THE ARTS & ECONOMIC VITALITY

RELATIONSHIPS BETWEEN THE ARTS, ENTREPRENEURSHIP & INNOVATION IN THE WORKPLACE

(working paper)

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"America's future economic growth and international competitiveness depend on our capacity to innovate. We can create the jobs and industries of the future by doing what America does best—investing in the creativity and imagination of our people."

> President Barack Obama Strategy for American Innovation February 4, 2011

"Productivity will not increase through sheer hard work but through creativity and innovation."

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Second Finance Minister Datuk Seri Wong Soon Koh Malaysia, May 11, 2014

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"Stimulate innovative thinking... strive to create a tolerant, harmonious, healthy, and upbeat innovation culture."

The State Council, The People's Republic of China, The National Medium- and Long-Term Program for Science & Technology Development (2006-2020)

•

"It is time for action to enable Europe's entrepreneurs, and Europe as a whole, to be more adaptable, creative and to have greater impact in globalized competition that is more demanding and more rapid than ever before."

European Commission's Communication to the European Parliament, the Council, the European Economic and Social Committee, and the Committee of the Regions, Entrepreneurship 2020 Action Plan, September 1, 2013

BRIDGING THE ARTS AND INNOVATION AT WORK

Creativity and innovation have achieved a privileged place in conversations about how to invigorate economic growth globally (e.g., A Strategy for American Innovation, The White House, February 4, 2011; China's National Medium- and Long-Term Program for Science and Technology Development, 2006-2020). Here in the United States, accelerating the generation of good, novel ideas that support the creation of jobs is a national priority (Startup America, The White House, January 31, 2011). Currently, a large-scale effort aimed at sparking innovation involves shoring up STEM learning (science, technology, engineering and math; Change the Equation initiative, The White House, September 16, 2010). This initiative represents an important movement that has the potential to improve the computational and scientific thinking abilities of Americans and bolster creative problem-solving. However, it may take more than a nationwide improvement and standardization in STEM achievement to fuel the kind of radical ideas that spark economic growth (Madjar, Greenberg, Chen, 2011; Zhao, 2012). The current research is rooted in the complementary idea that there is potential for a bridge between not only science, but also the arts and an

innovation-fueled economy.

This study examined how leisure time interests in the arts relate to entrepreneurship and innovation at work in a large sample (N=7,148) of Americans from the National Longitudinal Survey of Youth 1979 (NLSY79). Self-reported interest in visual arts, music, and literature was analyzed in relation to occupational innovation as indexed by history of business ownership, contributions to work leading to patent

applications, and considering oneself an entrepreneur. Analyses controlled for personality characteristics previously suggested to underlie innovation and creativity, including self-mastery and a willingness to take risks, as well as general educational attainment and math and verbal aptitudes. Findings indicated that individuals who considered themselves entrepreneurs, who started businesses, and who significantly contributed to work leading to patents were more likely to have reported an interest in the visual arts, in particular. This relationship held when controlling for self-mastery, risk-taking, educational attainment and aptitudes. The possibility that shared cognitive styles underlie both pursuit of the visual arts and occupational innovation is explored.

Backing Americans' interests in the visual arts—e.g., painting, drawing, prints, architecture, sculpture—may not only enrich culture, but may constitute a good investment in the economic vitality of the future. As will be described in this report, individuals who consider themselves entrepreneurs, who start businesses, and who have significantly contributed to work leading to patents are not just self-determined, mathematically-savvy risk-takers — they are also art lovers.

BACKGROUND

The existing research on workplace innovation largely focuses on describing the individual-level and organizational-level factors thought to support creative work. At the individual level, cognitive styles and practical abilities have been highlighted for their contributions to creative output (review: Anderson, Potocnik, Zhou, 2014). For example, individuals' mastery of tasks and skills is considered a prerequisite for the generation of useful, novel ideas within a domain (Amabile, 2012). On the other hand, personality factors, such as a tendency to enjoy thinking and to pursue learning for intrinsic reasons such as personal growth, as well as a willingness to take risks or tolerate ambiguity, have also been highlighted as individual-level factors critical to innovation (review: Anderson, Potocnik, Zhou, 2014; Dewett, 2007; Hirst, van Knippenberg, Zhou, 2009; Madjar et al., 2011; Martins & Terblanche, 2003; Zenasni, Besancon, Lubart, 2008).

At the organizational level, a workplace that fosters the individual-level factors behind creative output—such as employees' freedom and time to build skills and develop new ideas—is proposed to promote the creativity that results in innovation; whereas a pressured, excessively critical workplace with risk-averse management has been proposed to stifle worker innovation (Amabile, 1998, 2012). Indeed, a creativitysupporting work environment has been found to not only predict the generation of new products, but also their success in the market (Dul & Ceylan, 2014).

Beyond these cognitive, personality, and work-environment factors—and reflecting the focus of the current research—the creative use of time outside of work is

also likely to influence creative contributions on the job. Recent work has shown that self-reported involvement in creative activity during free time (i.e., the frequency of indicating: "I took part in creative tasks", "I used the time to explore my creative side", and "I expressed myself creatively") predicts on-the-job creativity as rated by the self and co-workers (Eschleman, Madsen, Alarcon, Barelka, 2014). Other work has proposed that broad leisure time interests involving multiple, focused, socially-oriented hobbies are linked to the production of valued inventions (Davis, Hoisl, Davis, 2014). Suggesting that the arts in particular are important to work-related innovation, greater professional impact in scientific research has been found to be associated with greater involvement in arts activities such as visual arts and crafts, music, and literature (Root-Bernstein, Bernstein, Garnier, 1995); and, exceptional innovators including Nobel Prize winners and National Academy of Sciences and Royal Society members are much more likely than the general public to also have hobbies in the arts (Root-Bernstein et al., 2008). Moreover, several key personality factors found in entrepreneurs—such as risk-taking, tolerance of ambiguity, and an internal locus of control-have been found to be highly present in artists and other creative people (Cho & Orazem, 2011; Madjar et al., 2011; Poorsoltan, 2012; Zenasni et al., 2008).

The current study builds upon this prior work and provides, for the first time, a look at how **interests in the arts (visual arts, music, and literature)** relate to **entrepreneurship and innovation at work** in a large sample of typical American workers from a range of occupations. The indices of economic vitality used in this study include the objective measures of history of business ownership and patent

applications, as well as self-reported identity as an entrepreneur. Importantly, personality characteristics previously suggested to underlie innovation and creativity, including self-mastery—a sense of agency and efficacy—and a willingness to take risks, as well as general educational attainment and aptitudes were analyzed alongside the role of arts interests for their contribution to occupational innovation.

METHODOLOGY

THE SAMPLE

The publicly available dataset used in this study was the **National Longitudinal Survey of Youth 1979 (NLSY79)**, sponsored and directed by the U.S. Bureau of Labor Statistics and conducted by the Center for Human Resource Research at The Ohio State University. The initial sample of the NLSY79 included 12,686 individuals (6,403 males and 6,283 females) in 1979. Participants were between the age of 14 and 21 at the time of the first interview (i.e., they were born in the late 1950s and early 1960s), and were interviewed annually beginning in 1979, and then biennially beginning in 1994. In order to assess the relationship between arts interests and occupational innovation, only those who responded to the survey questions about arts hobbies in 1994 (when respondents were mostly in their early thirties) and the occupational innovation variables of interest in 2010 (the most recent survey round; respondents were mostly in their late forties) were included in these analyses, resulting in a sample of 7,148 individuals (details provided in Table 1). Those who had data on self-mastery (N=7,004), willingness to take risks (N=7,099), math (N=6,726) and verbal aptitudes (N=6,723), and educational attainment (N=7,132) were included in analyses involving these variables.

Table 1.

MALES	FEMALES	HISPANIC	BLACK	"NON-BLACK, NON-HISPANIC"
3,461	3,687	1,352	2,222	3,574
(48.4%)	(51.6%)	(18.9%)	(31.1%)	(50%)

MEASURES OF ARTS INTERESTS AND OCCUPATIONAL INNOVATION

In survey year 1994, participants were posed the following question: *"Which of the following activities are you interested in?"* Among the options were three arts activities: **Art** (painting, drawing or prints; architecture; sculpture), **Music** (personalities; genre), and **Literature** (classical; poetry; fiction; humor). Other activities included Automobiles (classic/antique/show auto; racing auto), Cooking (recipes; table display/presentation), Gardening, Movies (personalities; genre), Nature (Sierra Club; landscape/seascape; zoological; underwater), and Sports (personalities; teams; variety). While some of these other activities certainly involve exercising creativity, this research focused on the three **arts activities** (Art, Music, and Literature; See Figure 1

for descriptive statistics). Analyses comparing arts interests to multiple, diverse leisure interests (Cf. Davis et al., 2014) were also conducted (see Appendix).



Figure 1. Percentages and frequency counts of individuals endorsing arts interests in this study.

Although participants' arts interests were only assessed one time, the timing of the assessment is opportune. In 1994, the respondents were between the ages of 29 to 36, likely in the throes of establishing themselves in their careers and adult lives. By examining work outcomes years later in 2010, when respondents were between the ages of 45 to 52 (the most recently available survey year), the analyses may be considered informative as to whether the activities these younger adults did for fun during the earlier life period had any relationship to their occupational innovation down the line, when they were likely at the height of their career achievement. Business ownership, patent applications, and entrepreneurship were assessed (see Figure 2 for

descriptive statistics) with items that asked whether respondents had ever **owned a business**¹, whether "anyone, including the respondent, ever applied for a U.S. **patent** for work that the respondent significantly contributed to", and whether the respondent "considered him/herself an **entrepreneur**" (response choices for all three items were "Yes" or "No"). A combined, continuous "Innovation Index" score was also constructed from these three items by averaging across responses for each item.



Figure 2. Percentages and frequency counts of individuals endorsing indicators of

occupational innovation.

¹ Business ownership item: "We would like to know whether you have ever owned a business. By business, we mean any activity operated with regularity for the purpose of generating income or profit. We are interested in all incorporated companies and partnerships in which you had any ownership share, as well as unincorporated businesses that you may have operated as a sole proprietor, independent contractor, consultant, or free-lancer. This even includes informal businesses such as cleaning services, gardening services, and the selling of goods out of your home, as long as they generated income and were operated on a regular basis. The only businesses we are not interested in are those operated on a highly sporadic basis, those carried out purely as a hobby, and those in which you were merely a shareholder or investor with no role in the operation of the company. Since you were 18 years old, have you ever owned a business that would be of interest to us according to this description?"

MEASURES OF SELF-MASTERY AND RISK TOLERANCE

Self-mastery was theorized to be a necessary factor in a link between arts interests and occupational innovation, since the belief that one can be effective in one's own life has been suggested to be a prerequisite for intrinsic motivation (Schwartz & Waterman, 2006). Intrinsic motivation, in turn, has been proposed to underlie both artistic creativity (e.g., Csíkszentmihályi, 1996) and innovation at work (Amabile, 1997; Hülsheger, Anderson & Salgado, 2009). In this study, **self-mastery** was assessed with the Pearlin Mastery Scale Percentile Score (available from survey year 1992 for 7,004 individuals in this study). This instrument has been found to have good construct validity, and sound internal reliability (Pearlin, Lieberman, Menaghan & Mullan,1981; Seeman, 1991). The scale score was constructed by the NLSY79 from participants' responses to the items shown in Table 2 using a 4-point Likert scale with choices ranging from "strongly agree" to "strongly disagree."

Table 2.

Pearlin Mastery Scale Items

There's no way I can solve the problems I have (reverse-coded) Sometimes I feel that I'm being pushed around in life (reverse-coded) I have little control over what happens to me (reverse-coded) I can do just about anything I really set my mind to I often feel helpless in dealing with the problems of life (reverse-coded) What happens to me in the future mostly depends on me There's little I can do to change important things in my life (reverse-coded). An open attitude toward risk-taking has also been proposed to underlie entrepreneurship, creativity, and artistic pursuits (Cho & Orazem, 2011; Madjar et al., 2011; Poorsoltan, 2012; Zenasni et al., 2008). In this study, risk-taking was measured with an item administered in survey year 2010, available for 7,099 individuals in this study. Participants rated their overall willingness to take risks with the item: "Are you generally a person who is fully prepared to take risks or do you try to avoid taking risks? Rate yourself from 0 to 10 where 0 means "unwilling to take any risks" and 10 means "fully prepared to take risks."

MEASURES OF APTITUDES AND EDUCATIONAL ATTAINMENT

Verbal and mathematical aptitudes and educational attainment were expected to factor into innovation at work since these represent intellectual resources for the formulation of novel ideas. Participants in the NLSY79 were administered the Armed Services Vocational Aptitude Battery (ASVAB) in 1980 (when respondents were approximately 15-22 years old), from which normed percentile scores representing math aptitude (constructed from the Arithmetic Reasoning and Mathematics Knowledge items, N=6,726) and verbal apttude (constructed from the Word Knowledge and Paragraph Comprehension items, N=6,723) were available. Scores were renormed twice (in 1989 and 2006) based on changes in standards (Ing, Lunney & Olsen, N.D.) Highest grade completed (HGC) for which credit was received as of 2010 was the measure of educational attainment (N=7,132; See Figure 3). HGC was nearly evenly split between the high school level (51%) and college level (46%) in the sample.



Figure 3. Frequency counts of highest grade completed by respondents.

DATA ANALYSIS

The data analysis procedures used in this study are presented along with the relevant research questions.

Question 1. How do arts interests (visual arts, music, and literature) relate to entrepreneurship, history of work contributing to patent

applications, and history of business ownership?

Representing an investigation into the primary research question, a series of three logistic regression analyses tested the predictive power of the arts variables (arts interests in three domains entered simultaneously in a single step: visual arts, music, and literature) for the occupational innovation variables: (a) entrepreneurship, (b) patent application history, and (c) business ownership. Additionally, a linear regression analysis (d) used the "Innovation Index" as the dependent variable (Table 3).

Question 2. Do *personality factors* (self-mastery and willingness to take risks) influence the strength of associations between arts interests and occupational innovation?

Representing an investigation into the secondary research question, the analyses conducted for Question 1 were repeated for Question 2 with self-mastery score and willingness to take risks entered with the arts interests in a single step as the predictor variables (Table 4).

Question 3. What is the contribution of *verbal* and *mathematical aptitudes* and *educational attainment* to occupational innovation, in relation to the contribution of arts interests and personality factors?

The analyses from Question 2 were repeated for Question 3 with arts interests, personality factors, verbal and math scores, and highest grade completed, entered simultaneously into step one (Table 5).

The results of analyses examining how pursuit of multiple, diverse leisure time interests rather than art-specific interests relates to occupational innovation are presented in the Appendix.

RESULTS

ARTS INTERESTS AND OCCUPATIONAL INNOVATION

Question 1. How do *arts interests* (visual arts, music, and literature) relate to entrepreneurship, history of work contributing to patent applications, and history of business ownership?

The results of four regression analyses with arts interests (visual arts, music, and literature) entered simultaneously in a single step to predict: (a) entrepreneurship, (b) patent application history, and (c) business ownership, and (d) combined innovation index are presented in Table 3. Interest in the visual arts ("ART") was the sole predictor of entrepreneurship, business ownership, and the innovation index. Both visual arts and literature interests ("ART" and "LIT") predicted work contributing to patent applications. Thus, the primary hypothesis of this research, that arts interests would be associated with occupational innovation in the general population of American workers, is supported. Specifically, interest in visual arts (painting, drawing, prints,

architecture, sculpture) was found to consistently predict all tested indicators of innovation: considering oneself an entrepreneur, significantly contributing to work that led to patent applications, history of business ownership, and the combined innovation index score.

Table 3.

Results of Regression Analyses Indicating the Role of Arts Interests in Occupational

Innovation

	(a)	Entrepr	eneurship		(b) Patent Application				(c) Business Ownership				(d) Innovation Index		
	В	SE	Wald	OR	В	SE	Wald	OR	В	SE	Wald	OR	В	SE	β
ART	0.295	0.069	18.241***	1.344	0.660	0.219	9.092***	1.935	0.258	0.076	11.518***	1.295	0.030	0.006	0.062**
MUSIC	0.041	0.065	0.400	1.042	-0.389	0.220	3.135	0.678	-0.114	0.071	2.539	0.892	-0.004	0.005	-0.010
LIT	-0.093	0.066	1.997	0.911	0.522	0.218	5.73*	1.685	0.111	0.072	2.37	1.117	0.002	0.005	0.005
			C&S R	C&S R-square						C&S R	<i>R</i> -square				
				0.003	0.003							0.004			

Note. ART = "Art (painting; drawing or prints; architecture; sculpture)", MUSIC = "Music (personalities; genre)", LIT = "Literature (classical; poetry; fiction; humor)." B = Unstandardized Coefficient, SE = standard error, OR = odds-ratio, β = Standardized Coefficient. *** = p < .001, ** = p < .01, * = p < .05.

THE ROLE OF PERSONALITY FACTORS

The results of the secondary analyses are presented next.

Question 2. Do personality factors (self-mastery and willingness to take

risks) influence the strength of associations between arts interests and

occupational innovation?

Table 4 presents the results of regression analyses examining the role of personality factors (self-mastery and willingness to take risks) in the associations between arts interests and occupational innovation. Results reveal that interest in the visual arts (painting, drawing, prints, architecture, sculpture) again consistently predicted all indicators of innovation: considering oneself an entrepreneur, significantly contributing to work that led to patent applications, history of business ownership, and the innovation index score—even when the personality factors of self-mastery and willingness to take risks were factored in. When self-mastery and risk-taking were factored in, an interest in literature also predicted entrepreneurship, a slight difference from the primary findings.

Table 4.

Results of Regression Analyses Indicating the Role of Personality Factors in the Relationships between Arts Interests and Occupational Innovation

		(a) Entrepreneurship				(b) Patent Application				(c) Business Ownership				(d) Innovation Index		
	В	SE	Wald	OR	В	SE	Wald	OR	В	SE	Wald	OR	В	SE	β	
ART	0.237	0.072	10.851***	1.267	0.603	0.22	7.492***	1.827	0.227	0.078	8.465**	1.254	0.026	0.006	0.052***	
MUSIC	0.011	0.068	0.024	1.011	-0.408	0.22	3.433	0.665	-0.14	0.073	3.666	0.87	-0.007	0.005	-0.016	
LIT	-0.137	0.069	3.971*	0.872	0.504	0.22	5.27*	1.655	0.07	0.074	0.904	1.073	-0.003	0.005	-0.006	
SELF-M	0.005	0.001	23.444***	1.005	0.004	0.004	0.95	1.004	0.005	0.001	16.005***	1.005	0.000	0.000	0.063***	
RISK	0.185	0.011	262.058***	1.203	0.151	0.038	15.758***	1.163	0.129	0.012	112.624***	1.138	0.015	0.001	0.202***	
			C&S R	-square		C&S R-	-square	C&S R-square						R-square		
				.047	.005					.022				.051		

Note. ART = "Art (painting; drawing or prints; architecture; sculpture)", MUSIC = "Music (personalities; genre)", LIT = "Literature (classical; poetry; fiction; humor)", SELF-M = Self-Mastery score, RISK = Willingness to Take Risks. *B* = Unstandardized Coefficient, *SE* = standard error, *OR* = odds-ratio, β = Standardized Coefficient. *** = *p* < .001, ** = *p* < .01, * = *p* < .05.

Also shown in Table 4, self-mastery was a significant predictor of entrepreneurship, business ownership, and the innovation index (but not patent applications). A willingness to take risks strongly predicted all indicators of occupational innovation, a finding supported by previous research (Madjar et al., 2011; Dewett, 2007; Martins & Terblanche, 2003; Zenasni et al., 2008). Again, critically, the effect of art interests was not accounted for by either personality factor. This suggests that above and beyond a willingness to take risks and a sense of effectiveness and control of one's life, an interest in the visual arts remains an independent predictor of occupational innovation broadly, and an interest in both the visual arts and literature relates to being a contributor to work leading to patent applications.

THE ROLE OF APTITUDES AND EDUCATIONAL ATTAINMENT

The results of analyses addressing the following question are presented below.

Question 3. What is the contribution of *verbal* and *mathematical aptitudes* and *educational attainment* to occupational innovation, in relation to the contribution of arts interests and personality factors? Table 5.

Results of Regression Analyses Indicating the Role of Aptitudes, Educational

Attainment, and Personality Factors in the Relationships between Arts Interests and

Occupational Innovation

		(a) Ent	repreneursh	(b) Patent Application				(3c) Business Ownership				(d) Innovation Index				
	В	SE	Wald	OR	В	SE	Wald	OR	В	SE	Wald	OR	В	SE	В	
ART	0.262	0.075	12.255***	1.299	0.483	0.232	4.318*	1.621	0.24	0.082	8.668**	1.271	0.026	0.006	0.054***	
MUSIC	0.014	0.07	0.038	1.014	-0.35	0.229	2.333	0.704	-0.129	0.076	2.894	0.879	-0.006	0.005	-0.015	
LIT	-0.056	0.075	0.559	0.946	0.036	0.239	0.023	1.037	-0.107	0.081	1.739	0.899	-0.007	0.006	-0.017	
SELF-M	0.005	0.001	20.239***	1.005	-0.003	0.004	0.673	0.997	0.003	0.001	4.242*	1.003	0.000	0.000	0.048***	
RISK	0.179	0.012	228.182***	1.196	0.189	0.046	17.065***	1.208	0.137	0.013	106.253***	1.147	0.014	0.001	0.194***	
VERBAL	-0.013	0.002	42.608***	0.987	-0.006	0.007	0.947	0.994	0.002	0.002	0.527	1.002	-0.001	0.000	- 0.087***	
MATH	0.007	0.002	10.809***	1.007	0.02	0.007	9.253**	1.02	0.012	0.002	28.544***	1.012	0.001	0.000	0.116***	
HGC	0.065	0.016	16.634***	1.068	0.223	0.049	20.296***	1.249	-0.01	0.017	0.32	0.99	0.004	0.001	0.046**	
		C&S R-square				C&S R-square			C&S R-square				R-square			
				.054				.015				.037			.058	

Note. ART = "Art (painting; drawing or prints; architecture; sculpture)", MUSIC = "Music (personalities; genre)", LIT = "Literature (classical; poetry; fiction; humor)", SELF-M = Self-Mastery score, RISK = Willingness to take risks, HGC = Highest grade completed. *B* = Unstandardized Coefficient, *SE* = standard error, *OR* = odds-ratio, β = Standardized Coefficient. *** = p < .001, ** = p < .001, ** = p < .05.

The analyses reported in Table 5 reveal that interest in the visual arts (painting, drawing, prints, architecture, sculpture) again consistently predicted all indicators of innovation: considering oneself an entrepreneur, significantly contributing to work that led to patent applications, history of business ownership, and the innovation index

score—even when personality factors, verbal and math aptitudes, and educational attainment were factored in. The effect of an interest in literature on patent applications and entrepreneurship (see Table 4) appears to have been accounted for by the addition of these factors in the models.

Specifically, in order of their positive contribution to the outcome variable in the models (Table 5), risk-taking, highest grade completed, art interest, and math aptitude predicted entrepreneurship; highest grade completed, risk-taking, math aptitude and art interest predicted work leading to patent applications; risk-taking, math aptitude, art interest and self-mastery predicted history of business ownership; and risk-taking, math aptitude, art interest, self-mastery, and highest grade completed predicted the innovation index. Verbal aptitude was actually a reverse predictor of considering oneself an entrepreneur and the innovation index.

Thus, while intellectual resources (particularly math aptitude) and education attainment are important predictors of occupational innovation, the effect of an interest in the visual arts remains significant alongside these factors.

SUMMARY: THE IMPORTANCE OF VISUAL ARTS

Across all analyses, an interest in the visual arts was a significant predictor of the tested indicators of innovation at work. Specifically, endorsing an interest in painting, drawing or prints; architecture; sculpture in 1994 (when respondents were between 29 and 36), predicted history of owning a business, contributing to work that led to patent applications, and considering oneself an entrepreneur several years down the line (when respondents were between 45 and 52). Interest in visual arts remained a significant predictor even when other control variables were factored in, including a sense of self-mastery, a willingness to take risks, verbal and mathematical aptitudes, and educational attainment. This suggests that there is something about a love of art beyond shared personality characteristics or associated intellectual and educational factors—that seems important to being a contributor to economic vitality and innovation in the United States workforce.

DISCUSSION

Why might an interest in the visual arts be consistently linked with the present indicators of occupational innovation: contributing to work leading to patent applications, history of business ownership, and considering oneself an entrepreneur? The results cannot be accounted for the shared personality factors of self-mastery and willingness to take risks, since visual arts interest remained a significant predictor of all the outcome variables even when these factors were included in the models (Amabile, 1997; Csíkszentmihályi, 1996; Hülsheger et al., 2009; Madjar et al., 2011; Dewett, 2007; Martins & Terblanche, 2003). Moreover, an interest in visual art is not a stand-in for general intelligence or access to higher levels of education. Indeed, when math and verbal aptitudes and highest grade completed were added to the models, visual arts interest consistently retained significance as an independent predictor.

It is possible that other shared psychological factors not tracked by the NLSY79 drive a pursuit of the visual arts and also the creation of one's own business, the ability to come up with new ideas for products, and a positive attitude toward entrepreneurship. These could include divergent thinking ability; a general tolerance of ambiguity; a willingness and skill for adapting privately-generated concepts into publicly-appreciable outcomes; and visual cognitive skills including attention to object-based distinctions in style, color, and form. Most likely, a combination of these factors is important.

TAKING ONE'S IDEAS INTO THE WORLD: LINKS BETWEEN ARTS AND ENTREPRENEURSHIP

Divergent thinking, or the ability to come up with multiple, original solutions to problems, has long been identified as foundational to creativity (e.g., McCrae, 1987). Suggesting it may also be important in occupational innovation as well, recent research has found divergent thinking to factor into the ideation style of successful entrepreneurs (Ames & Runco, 2005). It may be the case that having the ability to produce a number of unique ideas provides the necessary raw material for both artmaking and business creation. It is also possible that a tendency to be tolerant of ambiguity and to maintain productive thinking in the midst of uncertainty support this kind of fruitful idea generation across the art and business domains (Zenasni et al., 2008; Begley & Boyd, 1987; Bhuian, Richard & Shamma, 2010). However, how an individual manages and exploits his or her own novel ideas remains an important, separate issue. One possibility is that, for many people, starting a business is similar to an art project involving the strategic curation of ideas. For example, the process of branding, which involves coming up with an overarching business concept that is both functionally and stylistically fitting for a target market is comparable to the process of coming up with a concept for a painting and producing something that the artist believes will be viewed, understood and appreciated by the audience or gallery attendees (Schroeder, 2005). That is, art-making, like starting a business or coming up with novel, patent-worthy ideas, involves taking a privately-generated concept and making it available and appropriate for public consumption. Perhaps, it is the ability and motivation to have the contents of one's mind symbolized into imagery and received by the community-at-large that bridges the visual arts and occupational innovation.

The promotion of one's products involves taking a risk with the expression of one's ideas—the representations of one's ideas may be rejected by culture. However, there is more to this process than just risk-taking and culturally-tuned self-expression. There is also an intense process of making something "from scratch" that did not previously exist in the world. In the case of the visual arts, the product is a viewable object. Likewise, most businesses and patent-worthy ideas involve creating an actual physical object, establishing a storefront, or, at the least, producing viewable marketing materials consisting of meaningful images. Here is where certain cognitive processes, or tools of thinking, may link the visual arts and occupational innovation (Root-

Bernstein & Bernstein, 1999). Namely, the ability to imagine and model novel objects is likely to be helpful for both art-making, and the planning, designing, and marketing of a new business or product. Vividness of mental representations of objects (in contrast to spatial relations; Kozhevnikov, Kosslyn & Shephard, 2005) may be a key process involved in the links between the visual arts and occupational innovation. Differing from general spatial ability which involves dynamic mental transformations, object visualization ability involves producing detailed, high-resolution mental images and extracting holistic, global characteristics of visual scenes or objects (Kozhevnikov et al., 2005). This visual cognitive ability could drive the link between an interest in visual art-making and being an entrepreneur, as this skill could make it easier to bring products "to life" in ways that effectively reach and impact consumers.

IMPLICATIONS AND FUTURE DIRECTIONS FOR RESEARCH & POLICY

Further inquiry into how the arts factor into economic and intellectual vitality at an individual level will help define what limits or potentiates the association revealed by these analyses. Specifically, precisely describing what links the visual arts and entrepreneurial activity will be necessary. The collection of data on adults' arts involvement in greater detail, as exemplified in the National Endowment of the Art's Survey of Public Participation in the Arts (SPPA; NEA, 2009), may aid in this processs. Moreover, tracking underlying creative abilities and associated psychological processes (e.g., divergent thinking, tolerance for ambiguity, visual object

representation skills, motivation toward self-expression and cultural engagement) would be a novel and useful addition to surveys by organizations interested in tracking entrepreneurship and occupational innovation (such as the Bureau of Labor Statistics' National Longitudinal Surveys, or the Economic Census). Furthermore, survey items assessing workplace innovation and success of entrepreneurship may be useful addons to the SPPA.

Fostering creativity, inspiring innovation, and invigorating the economy is of interest to educators, policy-makers, and business leaders. While it is a natural assumption that creativity and innovation are to be found in abundance in artistic pursuits, and it has been claimed that ground-breaking ideas have roots in universal creative processes (e.g., Root-Bernstein, 2003) this research demonstrates for the first time that an interest in the visual arts (e.g., painting, drawing, prints, architecture, sculpture) predicts objective indicators of occupational innovation in the general population of American workers. Because arts interests earlier in adulthood were connected to later work outcomes, the findings of this research may be informative to those interested in how they might currently support and invigorate the lives of the innovators of tomorrow. That a history of business ownership, entrepreneurship, and work contributing to patent applications were consistently predicted by interest in the visual arts suggests that backing Americans' art interests may be a particularly good investment in the economic vitality of the future.

APPENDIX

ADDITIONAL RESULTS

How do arts interests compare to having diverse leisure time interests in predicting occupational innovation?

Recently, it has been proposed that diversity of leisure time interests may be critical to novel idea generation at work (Davis, Hoisl, Davis, 2014). To compare the contribution of specifically arts interests versus having multiple, diverse leisure time interests in predicting occupational innovation, significant arts predictors determined from the results of analyses for Question 1 (i.e., visual arts for entrepreneurship, business ownership, and the innovation index; visual arts and literature for patent application history) were entered in step one, and an indicator of broad leisure time interests (constructed from the total sum of all endorsed interests: "Activities Sum") was entered in step two to determine whether Activities Sum accounted for the effects of the arts interests.

Interest in visual arts maintained significance for all outcome variables (entrepreneurship: Wald = 5.68, p=.017, business ownership: Wald = 5.51, p=.019, patent applications: Wald = 5.09, p=.021, and the innovation index: β = .045, p=.001) when the Activities Sum variable representing diverse leisure time interests was entered into the model. The Activities Sum variable was also a significant predictor of

entrepreneurship (Wald = 5.57, p=.018) and the innovation index (β = .035, p=.01), but not of business ownership (p=.117) or patent applications (p=.779). Interest in literature dropped to non-significant (p = .091) when the Activities Sum variable was entered into the model for patent applications. These results indicate that visual arts interest in particular, and not having many interests in a broad range of activities, is a better predictor of occupational innovation as measured in this study.

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DATASET

The publicly available dataset used in this study was the National Longitudinal Survey of Youth 1979 (NLSY79) accessible here: <u>http://www.bls.gov/nls/nlsy79.htm</u>. Data may be obtained via the NLS Investigator (<u>https://www.nlsinfo.org/investigator/pages/login.jsp</u>). A bibliography of journal articles, working papers, conference presentations, and dissertations using the NLSY79 cohort is available here: <u>https://www.nlsinfo.org/bibliography/search/cohort=NLSY79</u>.