Problem Structuring and Creativity – Effects of Work-Time and Need for Cognitive Closure

When speaking on his philosophy, the 2016 Pritzker laureate Alejandro Aravena said "There is nothing worse than giving a good answer to the wrong question". Following Aravena's philosophy, it is worth asking first, what role does searching for a 'right question' play in the design process. Second, how does this search affect creativity, as creativity has a tremendous influence on the outcome's desirability and suitability. Third, under what conditions can such a search take place. Problem-Structuring is under-studied in creativity research, 'structuring' being an on-going process of self-interpretation of a problem while working on a solution with the goal of finding the 'right question' (Goel, 1994; Schön, 1984). This study aims at exploring the effects of Problem-Structuring on creative performance, which is defined as outcomes that are both novel and useful (Amabile, 1996). The context of the study is the domain of architectural design, wherein the possible direct and indirect effects of Work-Time, Need for Cognitive Closure (NFCC), and Problem-Types are considered.

A positive relationship between Work-Time and creativity is an early and robust finding in creativity research (Christensen, Guilford, & Wilson, 1957). Nevertheless, plausible explanations about the Work-Time and creativity relationship are scarce. The Serial-Order effect (Mednick, 1962), which states that ideas tend to get more novel as time progresses, is a widely accepted explanation that captures well creative performance in divergent-thinking tasks, but less so for more complex tasks that involve both divergent and convergent thinking. Drawing on a theory of Co-evolution of Problem and Solution spaces (Dorst & Cross, 2001), we hypothesize that Problem-Structuring mediates the positive effect of Work-Time on creativity in complex tasks, such that the larger the amount of time individuals spend on a task, the more efforts they put into Problem-Structuring, and hence the more creative their outcomes are. We proceed to suggest that Problem-Structuring interacts with NFCC (Webster & Kruglanski, 1994) - one's sense of urgency to reach a solution, so that one's sense of uncertainty is decreased - such that the positive relationship between Problem-Structuring and creativity is stronger for individuals with a low (rather than high) NFCC. Finally, we suggest that open problems (non-specific) that are originality oriented will have a stronger positive effect on creativity than problems that are either usefulness oriented or closed (specific), as the former problems pose fewer constraints, and leave more room for choice and exploration (Dillon, 1982; Getzels, 1975).

The uniqueness of this study is in zooming into architects' Problem-Structuring processes, on the course of solving a creative design problem, by asking them to "think aloud" and recording their verbalizations (van Someren, Barnard, & Sandberg, 1994). This enabled us to use a non-obtrusive measure of Problem-Structuring. Additionally, we assessed the architects' sketches for creativity. We designed an experimental field study, allocating professional architects and advanced students of architecture (n=48) to two experimental conditions with four problem types: type 1 – originality/usefulness oriented problems, and type 2 – open/closed problem presentation. Sessions were conducted individually with each participant, and lasted about 1.5 hours. Participants also filled out the shortened scale of NFCC (Roets & Van Hiel, 2011; Tadmor, Hong, Chao, Wiruchnipawan, & Wang, 2012). Problem Structuring was blindly assessed by three independent coders according to recordings of the participants' verbalizations (Atman, Chimka, Bursic, & Nachtmann, 1999; Ericksson & Simon, 1993; Goel & Pirolli, 1992). Three independent expert judges, who were blind to the experimental conditions, provided novelty and usefulness ratings to the final designs.

The findings provide partial support to our hypotheses, such that Problem-Structuring had a positive effect on the outcomes' novelty. The indirect effect of Work-Time on novelty through Problem-Structuring was positive for individuals whose NFCC was low (.21, .13, [.01, .56]), but not for those whose NFCC was high (-.01, .07, [-.16, .12]). The effect of originality oriented problems on novelty was positive for open-problems

(1.08, .39, [.29, 1.86]) but not for closed ones (-.29, .43, [-1.16,.59]). Finally, closed-problems had a positive effect on outcomes' usefulness (.70, .32, [.05, 1.36]). A qualitative analysis of participants' answers to open debriefing questions gives further ground to the Work-Time and Problem-Structuring positive relationship, while demonstrating how a short Work-Time results in: a) focusing on the outcome's physical-properties, b) neglecting purposes and goals – which form the 'right question' and are the result of problem structuring, and c) having difficulty in self-evaluating the proposed design along the process. Moreover, the answers provide initial indication of a possible compensating relationship between the kind of information designers seek and the outcome's creativity. While designers who stated that not enough information was present about the expected physical properties of the outcome - received high novelty scores, at the same time their designs tended to be less useful. Contrary, designers who stated that information concerning purposes and goals was missing received high usefulness scores. Regardless, individuals who stated that handling purposes and goals (i.e. Problem-Structuring) came easy to them were more likely to be more novel.

To summarize, this study uncovers the process of Problem Structuring, how it is affected by the duration of time spent on task, and how it affects outcomes' novelty. Moreover, it establishes the effects of problems' orientation and presentation on the novelty and usefulness of outcomes. The utilization of a unique methodology allowed us to deepen the understanding of Problem-Structuring and to validate its positive effect on outcomes' novelty. Finally, this study lists NFCC as influential on the relationship between Problem-Structuring and novelty, while demonstrating that counter intuitively, Work-Time or Problem-Structuring are not directly affected by NFCC.

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How To Measure A Person's Innovation Insights? The Development And Validation Of A Situational Judgment Test of Innovation Skills

Organizations have been focusing increasingly on innovation during the last decades. They have become more aware of the importance of the innovation skills and knowledge of their employees (Anderson, Potocnik, Zhou, 2014). As a result, organizations are focusing more on selecting employees with strong innovation skills, which requires a valid measurement for these skills. To date innovation skills have most frequently been measured with self-report questionnaires. However, self-report questionnaires are characterized by the disadvantage of mostly measuring persons' perceptions about their own skills. This can be problematic as research shows that people tend to overestimate their own abilities (Zell & Krizan, 2014; Sitzmann, Ely, Brown, & Bauer, 2010). An alternative assessment-instrument for selection environments, is a Situational Judgment Test (SJT). These kind of tests provide the opportunity to present realistic and work-related problem situations and a number of response options to candidates. The different response options differ in the way they score high or low on the measured dimension. For each situation the candidate needs to select the most appropriate response option (Lievens, Peeters, & Schollaert, 2008). A person's performance on these low-fidelity tests is a good predictor of their future behaviors in the workplace, as the behavioral responses candidates select in the test give an indication of how they would behave in similar situations in real-life (Wernimont, Campbell, 1968; Motowidlo & Beier, 2010). For organizations a situational judgment test of innovation skills can be an interesting and beneficial selection instrument to identify promising candidates who outperform others in the innovation process, as it provides a more indirect and situated measurement than self-report measurements (Bledow & Frese, 2009), and gives more insights in how the candidate would behave during future innovation processes, which is essential for the organization's success. The goal of this study was to develop and validate an improved measure of innovation skills and this resulted in a standardized, web-based, situational, and evidence-based test of innovation skills. More specifically, it taps one's skills for succeeding throughout the three phases of the innovation process, namely ideation, championing and implementation (Janssen, 2001).

METHOD

The presented scenario's in SJTs can be developed either deductively or inductively (Lievens, Peeters, & Schollaert, 2008). We chose to develop the SJT of innovation skills through induction, which means it is based on critical incidents of innovative performance. Critical incidents are real-life examples of situations in which someone performed exceptionally well or bad (Flanagan, 1954). For this SJT, we interviewed 26 innovation experts and collected more than 150 critical incidents which covered either the ideation, championing or implementation phase of the innovation process. The experts held varying managerial positions in small, medium or large enterprises from various industries, which were highly involved in realizing innovation inside and outside their organizations. Subsequently, the collected critical incidents were sorted in order to combine similar incidents, exclude inadequate incidents and to

allocate each of the incidents to one of the three innovation phases. Next, the critical incidents were converted into scenario's for the SJT. Several criteria were taken into account, such as avoiding redundancy, reformulating all incidents in a general way, and ensuring all cases were equal in length and complexity. This resulted in 70 initial scenario's, which were reduced to 30 after a first selection. Subsequently, we applied the inductive method for generating response options. We invited 23 innovation experts and 18 laypeople to generate actions which vary in effectivity for each scenario. Resulting in 1500 actions for the 30 cases remaining in this development stage. Next, we sorted all actions to exclude doubles and inadequate responses, and ensured they were all about equal in length and were generalizable. Further, we chose to develop a SJT which is scored based on an expert-based scoring key (Lievens, Peeters, & Schollaert, 2008). Thus, to be considered correct, the participant needs to choose the response option that is judged most effective by a group of innovation experts. Therefore, the 600 responses remaining in this development stage were evaluated by 23 other innovation experts. The effectivity of each response was rated by 8 experts on a 7-point effectivity scale. The effectiveness of each response was determined by calculating its average rating. We computed the degree of agreement between the raters and options for which there was no reasonable level of agreement between the experts were excluded.

The final SJT presents candidates 15 scenarios related to the innovation process, five for each phase of the innovation process. Each scenario is repeated 7 to 13 times, but each time a different pair of responses is presented of which the candidate needs to select a response. The response pairs, 150 in total, vary in difficulty. We decided to measure the skills for the three innovations each independently by observing how the participant responds to separate scenarios for the ideation, championing, and implementation-phase of the innovation process. As such, our SJT can be perceived as a test which consists of three underlying tests.

To validate the situational judgment test of innovation skills we conducted a study with a diverse group of 266 employees from diverse organizations. This gave us the opportunity to test multiple hypotheses about the nomological network. The participants were invited to fill out the SJT of innovation skills, a questionnaire asking about their demographic variables, and various scales to investigate the internal consistency, convergent, discriminant and predictive validity of the SJT (Christian, Edwards, & Bradley, 2008).

RESULTS

Results from our validation study showed that the SJT of innovation skills has adequate validity. ***Internal consistency***. The empirical IRT reliability for the total innovation test score was .73, for ideation 0.59, for championing 0.69, and for implementation .69, these results for internal consistency can be considered as good, as the internal consistency of SJTs tends to vary between .40 and .90 and is on average lower than for self-report measures. ***Convergent validity.*** The chance by which the population answers a test item correctly explains 32% of the variance in item-difficulty (i.e. difference in effectivity rating between the two response options in each pair) as rated by innovation experts. For

comparison, cognitive ability explains about the same amount of variance in supervisor-ratings of employee performance. Various studies show a weak to moderate correlation between the personality trait 'openness for experience' and measures of innovative work behavior. Therefore we expected that people with an open personality would on average also have higher scores for the SJT. All three innovation skills, showed a positive correlation with an open personality, $r = .23$ ($p < .01$) for ideation, $r = .23$ ($p < .01$) for championing, and $r = .26$ ($p < .01$) for implementation. The total innovation test score showed a correlation of $r = .23$ ($p < .01$) with an open personality. As challenging jobs help people to gain expertise in solving issues that might also be relevant in the innovation context, we expected that people in challenging jobs will on average also have higher scores for the SJT. All three innovation skills, showed a positive correlation with self-rated job challenge, $r = .15$ ($p < .05$) for ideation, $r = .13$ ($p < .05$) for championing, and $r = .15$ ($p < .05$) for implementation. The total innovation test score showed a correlation of $r = .16$ ($p < .05$) with job challenge. All three innovation skills measured by the SJT, showed a positive correlation with self-rated innovative performance, $r = .19$ ($p < .01$) for ideation, $r = .13$ ($p < .05$) for championing, and $r = .16$ ($p < .01$) for implementation. The total innovation test score showed a correlation of $r = .18$ ($p < .01$) with self-rated innovative work behavior. Stronger associations should not be expected, as the SJT is not a self-report measure of IWB. All three innovation skills, showed a positive correlation with cognitive ability, $r = .26$ ($p < .01$) for ideation, $r = .24$ ($p < .01$) for championing, and $r = .25$ ($p < .01$) for implementation. The total innovation test score showed a correlation of $r = .26$ ($p < .01$) with cognitive ability. As cognitive ability is a strong predictor of performance in general, one should reasonably expect that any behavioral assessment test correlates with cognitive ability. All these results support the convergent validity of the SJT of innovation skills. ***Divergent validity.*** All three innovation skills measured by the SJT and the total innovation test score, are uncorrelated with conscientiousness and with self-rated organizational citizenship behavior. These results support the divergent validity. ***Predictive validity.*** The total innovation score shows a positive and marginally significant association with supervisor ratings of employee innovative performance St.Bèta = .10 ($p = .05$).

CONCLUSION

This study examined the effectiveness of measuring innovation skills with a situational judgment test and focuses on the development and validation of this test. A thorough process was followed based on an expert model for developing the test. Positive results were found to measure innovation skills with this situational judgement test. We can conclude that situational judgment tests are a promising method for assessing innovation skills and can contribute to improving the validity of measurement in organizations.

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"I am going to die if I continue in a corporate job":
Navigating the transition to claiming creative identity at work

A large body of evidence has established that we are highly motivated to claim positively valenced identities. Research on the above-average effect (e.g. Kruger & Dunning, 1999) has established our propensity to rate ourselves highly on everything from intelligence and social status to leadership ability and immunity to bias. However, creativity appears to be a notable exception to this otherwise robust phenomenon. For instance, a recent HBR headline read "Crush the 'I'm not creative" barrier" (Dyer, Gregersen & Christensen, 2012). Why is creativity a difficult identity to claim? What psychological and emotional barriers must individuals navigate when seeking to enact a creative identity at work? To build theory on claiming creative identity I used an inductive, interview-based approach to examine the experience of professionals seeking to transition from 'corporate' into more creative work with the help of Escape the City, a London-based organization that runs 3-month intensive career change workshops called Tribes.

Creative identity. The creativity literature has linked creativity to the self with two constructs: creative self-efficacy (Tierney & Farmer, 2002) -- whether an individual feels confident that she can be creative in a given task -- and creative personal identity (Jaussi, Randel & Dionne, 2007) -- whether creativity is important to an individual's self-definition. Both have been found to increase creative performance. Yet two limitations characterize the way the creativity literature has approached creative identity. First, it has primarily considered identity as a static construct, despite the fact that the identity literature has established that identity is dynamic (Markus & Wurf, 1987). Second, it has focused primarily on creative 'stars' (e.g., Simonton, 1997; Goncalo, Vincent, & Audia, 2010). It remains unclear how 'average' individuals can transition to claiming a stronger creative identity.

METHODS

Research context. I selected Escape the City as a site for studying creative identity transitions for three reasons. First, it was important to find a context where individuals were in the middle of an identity transition to avoid both the ambiguity of the initial ideation phase and the optimism of hindsight. Second, I needed a context where individuals were transitioning from less-creative to more-creative work. Finally, individuals needed to be psychologically invested in the transition. Escape the City's Tribe program requires a significant investment in terms of resources (£2,300) and time (12 weekly 3-hour sessions and five weekends).

Data collection. On the first day of the Tribe (43 participants) I announced my request for individuals who are seeking to transition into more creative work. I conducted the first round of in-depth semi-structured interviews with all 19 volunteers and the Tribe leader within the first few weeks. The findings below are from the data of this first phase. A second phase of interviews will be conducted a month after the Tribe program finishes. The informants are diverse in terms of industry sector and demographic characteristics.

PRELIMINARY FINDINGS

The data revealed three distinct paths individuals follow to claim creative identity, three elements of the implicit theories of creativity they employ in the process and the cognitive and emotional barriers involved in navigating the transition.

Paths to claiming creative identity. Data analysis revealed three distinct paths to claiming a creative identity. Individuals on the Liberation path had their creative identity validated since childhood but have felt the enactment of that identity blocked at work. Those on the Awakening path never considered themselves creative until they received positive creativity-related feedback and enjoyment from work or leisure activities that accumulated over time into a

desire to seek a creative outlet at work. Finally, those on the Redemption path attempt to reclaim a previously abandoned creative identity.

Expanding definition. The data reveal an expanded definition of creativity in three ways. First, creativity is universalized to apply to everyone. Informants repeatedly emphasized that they believe "everyone is creative". Second, creativity becomes a way of being that is separate from the type of task being performed. This is related to but distinct from the concept of play (Mainemelis, & Ronson, 2006). Finally, the definition of creativity as self-expression emerged from the data. Informants spoke of wanting to recognize themselves in or see their fingerprints on the product of their work.

Navigating the transition. The transition to claiming a creative identity was fraught with cognitive and emotional barriers. Informants spoke of needing to release limiting beliefs that 'work is not supposed to be fun', that 'there is one right way of doing things' and that 'failure is personal'. Emotional barriers involved awareness of the 'inner critic', replacing it with the voice of the 'true self', acknowledging the fear of rejection and engaging in self-care practices.

CONCLUSION

My preliminary findings suggest three contributions of this research project to the academic literature. First, it establishes creative identity as a dynamic construct by showing how individuals transition to claim a creative identity. Second, to my knowledge the academic literature has not yet established that claiming a creative identity can be more problematic than other positive identities. This research provides evidence that creative identity is precarious and that claiming it is not straightforward. Finally, this work contributes to implicit theories of creativity by highlighting that employees may see creativity as much more than just the generation of novel and useful ideas and rather as self-expression.

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A Route to Insight via Another's Pain:

The Facilitating Effect of Schadenfreude on Creativity

Abstract

The present research investigates whether experiencing schadenfreude – the malicious pleasure felt at another's misfortune – enhances creativity. Across four studies (n = 597), we found that incidental schadenfreude enhanced individuals' performance on insight creativity tasks. These effects are present both when schadenfreude is elicited in situ (Experiments 1, 2, and 3) and when participants recall experiencing schadenfreude (Experiment 4), and across multiple behavioral measures of creativity. In Experiment 3, we found that the facilitating effect of schadenfreude could be partially explained by schadenfreude freeing attentional resources as evidenced by performance on the Eriksen Flanker Task. In Experiment 4, we found that the relationship between schadenfreude and creativity was moderated by trait approach motivation, such that the creativity-facilitating effect of schadenfreude was significantly stronger for those low (versus high) in approach motivation.

Schadenfreude – the pleasure that results from another's misfortune (Smith, 2013; Takahashi et al., 2009) – has been described as the worst emotion humans are capable of experiencing, even labeled "the laughter of hell" (Schopenhauer, 1897). Indeed, schadenfreude has been linked to hostile interpersonal and intergroup behavior (Spears & Leach, 2004). Yet schadenfreude is also acknowledged to be a near-universal emotion. Why is this morally dubious emotion so pervasive if it is so destructive? In this research, we suggest that incidental schadenfreude may have a previously unrecognized benefit – namely, that it facilitates creativity.

While there have been only a few investigations of the benefits of schadenfreude, there is some evidence that it bolsters self-esteem (via downward social comparison) and may reinforce ingroup identity by reinforcing the distinction between ingroup and outgroup (Spears & Leach, 2004; van Dijk & Ouwerkerk, 2014). These findings help explain why schadenfreude persists, as they highlight that schadenfreude, like other emotions that involve social comparisons, may have served an adaptive function in human evolution (Smith, 2000). If schadenfreude facilitates creativity, as we suggest, it is also likely to have increased fitness by increasing individuals' ability to adapt to changing environments.

Our hypothesis that schadenfreude enhances creativity is novel, yet several lines of reasoning from widely varying theoretical perspectives suggest that such a link might exist. First, schadenfreude is experienced as a positively valenced emotion (Boecker, Likowski, Pauli & Weyers, 2015) and the link between positive discrete emotion and affect is well established (for a meta-analytic review, see Baas, DeDreu & Nijstad, 2008; Frederickson, 2013; Isen, 2008).

Second, schadenfreude may play a role in releasing cognitive resources otherwise occupied by the processing of other emotions. For example, malicious envy shifts attentional resources towards the envied other because it highlights one's low position in the social

hierarchy (Crusius & Lange, 2014). In contrast, schadenfreude is often evoked when envied targets receive their "comeuppance" (e.g., van de Ven et al., 2015). Because it demands the exploration of new parts of conceptual space or the modification of the rules and routes of such conceptual space (Boden, 1994), creativity requires extensive cognitive resources. Any disruption to task concentration may hinder working memory capacity and thus reduce creativity. Hence, if schadenfreude releases cognitive resources that are occupied by thoughts about injustice, revenge, or envy, it should facilitate creativity.

However, schadenfreude is unlikely to have the same effect for all. In our research we explore one particular boundary condition of the link between schadenfreude and creativity – approach motivation. Converging evidence suggests that approach motivation, or "the impulse to go toward" (Harmon-Jones, Harmon-Jones, & Price, 2013, p. 291), fosters creativity because it enhances cognitive flexibility (Cretenet & Dru, 2009). While often triggered by external stimuli, approach motivation can also be observed in the absence of stimuli and can be conceptualized as a trait variable (Carver & White, 1994; Harmon-Jones et al., 2013). We argue that if schadenfreude unlocks people's creativity by fostering broader cognitive associations and releasing cognitive resources, its effect on creativity might be more pronounced for people who are less dispositionally able to be creative – those low in approach motivation.

We conducted four experiments to assess the effect of incidental schadenfreude on creative performance, using convergent operationalizations of schadenfreude and multiple measures of creativity. Across our studies, we specifically examined creative insight tasks, which require individuals to move beyond conventional and fixed thought patterns and assumptions (e.g., Dietrich & Kanso, 2010; Sternberg & Davidson, 1995). We manipulated schadenfreude (versus a neutral emotion control condition) using a scenario and video induction (Experiments

1, 2, and 3) and asked participants to recall experiencing schadenfreude (Experiment 4) versus a neutral feeling. We measured creativity via participants' performance on subsequent insight puzzles (Experiment 1) and the Remote Associates Task (Experiments 2, 3 and 4). By triangulating the results across schadenfreude manipulations and two different measures of creativity, we bolster the validity of our conclusions. In Experiments 1 and 3, we tested the affective and cognitive mechanisms that may explain the relationship between schadenfreude and creativity. Finally, in Experiment 4, we investigated whether approach motivation moderated the link between schadenfreude and creativity.

Our results provide the first empirical evidence that feeling pleasure at another's misfortune enhances creativity and provide evidence that this effect is not attributable to the broaden-and-build hypothesis (e.g., Fredrickson, 2013), as positive affect did not mediate the relationship between schadenfreude and creativity (Experiment 1). Instead, we find evidence that schadenfreude frees attentional resources that are necessary for heightened creativity. In Experiment 3, the positive effect of schadenfreude on creativity was more pronounced among those whose attentional resources were constrained, as evidenced by their performance on the Eriksen Flanker Task. Finally, we identify an important boundary condition; the creativity-facilitating effect of schadenfreude was eliminated for those high in approach motivation.

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Creative and Famous? An Empirical Analysis of the Relationship Between Creativity and Fame of Artistic Innovators Across Time and Space

If we had an objective way of determining literary quality, it does not seem at all likely that we would find Shakespeare (with 9,118 books) to be 44 times better than Marlowe (with 205 books) or 4,559 times better than John Cleveland (with 2 books). – Colin Martindale

Introduction

Creativity is often cited as the attribute that separates artists who are household names from those are obscure. Yet we can easily think of talented musicians, scientists, artists who remained obscure throughout their careers. Van Gogh wrestled with poverty and obscurity throughout his lifetime. Nonetheless, our abiding intuition is that a producer's fame bears some relationship to their creative talent. My goal is to probe this intuition further by examining the relationship between creativity and fame of the pioneers of early 20th century abstract artists over 95 years and across five markets.

Two key factors plague empirical explorations of creativity and fame. The first challenge is measuring producers' creativity on a large scale. Prior work has often relied on expert evaluations (Hennessey and Amabile 1999, Amabile 1983). While fruitful, relying on experts can limit the number of producers and the work one might study. Asking experts to evaluate the creativity of even 100 producers entails a significant drain on their cognitive resources. Having multiple experts might address the problem, but that involves introducing the experts' own subjective aesthetic and hence more noise into the measures. Every measure of creativity has its limitations. But present day advances in computational power, give us an opportunity to develop measures of complex creative products for a large number of producers.

Expert measures also confine our scale of our analysis, often to a relatively small sample of the most eminent producers in a field. Such limited samples can result in an incomplete picture of the relationship between creativity and creative success. If the samples only include already canonized writers, musicians, scientists etc., then it is likely that more often than not, the relationship between creativity and fame will be biased positively.

In this study, I address the two limitations of the existing literature. Using image recognition, I compute a novel measure of the creativity of 55 pioneers of abstract art. This method allows me to analyze the creativity of the artists' output over time. Thus I am able to trace the artists' creativity and fame over 95 years. My sample of artists is not restricted to already established artists. The artists in my sample vary considerably in fame, from artists who are household names to those whose have barely escaped obscurity. I examine whether the variation in creativity accounts for their variation in fame at the early stages of their career as well as throughout their career and beyond. By tracing the artists' creativity and fame over time, I am

able to control for the influence of their prior and subsequent creativity on their fame at any given point in time.

Fame: My measure of the fame is a proportion of an artist's name mentions in the google n-Gram corpus in five languages – British English, French, German, and US English – for each year between 1905-2000. The Google n-gram corpus comprises over 8 million books which represent six percent of the books ever published. As such it provides a closer proxy for a defining feature of fame, the "sheer numbers of people who know one's name." (Currid-Halkett, 2010, pg. 66).

Computational Creativity Measure

In accordance with prior research on creativity, I measure creativity at the level of product which in this case is an art work (Reis & Renzulli 1991, Besemer, & O'Quin 1986). I used 2218 images of the works of 55 pioneers of abstract art.

My measure of creativity is meant to capture the novelty of a piece of work relative to works in the representational paradigm that preceded the emergence of the abstract art movement. For this I employ a novel measure of creativity that draws on advances in computer science and machine learning. I used an image recognition algorithm to represent each painting as a1000 dimensional vector of features. I applied this algorithm to each work of the 55 pioneers of abstract in my data as well as to 2000 images of art works from the 19th century representational paradigm. In order to measure the novelty of each work of abstract art, I computed the cosine distance between its feature vector and the feature vector of each of 19^{th} century pieces of art in my data. Thereafter, I took the average of the cosine distances of a focal work of abstract art from all the 19^{th} century works of art. The greater this distance for a focal work of abstract, the more novel it is.

The computational creativity score for each artist is the average of the cosine distance of all her works. An artist's cumulative creativity in each year is the average of her computational creativity score up until that year.

Biographical Variables: Data on the biographical details of the artist comes from art encyclopedias and the Museum of Modern Art.

Preliminary Results

I find that fame and creativity are at best weakly correlated across time and the five languages: For instance, in the case of US English, between 1905-1920, the correlations fall monotonically from 0.2 and 0; between 1920-1940, the correlations fall further monotonically to values ranging from 0 to -0.6; after 1940, the correlations increase slightly and plateau around -0.2 and -0.4.

In order to control for an artist's biographical details, I estimated an OLS model with the dependent variable as an artist's fame in a year and the main independent variable as the cumulative creativity of an artist up until the preceding year. Table 2 lists the models for an artist's fame in US English for nine years, 1910, 1926, 1935, 1945, 1955, 1965, 1975, 1985 and 2000. Figure 1 plots the estimate of the coefficient of cumulative creativity for each of these nine models. The dotted red lines are the confidence interval bounds for the estimates. It is worth noting that, in general, across all languages, the estimates become more negative over time. An exception to this trend are the estimates for British fame, where the negative value of the estimates decrease monotonically between 1911 and 1945. After this period, the estimate of the

creativity coefficient remains negative but fluctuates, linear decreases in the coefficient values are succeeded by linear increases in its values.

Overall, the estimates vary between zero and negative values though the width of the confidence intervals indicate greater uncertainty about these values than the estimates for the models of US Fame. For instance, I observe that the estimates for French and German fame models have large negative values but are not statistically significant.

Next Steps: My next steps are (a) to refine the computational measure of creativity (b) to examine how variance in an artists' creativity, as well as their peak creativity relates to their fame and finally (d) to examine the relationship between expert and machine evaluation of creativity

Psychological and sociological literature that suggests that even though we like the notion of creativity, we are actually biased against creativity (Mueller, Melwani & Goncalo 2011) -- more often than not, new ideas, technologies etc. encounter resistance rather than a red carpet. A computational measure of creativity, which while created by humans, can be consistently applied consistently to the work of a much larger sample of artists, celebrated and otherwise. This in turn will give me chance to examine if creative work necessarily becomes famous. In answering this question, I hope to understand our biases in evaluating and valuing creativity and institutional/market features that shape how creative talent is rewarded (or not).

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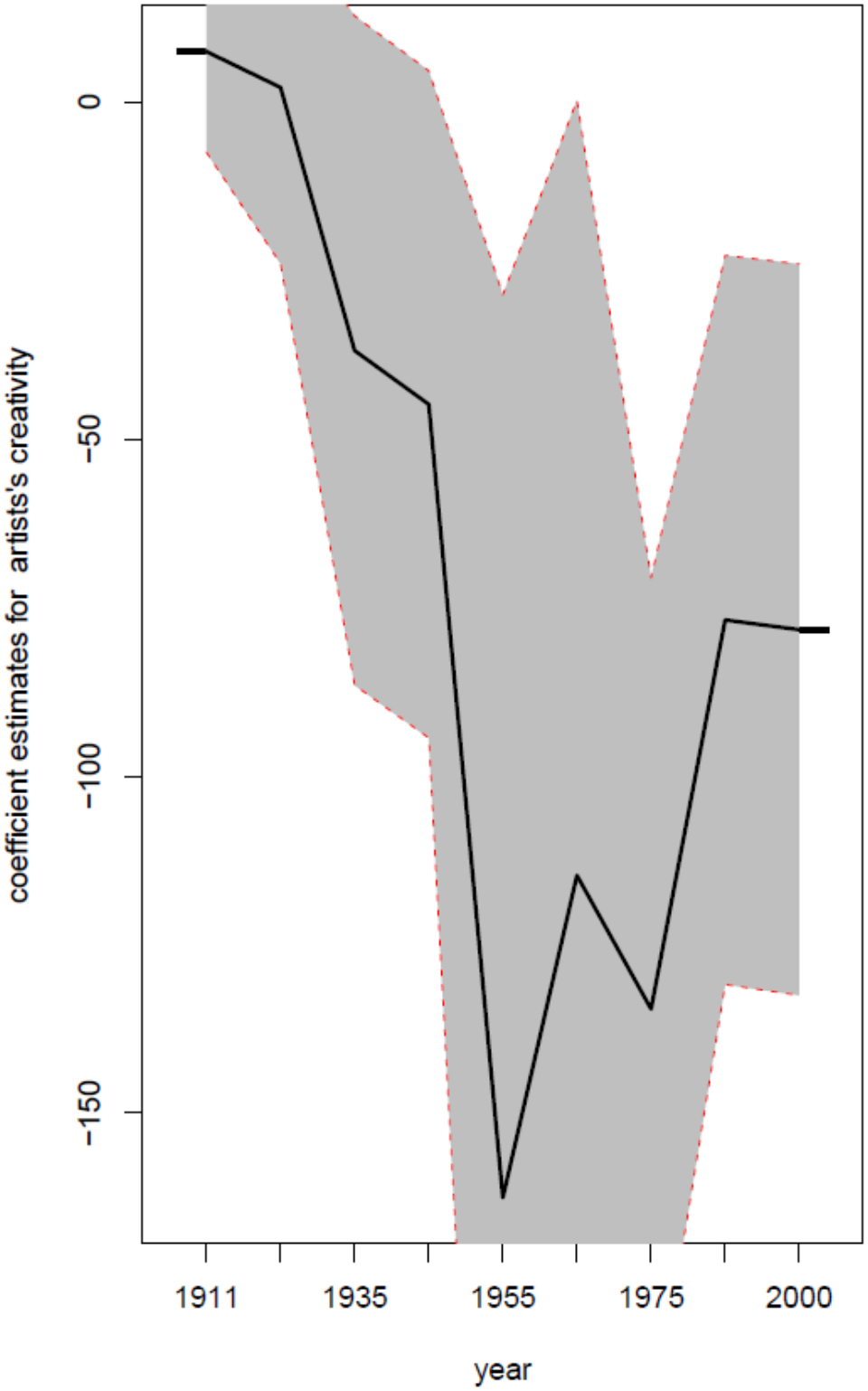
Figure 1: Estimate and Confidence Interval for Coefficient of Artist's Creativity in OLS models of artists' US fame in 1910, 1926, 1935, 1945, 1955, 1965, 1975, 1985, 2000



	USFame1905	USFame1910	USFame1926	Fame1935	Fame1945	Fame1955	Fame1965	Fame1975	Fame1985	Fame2000	CDM1905	CDM1910	CDM1926	CDM1935	CDM1945	CDM1955	CDM1965	CDM1975	CDM1985	CDM2000	Mediano.	Number of Movements	Age1910
USFame1905	1.00																						
USFame1910	0.78	1.00																					
USFame1926	0.38	0.57	1.00																				
Fame1935	0.14	0.30	0.87	1.00																			
Fame1945	-0.01	0.19	0.75	0.95	1.00																		
Fame1955	0.03	0.23	0.78	0.95	0.97	1.00																	
Fame1965	-0.01	0.20	0.78	0.93	0.93	0.96	1.00																
Fame1975	0.01	0.20	0.75	0.85	0.81	0.88	0.94	1.00															
Fame1985	0.00	0.19	0.77	0.90	0.89	0.93	0.97	0.97	1.00														
Fame2000	-0.02	0.18	0.78	0.92	0.92	0.95	0.98	0.96	0.99	1.00													
CDM1905	0.18	0.27	0.34	0.17	0.08	0.22	0.24	0.33	0.28	0.25	1.00												
CDM1910	0.20	0.26	0.19	0.21	0.10	0.20	0.18	0.21	0.19	0.16	0.59	1.00											
CDM1926	-0.01	-0.10	-0.28	-0.34	-0.40	-0.35	-0.32	-0.24	-0.28	-0.32	0.08	0.11	1.00										
CDM1935	-0.13	-0.31	-0.67	-0.80	-0.86	-0.80	-0.73	-0.60	-0.70	-0.76	-0.02	-0.06	0.42	1.00									
CDM1945	-0.41	-0.35	-0.29	-0.29	-0.25	-0.28	-0.21	-0.30	-0.27	-0.26	-0.16	-0.34	0.00	0.49	1.00								
CDM1955	-0.41	-0.35	-0.29	-0.30	-0.25	-0.29	-0.21	-0.30	-0.28	-0.26	-0.16	-0.34	-0.02	0.49	1.00	1.00							
CDM1965	-0.41	-0.36	-0.30	-0.28	-0.24	-0.27	-0.20	-0.29	-0.27	-0.26	-0.16	-0.33	-0.01	0.49	1.00	0.99	1.00						
CDM1975	-0.41	-0.36	-0.30	-0.28	-0.24	-0.27	-0.19	-0.29	-0.27	-0.26	-0.16	-0.33	-0.01	0.49	1.00	0.99	1.00	1.00					
CDM1985	-0.41	-0.36	-0.30	-0.28	-0.24	-0.27	-0.19	-0.29	-0.27	-0.26	-0.16	-0.33	-0.01	0.49	1.00	0.99	1.00	1.00	1.00				
CDM2000	-0.41	-0.36	-0.30	-0.28	-0.24	-0.27	-0.19	-0.29	-0.26	-0.26	-0.16	-0.33	-0.01	0.49	0.99	0.99	1.00	1.00	1.00	1.00			
Mediano.	-0.21	-0.26	-0.26	-0.24	-0.23	-0.22	-0.24	-0.23	-0.20	-0.21	-0.23	-0.15	-0.08	0.20	0.16	0.17	0.18	0.18	0.18	0.18	1.00		
Number of Movements	-0.17	-0.10	-0.08	0.08	0.10	0.14	0.22	0.22	0.23	0.22	0.09	0.09	0.08	-0.07	-0.01	-0.02	0.00	0.01	0.01	0.01	0.10	1.00	
Age1910	0.10	0.14	0.10	0.07	0.05	0.09	0.08	0.09	0.10	0.08	0.37	0.39	0.05	-0.04	0.04	0.03	0.03	0.03	0.03	0.03	-0.14	0.04	1.00

Table1: Descriptive Statistics

Table 2: OLS model for estimating an artist's fame in the years 1910, 1926, 1935, 1945, 1955, 1965, 1975, 1985 and 2000

Dependent Variable: Log odds transformation of US Fame of an Artist

	USFame1910	USFame1926	USFame1935	USFame1945	USFame1955	USFame65	USFame75	USFame1985	USFame2000
Cumulative Creativity 1909	7.499								
	(7.631)								
Cumulative Creativity 1925		2.180							
		(13.347)							
Cumulative Creativity 1934			-36.870						
			(25.335)						
Cumulative Creativity 1944				-44.840*					
				(25.251)					
Cumulative Creativity 1954					-162.527**				
					(68.336)				
Cumulative Creativity 1964						-114.735*			
						(58.679)			
Cumulative Creativity 1974							-134.563***		
							(32.641)		
Cumulative Creativity 1984								-76.833***	
								(27.600)	
Cumulative Creativity 1999									-78.281***
									(27.679)
USFame1905	0.633***	0.419**	0.217	0.290	0.111	0.001	-0.115	-0.110	-0.119
	(0.149)	(0.198)	(0.205)	(0.203)	(0.216)	(0.185)	(0.103)	(0.087)	(0.088)
Female	-1.985	-6.567	-8.146	-15.749*	-9.193	-4.724	-4.873	-3.919	-4.288
	(5.793)	(8.057)	(8.212)	(8.168)	(7.545)	(6.474)	(3.606)	(3.048)	(3.066)
American	-6.952	5.776	10.678	5.844	-2.317	4.463	-0.009	0.624	-0.007
	(5.839)	(7.990)	(8.212)	(8.166)	(7.527)	(6.463)	(3.601)	(3.044)	(3.061)
No. of Movements	-1.169	3.719	2.598	2.867	0.278	0.331	1.287	0.878	0.922
	(1.954)	(2.738)	(2.810)	(2.797)	(2.588)	(2.213)	(1.232)	(1.042)	(1.047)
No. of Media	-3.517	-1.782	-3.982	-1.009	-0.234	0.117	-0.243	0.355	0.158
	(3.113)	(4.388)	(4.581)	(4.554)	(4.131)	(3.544)	(1.974)	(1.669)	(1.679)
Age1910	-0.056	0.328	-0.020	-0.065	0.517*	0.225	0.177	0.377***	0.353***
	(0.217)	(0.298)	(0.305)	(0.304)	(0.287)	(0.246)	(0.137)	(0.116)	(0.117)
Constant	-8.062	-29.358	2.383	8.669	79.554*	50.955	65.287***	18.920	20.475
	(12.082)	(18.815)	(22.859)	(22.823)	(45.402)	(38.944)	(21.665)	(18.313)	(18.361)
Observations	53	53	53	53	53	53	53	53	53
R^2	0.433	0.239	0.220	0.236	0.274	0.161	0.342	0.325	0.312
Adjusted R^2	0.345	0.121	0.099	0.117	0.161	0.031	0.240	0.220	0.205
Residual Std. Error (df = 45)	13.304	18.780	19.264	19.162	17.677	15.165	8.447	7.141	7.183
F Statistic (df = 7; 45)	4.909***	2.021*	1.818	1.984*	2.423**	1.236	3.342***	3.097***	2.917**

Note: *p<0.1; **p<0.05; ***p<0.01