focus primarily on the nature learning objective and/or desired output. More research is needed to understand how a player can extract specific lessons out of a game and, given the variety and complexity of computer game activities available, and which gaming-design environments enable certain forms of behaviors or cognitive skills to emerge (Statler et al., 2011; Zichermann et al., 2011). Regardless, it is evident that well designed gaming

environment enables individuals to engage in various forms of cognitive development. Therefore, we put forward the following hypothesis:

H1: Frequent video gamers will exhibit an entrepreneurial mindset.

3. Entrepreneurial Cognitions

Entrepreneurs have an ability to gather, process, and enact information in their environments. It has long been known that these exceptional individuals possess a distinctive capacity to create and optimize new ventures; with a stream of researchers attributing various forms of knowledge structures as the antecedent to success within this realm. This has given rise to some scholars contending that alertness and opportunity recognition are core cognitive skill that entrepreneurs must possess (e.g., (Barney, Clark, & Alvarez, 2002; Baron, 2004); (McCline, Bhat, & Baj, 2000)). It is typically understood as the ability recognize or perceive opportunities to create new markets, products, and services (Chandra et al., 2009; Chen and Yang, 2009; Christensen et el., 1989; Gruber et al., 2008; Lumpkin and Lichtenstein, 2005; Wang et al., 2013). It has been defined as the field of study that aims to understand how entrepreneurs identify opportunities; e.g. “the processes of discovery, evaluation, and exploitation of opportunities" (Shane and Venkataraman, 2000). Within the last three decades there has been considerable work on opportunity recognition research, but the field is still fragmented and empirically underdeveloped (George et al., 2016). Whilst still a developing field of study, it seems as though the ability to be entrepreneurial is significantly dependent upon the cognitive skill of opportunity recognition (Kreiser et al., 2013; Lent et al., 2002; Santos et al., 2015). The ways opportunities are recognized, and the identification process has not yet received enough empirical treatment (George et al., 2016; Gielnik et al., 2012; Martin and Wilson, 2016).

Opportunity recognition is a multifaceted process (Corbett, 2007; Dimov, 2007) that relies upon a relationship between discovery and creativity (Mathisen and Einarsen, 2004). It requires a cognitive processing capability which blends market information with creativity (Gundry et al., 2016; Martin and Wilson, 2016; Vaghley and Julien, 2010). It is a subjective and complex process that might be developed at the individual level (Endres and Woods, 2007; Fillis and Rentschler, 2010: Ward, 2004). If the entrepreneurial orientation is dependent on an individual’s

ability to effectively engage in opportunity recognition, and opportunity recognition is a cognitive skill that develops over time (Chandra et al., 2009; Lent et al., 2002; Tang et al., 2012), then research should focus on the factors that enable and foster the development of this skilled behavior. Surprisingly, this is an under-researched area in both entrepreneurial orientation research and within the entrepreneurial education work ((Fellnhofer & Kraus, 2015)).

As a construct, entrepreneurial alertness and opportunity recognition are composed of three interrelated main activities: scanning, association, and judgement (Tang et al., 2012). Scanning refers to an individual's ability to navigate and integrate information within new environments (Weick, 1996), and the way that an entrepreneur will scan for multiple possibilities using their knowledge base (Ericsson et al, 1993). This is similar to the ways in which gamers analyze complex information during game play. Therefore, it is proposed that:

H2 Frequent gamers will score highly in the entrepreneur cognitive skill of scanning.

Association is defined as a "heightened sensitivity which leads to further search and processing of opportunities" (Tang et al., 2012, 79). When encountered with further information, this cognitive ability allows individuals to make logical extensions to their currently held knowledge stocks (Ericsson et al., 1993), thereby enabling a creative process in problem solving allowing the individual to more effectively identify opportunities. Therefore, it is proposed that:

H3 Frequent gamers will score highly in the entrepreneur cognitive skill of association.

Additionally, the opportunity recognition construct suggests that effective entrepreneurs possess a strong judgement capability. This is defined as the ability to align information obtained to held beliefs (Tang et al., 2012; Baron, 2006). This allows the entrepreneur to connect disparate information to make sense of the information presented. Therefore:

H4 Frequent gamers will score highly in the entrepreneur cognitive skill of judgement.

3. The Individual Entrepreneurial Orientation Attitude

The theory of entrepreneurial orientation (EO) serves as the basis for examining psychometric profiles (for an overview, see e.g. (Gupta & Wales, 2017) or (Wales, 2016)). It was initially designed to characterize firm-level abilities to create new ventures and markets (Lumpkin and Dess, 1996; Covin and Slevin, 1989). The entrepreneurial orientation model is a collection of psychometric scale items used to characterize and predict the manifestation of entrepreneurial activities from the firm level (Kreiser et al., 2013; Miller, 1983). Typically, the high values in each of the entrepreneurial orientation dimensions are desirable but vary in prevalence across firm (Fellenhofer et al., 2016). Over the past 20 years, the construct has proven to be useful in research and practice for characterizing firms across industrial and strategic contexts; and specifically, for describing the levels of risk-taking, proactiveness, and innovativeness of firms (Lankamp and Lane, 2012). However, the collective understanding of the firm-level construct is that organizations are highly varied across each of these dimensions.

Recent work has begun to explore the entrepreneurial dimensions beyond the firm-level and have applied the scale items to the individual level (e.g.; Kollman et al., 2007; Goktan and Gupta, 2015; (Kraus, Breier, Jones, & Hughes, 2019); (Covin et al., 2020)). This was because debates emerged over the validity of a solitary construct at the firm level may have diluted a far more complex sociological and psychological process. In doing so, the methodological framing of the construct has been more explored and applied to the individual/micro-level components of firm (Goktan and Gupta, 2015). The main premise of the work within this domain is that the individual's agents embedded within the social structure have a mutually reinforcing influence on the overarching economic performance of the firm. In doing so, the original model can be extended, refined, and tested to postulate a broader range of cognitive factors that drive entrepreneurship. For example, research has suggested that an individual entrepreneur is tolerant of ambiguous situations, prefer autonomy, resist conformity, enjoy risk-taking, and adaptable (Sexton and Bowman, 1985). Thus, these findings suggest that the EO model may require some adaption. In this stream of research, scholars aim to identify the various psychological factors that influence this process from an individual mindset point of view. Therefore, it is important to consider them within entrepreneurial mindset studies.

Based on this discussion, we propose the following hypotheses to test the likelihood that gamers will score highly in the entrepreneurial orientation construct.

H5: Frequent gamers will exhibit a higher level of risk taking.
H6: Frequent gamers will exhibit a higher level of proactiveness.
H7: Frequent gamers will exhibit a higher level of innovativeness.

Implicit within this research strand is the notion entrepreneurial behavior is embedded within certain cognitive skills and may emerge over time. The usage of the EO model (within the context of individual entrepreneurs) provides opportunities for further elaboration for influencing variables, such as the cultural environment, political-legal environment, macro-economic and micro-economic environment (Kim et al., 2015; Kollman et al., 2007). This has resulted in the opportunity to align cognitive constructs (e.g., (Harms, Schulz, Kraus, & Fink, 2009); (Dimov, 2004)), as a key cognitive skill for the EO model.

H8: Frequent gamers who exhibit higher levels of entrepreneurial orientation psychometric profile will also exhibit higher opportunity recognition capabilities.

6. Methodology

This exploratory study was designed using a deductive approach. As the study aims to understand existing models and results within a new context, a quantitative design is the most suitable (Creswell, 2001; Gray, 2007). Pre-determined methods (sample description, regression analysis, correlation analysis), instrument-based questions (online survey), gathered data will be used for the research. It is noted that the correlation analysis and regression analysis is grounding on theoretical assumptions of causality, but this causality itself cannot be proven within the scope of these methods. Thus, the research shows up relations among the different constructs (Fowler, 2009; Little, 2013; Nunnally, 1978; Diamantopoulos & Winklhofer (2001)).

6.1. Sample

The participants in the study account for 223 people gathered from the online academic survey platform “Prolific”. Prolific is an innovative start-up incubator company from the University of Oxford, which offer a high-quality participant pool. Participants must fulfil the following requirements to be considered: age above 18, minimum three video gaming hours per week, region/country of residence either Europe or USA. Due to non-completed responses three of the 223 participants have been excluded, another two for providing an incorrect answer to a bogus question (respondents were asked to click on a predefined option in order to check whether reading and comprehension took place – “Please tick somewhat disagree”), and the final one due to playing an amount per week well over 100 hours per week (101.92 hours), resulting in a total amount of 217 valid survey responses. Out of the participants there are 57 female (26.3%). The average age is 31.42 (standard deviation 8.02). 59.9% (130) of the participants have their residence in the United States of America, while 40.1% (87) live in Europe (including people from Australia, Bosnia and Herzegovina, Canada, Croatia, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Lithuania, Luxembourg, Malta, Montenegro, Norway, Poland, Portugal, Serbia, Spain, Sweden, Switzerland, Ukraine, and United Kingdom in an alphabetical order). 14 genres of gaming were covered (“Please tick those genres, which you are playing more frequently [max. 5].”). Genre role-play games, RPG, (157, 72.35%) was played on average 18.86 hours per week (SD = 12.99, min = 4, max = 85). The genre of shooter (134, 61.75%) was second with a 19.65 hours average (SD = 12.52, min = 4, max = 70), followed by strategy (94, 43.32%) with a 19.11 hours average (SD = 10.18, min = 4, max = 50) and simulation (54, 28.88%) played on average for 23.65 hours (SD = 15.96, min = 4, max = 85). Finally, the management genre (49, 22.58%) yielded an average of 19.37 hours played (SD = 12.18, min = 4, max = 58). Overall, the sample seems to be representative for the gaming population, with a lower share of women, a rather young audience and a wide range of hours played over more (Role Playing Game, hereafter abbreviated RPG, shooter) and less prominent genres (simulation, management).

6.2. Data Collection

The approach to developing a valid and reliable questionnaire is a broadly discussed topic in academia (Fowler, 2009; Little, 2013; Schendra, 2014). A well-accepted approach of creating a questionnaire is to utilize a commonly used or previously published scale (Little, 2013; Churchill (1979)). This approach is well accepted because of its advantage to rely on previously testes scales, which increases the possibility to receive a questionnaire that is reliable and valid. The questionnaire used for this research is a gathering of previously validated instruments.

The scales for the individual entrepreneurial orientation dimensions innovativeness, proactiveness, and risk-taking are derived from Fellnhofer et al. (2016), who again based it on the scales developed by Bolton ((2012)) and Langkamp-Bolton ((2012)). Tang et al. (2012) have developed an instrument to measure one's opportunity recognition by three subscales: Scanning and search, association and connection, as well as evaluation and judgment. Opportunity recognition yielded a Cronbach's alpha-based reliability of .92 with all sub-scales exceeding the Cronbach's alpha threshold of .7 (Nunally, 1978). Finally, the intensity of playing games was measured by having respondents indicating the number of hours playing per week ("How much hours do I spend per week for playing video games?"). Since this indicator is concrete and easy to understand in correspondence with the C-OAR-SE procedure by Bergqvist & Rossiter (2007) and Rossiter (2002), no multiple item measure was applied. Intensity was log-transformed thereafter to normalize its distribution (rather chi-square distributed before). All scales and sub-scales showed convergent validity (average variance extracted, hereafter termed AVE > .5 applying a Maximum Likelihood-Confirmatory Factor Analysis, hereafter termed CFA, of all multi-item measures) and were discriminant from each other by applying the HTMT procedure (Henseler et al. (2015); Voorhees et al. (2016)).

Within this study, the following covariates are used as control variables: gender, age, education, profession, residence, and the genre respondents preferably played (multiple responses). All categories were coded as dummy variables. The covariates of interest in a study are determined by other similar studies close to the field of interest. For instance, gender impact the proclivity for entrepreneurship (Goktan and Gupta, 2015) control age and gender within their development of the opportunity recognition scale (Tang et al., 2012). Within the development of the individual entrepreneurial orientation scale by Lumpkin and Dess (1996) they were controlling their

instrument measurement by education and gender. An assessment about potential linkages from Kreiser et al. (2013) between dimensions of entrepreneurial orientation and cultural dimensions led to the conclusion that at least two of the three subscales from the entrepreneurial orientation scale have strong connections to the cultural environment, hence the country of residence has also been implemented as an additional covariate. Lastly, the preferred genre of gaming (e.g., classic or action adventures, shooters, simulations or sport games) was controlled in order to assess differences in the required skills for those genres (e.g., simulations require more planning while shooters and sport games require quick interaction, see Wilson et al. 2009).

Past research on entrepreneurial orientation shows that the dimension of entrepreneurial orientation correlates high with each other and the performance measure (Corbett, 2007; Kruger and Brazeal, 2013; Wiklund and Shepherd, 2003). As opportunity recognition is crucial to be a successful entrepreneur, this newly introduced performance measure fits well into the entrepreneurial orientation construct, in comparison to the other constructs.

7. Results

A stepwise regression approach was applied to derive the influences on opportunity recognition using linear mixed-effect models allowing for random intercepts and individual mean differences of respondents. In a base model (model 1), only the covariates were regressed on the dependent variable. Further, a second model (model 2) adds the main effects of dimensions of entrepreneurial orientation (risk-taking, proactiveness, innovativeness) and intensity to model 1. Model 3 then investigates main and interaction effects of intensity and entrepreneurial orientation dimensions. Owing to the fact that main effects may become redundant, model 4 finally tests interaction effects only (Aiken & West (1991); Rosnow & Rosenthal (1989)). By comparing models with information criteria (AIC, BIC), it is found that model 4 fits the data best, indicating that the influence of risk-taking, proactiveness and innovativeness on opportunity recognition is indeed moderated by gaming intensity (Table 1). Table 2 depicts the estimates from model 4.

Table 1. Model description

	Model 1	**Model 2**	**Model 3**	**Model 4**
Variables included	Gender, age, education, profession, residence, genre (covariates)	Covariates + risk-taking, proactiveness, innovativeness, intensity (main effects)	Covariates + main effects + risk-taking * intensity, proactiveness * intensity, innovativeness * intensity (interaction effects)	Covariates + interaction effects only
AIC (lower is better)	646.85	443.59	459.01	**361.04** (lowest)
BIC (lower is better)	762.39	571.09	595.34	**489.47** (lowest)

Table 2. Estimates for the interaction model

Coefficient	Estimate	Std. Error	t	p(t)
(Intercept)	*-.67*	*.28*	*-2.38*	*.02***
Covariates (control variables)				
Genre Classic Adventure	-.10	.09	-1.06	.29
Genre Action Adventure	.09	.09	.98	.33
Genre Arcade	-.05	.11	-.47	.64
Genre Brain Teaser	-.07	.13	-.56	.58
Genre Jump and Run	.08	.10	.84	.40
Genre Board Game	-.12	.14	-.84	.40
Genre Children	-.14	.33	-.43	.67
Genre Management	.09	.10	.91	.36
Genre RPG	.09	.09	1.01	.32
Genre Shooter	*.27*	*.08*	*3.22*	*.00****
Genre Simulation	.10	.10	.96	.34
Genre Lifestyle	.10	.21	.48	.63
Genre Sport	-.15	.10	-1.53	.13
Genre Strategy	-.03	.08	-.32	.75
Gender Male	-.09	.09	-.91	.36
Age	.01	.01	1.48	.14
Residence Germany	.07	.31	.23	.82
Residence Greece	.20	.34	.61	.55
Residence Hungary	.00	.30	.00	1.00
Residence Poland	-.34	.30	-1.11	.27
Residence Portugal	.22	.35	.64	.52
Residence Russia	.05	.42	.11	.91
Residence Spain	-.05	.24	-.19	.85
Residence Sweden	-.03	.42	-.06	.95
Residence United Kingdom (UK)	-.12	.16	-.73	.47
Residence United States of America (USA)	.03	.14	.24	.81
Education Compulsory schooling	-.02	.15	-.11	.91
Education Doctoral study	.16	.14	1.11	.27
Education School leaving examination	.10	.16	.64	.52
Education University of applied sciences study	.12	.17	.73	.47
Professional Status Freelancer/self-employed	.21	.12	1.74	.08
Professional Status Student	*.27*	*.11*	*2.42*	*.02**
Professional Status Unemployed	.05	.12	.38	.70
Interaction effects				
*Risk-taking * Intensity*	*.07*	*.02*	*3.25*	*.00****
*Proactiveness * Intensity*	*.15*	*.03*	*5.47*	*.00****
*Innovativeness * Intensity*	*.06*	*.03*	*2.38*	*.02**

Notes. Linear-mixed effects model for dependent variable opportunity recognition with REML estimator (random: intercept, respondent mean opportunity recognition). R^2 (fixed effects): .69, F(36, 180) = 14.40, p(F) = .00. Random effect SD: .48 (Intercept), .18 (Residuals). Omitted base line categories: gender (female), residence (Canada), education (other), professional status (employed). Estimates unstandardized. ***: $p \leq .001$, **: $p \leq .01$, *: $p \leq .05$. Significant coefficients in *italics*.

It becomes evident that the only few coefficients are significant, despite a very good model determination ($R^2 = .69$). The intercept ($b = -.67$, $p \leq .001$) shows that the average opportunity recognition is below the average but is increased by gamers frequently playing shooters ($b = .27$, $p \leq .001$) and by student gamers ($b = .27$, $p \leq .001$). The lack of other relevant control variables

indicates that opportunity recognition for gamers is not different for genders, ages, residence and education. Further, the positive interaction effects of risk-taking (b = .07, p ≤ .001), proactiveness (b = .15, p ≤ .001) and innovativeness (b = .06, p ≤ .05) with intensity illustrate synergies between playing intensity and the entrepreneurial orientation dimensions in increasing opportunity recognition. In a nutshell and as depicted in Figures X1, X2 and X3, playing games more intensively increases the effect of entrepreneurial orientation on recognizing opportunities in all three dimensions. All three figures illustrate the slopes of each dimension on opportunity recognition for low (mean – 1 SD), moderate (mean) and high (mean + 1 SD) levels of intensity.

Figure X1. Interaction of risk-taking and intensity on opportunity recognition

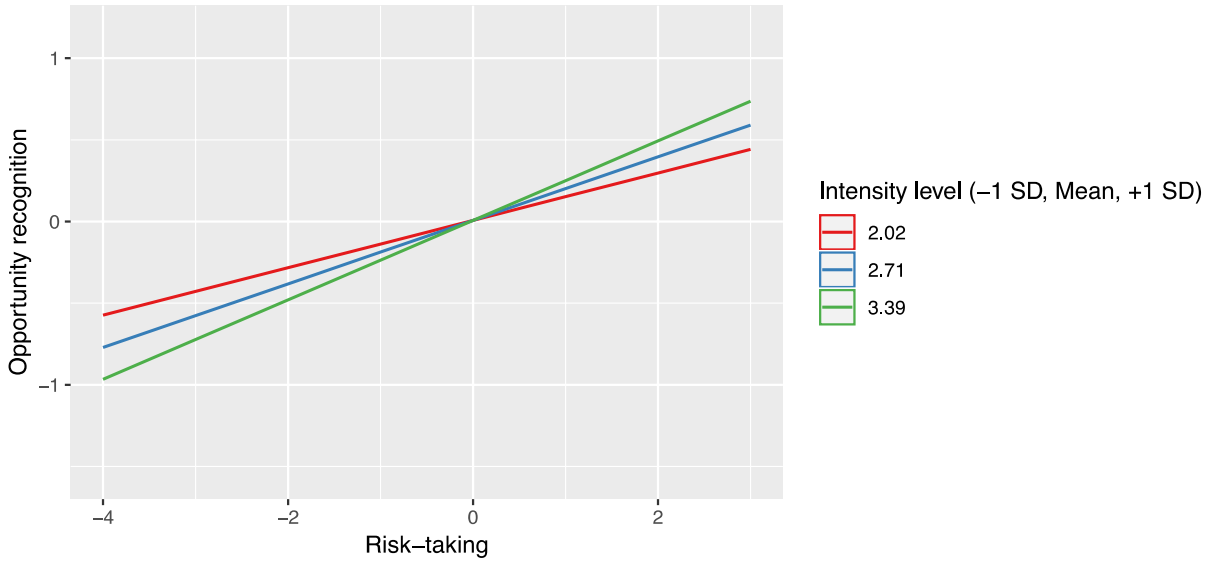


Figure X2. Interaction of proactiveness and intensity on opportunity recognition

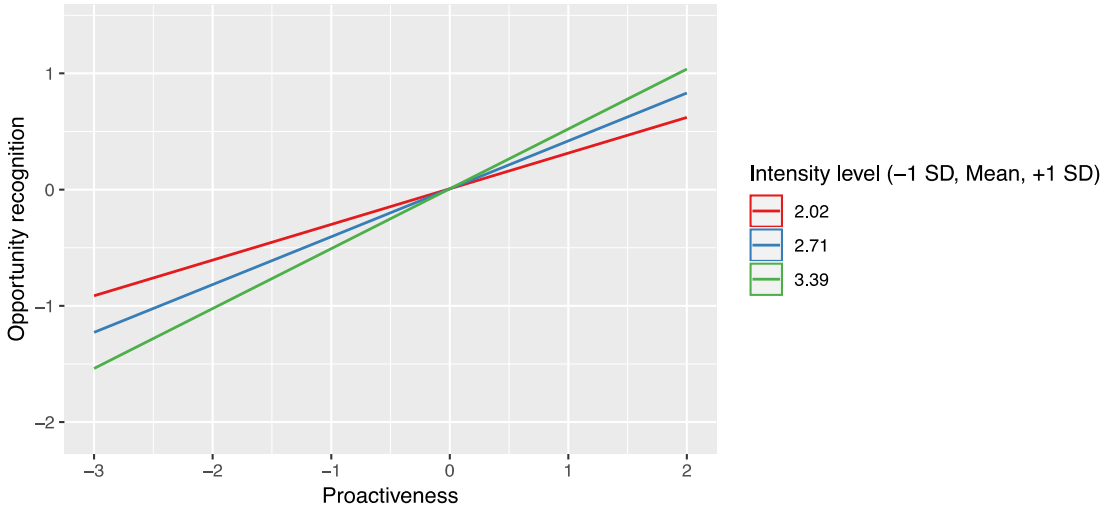
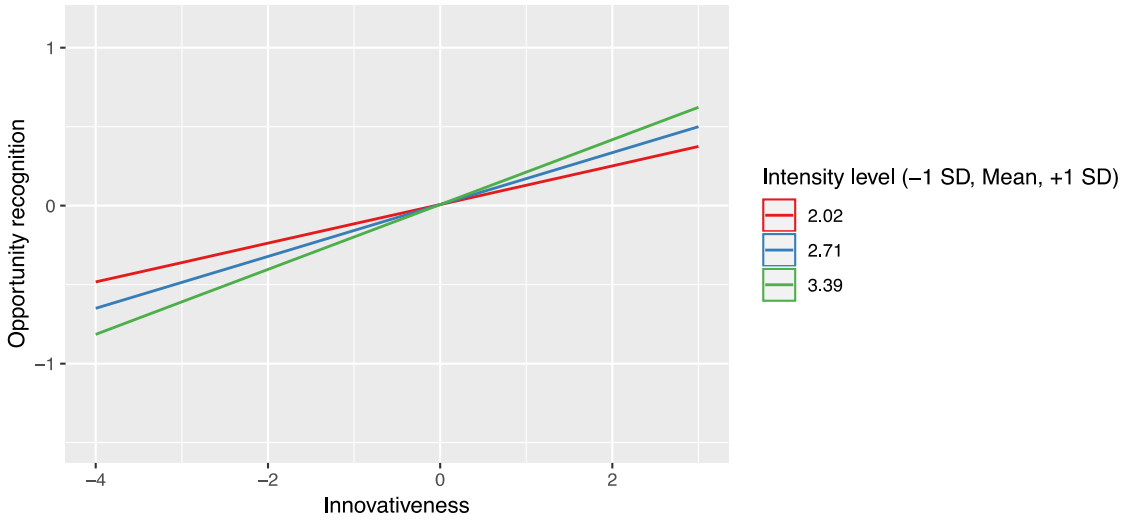


Figure X3. Interaction of innovativeness and intensity on opportunity recognition



6. Discussion

Due to the exploratory character of this study, we structure the discussion in some major questions that arise from the results.

Why do shooter gamers show increased opportunity recognition?

A key finding of this study was the interaction effects the shooting genre games have on the prevalence of opportunity recognition cognitive skills. Opportunity recognition was measured via three associated cognitive subscales: scanning and search, association and connection, and evaluation and judgment. This is interesting in several ways. The design and 'play' elements of shooter games require the players to quickly interact and decide within the environment (Wilson et al. 2009). That is, gamers need to react or evaluate and decide quickly based on the information provided, which is similar to research findings that have suggested the process of efficient evaluation is needed for entrepreneurial opportunity recognition (Shane and Vankataraman, 2000). Respondents who play shooters therefore may not be more successful in opportunity recognition yet, but the results suggest that these individuals are displaying similar cognitive processing skills to decisively making quick decisions. Notwithstanding that causality cannot be assumed, the other way of effect may also be possible. Ventura et al. (2012) found that certain video gaming genre preferences can lead to higher academic performance when mediated by openness and consciousness. Hence, the attributes inherent in opportunity recognition, openness to ideas, conscious evaluation and quick decision making may lead people with high opportunity recognition to choose the shooter genre more frequently and/or play those games more intensively as they fit with their cognitions. Future research could further explore this link by examining across a longitudinal basis. Additionally, further studies could be designed to examine the causal relationships between this game genre, cognitive skills, and entrepreneurship.

Why do student gamers show increased opportunity recognition?

Another interesting result of this study were the variations between demographic groups. While the study's sample was designed to capture the perceptions of self-reported gamers, students were found to have a higher likelihood of opportunity recognition skills. Generally speaking, students have been previously found to be less driven by attitudes and to have stronger cognitive skills than non-students (Peterson, 2001). Since opportunity recognition requires high cognitive processing capability blending market information with creativity (Gundry et al., 2016; Martin and Wilson, 2016; Vaghley and Julien, 2010), it becomes evident that this dependence on

cognitive skills fits well with the often-found higher cognitive skills of students. In cooperation with the importance of consciousness in gaming settings (Ventura et al., 2012), it seems that student gamers are well trained in using their cognitive skills and therefore apply their skills in evaluating opportunities or, vice versa, their opportunity recognition skills motivate them to seek opportunities in gaming. The link between student cognitions and the ability to quickly evaluate opportunities is promising avenue for future research, as well as how the game design mechanics might enable this type of entrepreneurial activity.

Why is intensity amplifying the effects of entrepreneurial orientation dimensions on opportunity recognition?

Both, the link between entrepreneurial orientation and opportunity recognition itself, as well as the imprint of individual personality, is well established within the entrepreneurial thinking literature (Gupta et al., 2015). People act more risk-taking, proactive, and innovative because they are open to new ideas and experiences, producing internal motivation that can help to boost the experienced situation into valuable learning (Padilla-Melendez et al., 2014). Since it has been argued that gaming increases consciousness and openness (Ventura et al., 2012), it is likely that gaming intensity supports the beneficial effects of entrepreneurial orientations on opportunity recognition on the same personality trait level. In a nutshell, gaming may attract personalities that possess higher entrepreneurial skills. Alternatively, playing games, particularly shooting games, may also sharpen the skills relevant for entrepreneurial thinking and thereof strengthen opportunity recognition. This second implication however requires some causality not intended in the present research, but is a fruitful avenue for future research.

7. Implications and Conclusion

This study makes several contributions to the literature and offers several promising avenues for future research. While attempts were made to enhance the generalizability of the study, some limitations impinge upon our ability to apply the lessons on a broader scale. Throughout the discussion we have provided several recommendations to expand this work, and to further test the hypotheses put forward. Importantly, the results of this study suggest that there are certain

forms of games activities and design options that could unlock the cognitive development of opportunity recognition in the pre-nascent phases of an entrepreneur. Future studies could expand upon the notion of game genres, the entrepreneurial mindset, and various different sample populations to further test this finding. Additionally, capturing the cognitive processing of the pre-nascent entrepreneur is a methodological issue and this study makes a contribution to the entrepreneurial intent literature. Finally, this study has practical implications for game designers and managers, as it emphasizes the need for gamification strategies to consider the anticipated behavioral outcomes and the influence certain design activities may have on the development of desired cognitive skills.

References

Aiken, L. S., & West, S. G. (1991). Multiple regression: Testing and interpreting interactions. Thousand Oaks, CA, US: Sage Publications, Inc.

Argawal, R., and Karahanna, E., (2000). Time flies when your having fun: Cognitive absorption and beliefs about information technology usage. MIS Quarterly, 24(4), 665-694.

Barney, J. B., Clark, C., & Alvarez, S. Where does entrepreneurship come from: Network models of opportunity recognition and resource acquisition with application to the family firm. In Second Annual Conference on Theories of the Family Enterprise, Philadelphia, December 2002 2002: University of Pennsylvania

Baron, R. A. (2004). Opportunity Recognition: Insights from a cognitive perspective. In J. E. Butler (Ed.), Opportunity Identification and Entrepreneurial Behavior (pp. 47-76). Greenwich, CN: IAP.

Bergkvist, L., & Rossiter, J. R. (2007). The predictive validity of multiple-item versus single-item measures of the same constructs. Journal of Marketing Research, 44(2), 175-184.

Bolton, D. L. (2012). Individual entrepreneurial orientation: Further investigation of a measurement instrument. *Academy of Entrepreneurship Journal, 18*(1), 91-98.

Carlen, J. (2016). A brief history of entrepreneurship. Columbia Business School Publishing, NY.

Chandra, Y., Styles, C., and Wilkinson, I. (2009). The recognition of first time international entrepreneurial opportunities. International Marketing Review, 26(1), pp 30–61.

Chen, M.-H., and Yang, Y.-J. (2009). Typology and performance of new ventures in Taiwan: A model based on opportunity recognition and entrepreneurial creativity. International Journal of Entrepreneurial Behavior & Research, 15(5), 398–414.

Christensen, P. S., Madsen, O. O., and Peterson, R. (1989). Opportunity Identification: The Contribution of Entrepreneurship to Strategic Management. Denmark: Aarhus University Institute of Management.

Corbett, A. C. (2007). Learning asymmetries and the discovery of entrepreneurial opportunities. Journal of Business Venturing, 22(1), 97–118.

Covin, J. G., Rigtering, J., Hughes, M., Kraus, S., Cheng, C.-F., & Bouncken, R. (2020). Individual and team entrepreneurial orientation: Scale development and configurations for success. 112, 1-12.

Covin, J. G. & Slevin, D. P. (1989). Strategic management of small firms in hostile and benign environments. Strategic Management Journal, 10 (1), 75-87.

Creswell, J. W. (2001). Research design: Qualitative & quantitative approaches (17. Dr). Thousand Oaks, Calif.: Sage Publications.

Dai, L., Maksimov, V., Gilbert, B. Anitra & Fernhaber, S. A. (2014). Entrepreneurial orientation and international scope: The differential roles of innovativeness, proactiveness, and risk-taking. Journal of Business Venturing, 29 (4), 511-524.

Deterding, S. (2014). Eudaimonic design, or: Six invitations to rethink gamification. In M. Fuchs, S. Fizek, P. Ruffion, & N. Sharpe (Eds). Rethinking Gamification: 305-331. Lineberg, Germany, Mason Press.

Deterding, S., Khaled, R., Nacke L.E. and Dixon, D. (2011) Gamification: Toward a Definition. CHI 2011 Gamification Workshop Proceedings, Vancouver, 2011, 12-15.

Dimov, D. P. (2004). The individuality of opportunity recognition: A critical review and extension. In J. E. Butler (Ed.), Opportunity Identification and Entrepreneurial Behavior (pp. 135-162). Greenwich, CN: IAP.

Dimov, D. (2007). Beyond the Single-Person, Single-Insight Attribution in Understanding Entrepreneurial Opportunities. Entrepreneurship Theory and Practice, 31(5), 713–731.

Endres, A. M., & Woods, C. R. (2007). The case for more "subjectivist" research on how entrepreneurs create opportunities. International Journal of Entrepreneurial Behaviour & Research, 13(4), 222–234.

Fillis, I., & Rentschler, R. (2010). The role of creativity in entrepreneurship. Journal of Enterprising Culture, 18(1), 49–81.

Fellnhofer, K., & Kraus, S. (2015). Examining attitudes towards entrepreneurship education: a comparative analysis among experts. International Journal of Entrepreneurial Venturing, 7(4), 396-411.

Fellnhofer, K., Puumalainen, K. & Sjogren, H. (2016). Entrepreneurial orientation and performance - are sexes equal? International Journal of Entrepreneurial Behavior and Research, 22 (3), 346-374.

Ferreira, T., Araujo, A., Fernandes, S., Miguel, I., (2017). Gamification in the workplace: A systematic literature review. Advances in Intelligent Systems and Computing, 284-290.

Fornell, C. & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. Journal of Marketing Research, 18 (1), 39.

Fowler, F. (2009). Survey research methods (4th ed.). 2455 Teller Road, Thousand Oaks California 91320 United States: SAGE Publications, Inc.

Garris, R. & Ahlers, R. (2001). A game-based training model: Development, application, and evaluation. Interservice/Industry Training, Simulation, and Education Conference.

George, N. M., Parida, V., Lahti, T., & Wincent, J. (2016). A systematic literature review of entrepreneurial opportunity recognition: insights on influencing factors. International Entrepreneurship and Management Journal, 12(2), 309–350.

Gielnik, M. M., Frese, M., Graf, J. M., & Kampschulte, A. (2012). Creativity in the opportunity identification process and the moderating effect of diversity of information. Journal of Business Venturing, 27(5), 559–576.

Goktan, A. Banu & Gupta, V. K. (2015). Sex, gender, and individual entrepreneurial orientation: Evidence from four countries. International Entrepreneurship and Management Journal, 11 (1), 95-112.

Gray, P. (2007). The research imagination: An introduction to qualitative and quantitative methods. Cambridge: University Press.

Green, S., Bavelier, D. (2003). Action video game modify visual selective attention. Letters to Nature, 423, 29 May 2003: 534-537.

Gruber, M., MacMillan, I. C., & Thompson, J. D. (2008). Look Before You Leap: Market Opportunity Identification in Emerging Technology Firms. Management Science, 54(9), 1652–1665.

Guerrero, M. & Pena-Legazkue, I. (2013). The effect of intrapreneurial experience on corporate venturing: Evidence from developed economies. International Entrepreneurship and Management Journal, 9 (3), 397-416.

Gundry, L. K., Ofstein, L. F., & Monllor, J. (2016). Entrepreneurial Team Creativity: Driving Innovation from Ideation to Implementation. Journal of Enterprising Culture, 24(1), 55–77.

Gupta, V. K., Niranjan, S., Goktan, B. A. & Eriskon, J. (2015). Individual entrepreneurial orientation role in shaping reactions to new technologies. International Entrepreneurship Management Journal.

Gupta, V. K., & Wales, W. J. (2017). Assessing Organisational Performance Within Entrepreneurial Orientation Research: Where Have We Been and Where Can We Go from Here? *The Journal of Entrepreneurship, 26*(1), 51-76.

Hamari, J., Koivisto, J., & Sarsa, H., (2014). Does gamification work? – A literature review of empirical studies on gamification. Proceedings of the 47th Hawaii International Conference on System Sciences (HICSS), (pp 3025-3034). Hawaii.

Harms, R., Schulz, A., Kraus, S., & Fink, M. (2009). The Conceptualization of 'Opportunity' in Strategic Management Research. International Journal of Entrepreneurial Venturing, 1(1), 57-71.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. Journal of the Academy of Marketing Science, 43(1), 115-135.

Hisam, A., Mashhadi, S., Faheem, M., Sohail, M., Ikhlaq, B., Iqbal, I., 2018. Does video games effect cognitive abilities in Pakistani chidren? *Pakistan Journal of Medical Sciences.* 34(6), 1507-1511.

Huotari, K., & Hamari, J. (2017). A definition for gamification: Anchoring gamification in the service marketing literature. *Electronic Markets,* 27(1), 21-31.

Hurley, Ben (May 16, 2013). "Everyone loves winning: how Rydges used gamification to double sales". *afr.com*. Retrieved September 13, 2016.

Ireland, R. D., Webb, J. W., & Coombs, J. E. (2005). Theory and methodology in entrepreneurship research. In D. Ketchen & D. D. Bergh (Eds.), Research methodology in strategy and management, vol. 2: 1–32.

Jeno, L. M., Grytnes, J.-A. & Vandvik, V. (2017). The effect of a mobile-application tool on biology students' motivation and achievement in species identification: A self-determination theory perspective. Computers & Education, 107: 1-12.

Kim, C., Jeon, J.-H., & Kim, M.-S. (2015). Identification and Management of opportunities for technology-based services: a patent-based portfolio approach. Innovation: Management, Policy & Practice, 17(2), 232–249.

Kollmann, T., Christofor, J. & Kuckertz, A. (2007). Explaining individual entrepreneurial orientation: Conceptualisation of a cross-cultural research framework. International Journal of Entrepreneurship and Small Business, 4 (3), 325.

Kraus, S., Breier, M., Jones, P., & Hughes, M. (2019). Individual entrepreneurial orientation and intrapreneurship in the public sector. *International Entrepreneurship and Management Journal, 15*(4), 1247-1268.

Kreiser, P. M., Marino, L. D., Kuratko, D. F. & Weaver, K. Mark. (2013). Disaggregating entrepreneurial orientation: the non-linear impact of innovativeness, proactiveness and risk-taking on SME performance. Small Business Economics, 40 (2), 273-291.

Krueger, N. Brazeal, D., (1994). Entrepreneurial potential and potential entrepreneurs. Entrepreneurship Theory and Practice, 18(3): 91-104.

Langkamp Bolton, D. & Lane, M. D. (2012). Individual entrepreneurial orientation: Development of a measurement instrument. Education + Training, 54 (2/3), 219-233.

Lent, R.W., Brown, S.D., & Hackett, G. (2002). Social cognitive career theory (pp. 255-311). In D. Brown, L. Brooks, and Associates, *Career choice and development* (4th Ed.). San Francisco, CA: Jossey-Bass.

Little, T. D. (2013). The Oxford Handbook of quantitative methods, volume 1: Foundations. Oxford Library of Psychology. Oxford: Oxford University Press USA.

Lumpkin, G. T. & Dess, G. G. (1996). Clarifying the entrepreneurial orientation construct and linking it to performance. Academy of Management Review, 21 (1), 135-172.

Lumpkin, G. T., Lichtenstein, B. B., (2005). The Role of Organizational Learning in the Opportunity- Recognition Process. Entrepreneurship Theory and Practice, 29(4), 451–472.

Martin, L., & Wilson, N., (2016). Opportunity, discovery and creativity: A critical realist perspective. International Small Business Journal, 34(3), 261–275.

Mathisen, G. E., Einarsen, S., (2004). A Review of Instruments Assessing Creative and Innovative Environments Within Organizations. Creativity Research Journal, 16(1), 119–140.

McAllister, K., (2004). Game work: Language, power, and computer game culture. University of Alabama Press, Alabama.

McCline, R. L., Bhat, S., & Baj, P. (2000). Opportunity recognition: An exploratory investigation of a component of the entrepreneurial process in the context of the health care industry. Entrepreneurship Theory & Practice, 25(2), 81-94.

McGrath, R. G., & MacMillan, I. (2000). The entrepreneurial mindset. Boston: Harvard Business School Press.

Miller, D., (1983). The correlates of Entrepreneurship in three types of firms. Management Science, 29 (7), 770-791.

Neck, H. M., Greene, P. G., (2011). Entrepreneurship education: Known Worlds and New Frontiers. Journal of Small Business Management, 49 (1), 55-70.

Nunally, J. C., (1978). Psychometric theory. 2nd Edition, McGraw-Hill, New York.

Padilla-Melendez, A., Fernandez-Gamez, M. A., Molina-Gomez, J., (2014). Feeling the risks: effects of the development of emotional competences with outdoor training on the entrepreneurial intent of university students. International Entrepreneurship and Management Journal, 10 (4), 861-884.

Peterson, R. A., (2001). On the use of college students in social science research: Insights from a second-order meta-analysis. Journal of Consumer Research, 28(3), 450-461.

Raftopolous, M., (2014). Towards gamification transparency: A conceptual framework for the development of responsible gamified enterprise systems. Journal of Gaming and Virtual Worlds, 6(2), 159-170.

Roos, J., Victor, B., (1999). Towards a new model of strategy-making as serious play. European Management Journal, 17, 348-355.

Ruhi, U., (2015-01-01). Level Up Your Strategy: Towards a Descriptive Framework for Meaningful Enterprise Gamification. Technology Innovation Management Review. **5** (8).

Ryan, R. M., Rigby, C. S., Przybylski, A., (2006). The motivational pull of video games: A Self-Determination theory approach. Motivation and Emotion, 30 (4), 344-360.

Santos, S. C., Caetano, A., Baron, R., & Curral, L., (2015). Prototype models of opportunity recognition and the decision to launch a new venture: Identifying the basic dimensions. International Journal of Entrepreneurial Behaviour & Research, 21(4), 510–538.

Schendera, C. F. G., (2014). Regressionsanalyse mit SPSS (2. korr. und aktualisierte Aufl.). De Gruyter Studium. München: De Gruyter

Schutter, B., Abeele, V., (2010). Designing meaningful play within the psycho-social context of older adults. Proceedings of the 3rd International Conference on Fun and Games, 84-93.

Scott, S, Hughes, P, Hodgkinson, I & Kraus, S (2019). Technology Adoption Factors in the Digitization of Popular Culture: Analyzing the Online Gambling Market. Technological Forecasting and Social Change 148: 119717.

Sexton, D. L., Bowman, N., (1985). The entrepreneur: A capable executive and more. Journal of Business Venturing, 1(1), 129–140.

Shane, S., & Venkataraman, S., (2000). The promise of entrepreneurship as a field of research. Academy of Management Review, 25(1), 217–226.

Siegel, P. H., Omer, K. & Agrawal, S. P., (1997). Video simulation of an audit: an experiment in experiential learning theory. Accounting Education, 6 (3), 217-230.

Statler, M., Heracleous, L., Jacobs, C., (2011). Serious play as a paradox. The Journal of Applied Behavioral Science. 47(2), 236-256.

Suh, A., Cheung, C., Ahuha, M., and Wagner, C., (2017). Gamification in the workplace: the central role of aesthetic experience. Journal of Management Information Systems, 34(1), 268-305.

Tang, J., Kacmar, K. Michele & Busenitz, L., (2012). Entrepreneurial alertness in the pursuit of new opportunities. Journal of Business Venturing, 27 (1), 77-94.

Vaghely, I. P., & Julien, P.-A., (2010). Are opportunities recognized or constructed? An information perspective on entrepreneurial opportunity identification. Journal of Business Venturing, 25(1), 73– 86.

Ventura, M., Shute, V. & Kim, Y. J., (2012). Video gameplay, personality and academic performance. Computers & Education, 58 (4), 1260-1266.

Vesa, M., & Harviainen, J., (2019). Gamification: Concepts, consequences, and critiques. Journal of Management Inquiry, 28(2), 128-130.

Wales, W. J. (2016). Entrepreneurial orientation: A review and synthesis of promising research directions. *International Small Business Journal, 34*(1), 3-15.

Wang, Y.-L., Ellinger, A. D., & Wu, Y.-C. J., (2013). Entrepreneurial opportunity recognition: an empirical study of R&D personnel. Management Decision, 51(2), 248–266.

Ward, T. B., (2004). Cognition, creativity, and entrepreneurship. Journal of Business Venturing, 19(2), 173–188.

Wiklund, J. & Shepherd, D., (2003). Knowledge-based resources, entrepreneurial orientation, and the performance of small and medium-sized businesses. Strategic Management Journal, 24 (13), 1307-1314.

Wilson, K. A., Bedwell, W. L., Lazzara, E. H., Salas, E., Burke, C. Shawn, Estock, J. L., Orvis, K. L. & Conkey, C. (2009). Relationships between game attributes and learning outcomes. Simulation & Gaming, 40 (2), 217-266.

Zichermann, G., Cunningham, C., (August 2011). "Introduction". Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps (1st ed.). Sebastopol, California: O'Reilly Media. p. xiv..

Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park: Sage Publications.

Barney, J. B., Clark, C., & Alvarez, S. (2002, December 2002). *Where does entrepreneurship come from: Network models of opportunity recognition and resource acquisition with application to the family firm.* Paper presented at the Second Annual Conference on Theories of the Family Enterprise, Philadelphia.

Baron, R. A. (2004). Opportunity Recognition: Insights from a cognitive perspective. In J. E. Butler (Ed.), *Opportunity Identification and Entrepreneurial Behavior* (pp. 47-76). Greenwich, CN: IAP.

Bergkvist, L., & Rossiter, J. R. (2007). The predictive validity of multiple-item versus single-item measures of the same constructs. *Journal of Marketing Research, 44*(2), 175-184.

Bolton, D. L. (2012). Individual entrepreneurial orientation: Further investigation of a measurement instrument. *Academy of Entrepreneurship Journal, 18*(1), 91-98.

Churchill, G. A. (1979). A paradigm for developing better measures of marketing constructs. *Journal of Marketing Research, 16*(1), 64-73.

Covin, J. G., Rigtering, J., Hughes, M., Kraus, S., Cheng, C.-F., & Bouncken, R. (2020). Individual and team entrepreneurial orientation: Scale development and configurations for success. *112*, 1-12.

Diamantopoulos, A., & Winklhofer, H. M. (2001). Index construction with formative indicators: An alternative to scale development. *Journal of Marketing Research, 38*(2), 269-277.

Dimov, D. P. (2004). The individuality of opportunity recognition: A critical review and extension. In J. E. Butler (Ed.), *Opportunity Identification and Entrepreneurial Behavior* (pp. 135-162). Greenwich, CN: IAP.

Fellnhofer, K., & Kraus, S. (2015). Examining attitudes towards entrepreneurship education: a comparative analysis among experts. *International Journal of Entrepreneurial Venturing, 7*(4), 396-411.

Gupta, V. K., & Wales, W. J. (2017). Assessing Organisational Performance Within Entrepreneurial Orientation Research: Where Have We Been and Where Can We Go from Here? *The Journal of Entrepreneurship, 26*(1), 51-76.

Harms, R., Schulz, A., Kraus, S., & Fink, M. (2009). The Conceptualization of 'Opportunity' in Strategic Management Research. *International Journal of Entrepreneurial Venturing, 1*(1), 57-71.

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science, 43*(1), 115-135.

Kraus, S., Breier, M., Jones, P., & Hughes, M. (2019). Individual entrepreneurial orientation and intrapreneurship in the public sector. *International Entrepreneurship and Management Journal, 15*(4), 1247-1268.

Krueger, N., & Sussan, F. (2017). Person-level entrepreneurial orientation: clues to the'entrepreneurial mindset'? *International Journal of Business and Globalisation, 18*(3), 382-395.

Langkamp-Bolton, D., & Lane, M. D. (2012). Individual entrepreneurial orientation: Development of a measurement instrument. *Education+ Training, 54*(2/3), 219-233.

McCline, R. L., Bhat, S., & Baj, P. (2000). Opportunity recognition: An exploratory investigation of a component of the entrepreneurial process in the context of the health care industry. *Entrepreneurship Theory & Practice, 25*(2), 81-94.

McGrath, R. G., & MacMillan, I. (2000). *The entrepreneurial mindset*. Boston: Harvard Business School Press.

Rosnow, R. L., & Rosenthal, R. (1989). Definition and interpretation of interaction effects. *Psychological Bulletin, 105*(1), 143-146.

Rossiter, J. R. (2002). The C-OAR-SE procedure for scale development in marketing. *International Journal of Research in Marketing, 19*(4), 305-335.

Voorhees, C. M., Brady, M. K., Calantone, R., & Ramirez, E. (2016). Discriminant validity testing in marketing: an analysis, causes for concern, and proposed remedies. *Journal of the Academy of Marketing Science, 44*(1), 119-134.

Wales, W. J. (2016). Entrepreneurial orientation: A review and synthesis of promising research directions. *International Small Business Journal, 34*(1), 3-15.