

All You Need to Do Is Ask? The Exhortation to Be Creative Improves Creative Performance More for Nonexpert Than Expert Jazz Musicians

David S. Rosen, Youngmoo E. Kim, Daniel Mirman, and John Kounios
Drexel University

Current creativity research reveals a fundamental disagreement about the nature of creative thought, specifically, whether it is primarily based on automatic, associative (Type 1) or executive, controlled (Type 2) cognitive processes. We propose that Type 1 and Type 2 processes make differential contributions to creative production depending on domain expertise and situational factors such as task instructions. We tested this hypothesis with jazz pianists who were instructed to improvise to a novel chord sequence and rhythm accompaniment. Afterward, they were asked to perform again under instructions to be especially creative which, via goal activation, is thought to prompt the musicians to engage Type 2 processes. Jazz experts rated all performances. Overall, performances by more experienced pianists were rated as superior. Moreover, creativity instructions resulted in higher ratings. However, there was an interaction between instructions and expertise, revealing that explicit creativity instructions significantly improved improvisation ratings only for the less experienced musicians. We propose that activating or reconfiguring executive Type 2 processes facilitates creativity for less experienced musicians, but does not improve creative performance significantly for more experienced ones because the latter have largely automatized the processes responsible for high-level improvisation or because they have achieved a near-optimal balance between associative Type 1 and executive Type 2 processes. Thus, increasing controlled Type 2 processing is unlikely to help, and may sometimes even diminish, the creativity of experts' performances.

Keywords: creativity, jazz improvisation, expertise, explicit instructions, creative processes

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Despite the recent interest and upsurge in research on creativity, substantive progress has been limited by the lack of a consensus definition of creative thought. One topic of debate is the extent to which creativity relies primarily on controlled executive processes or automatic associative ones (Barr, Pennycook, Stolz, & Fugelsang, 2015; Nijstad, De Dreu, Rietzschel, & Baas, 2010). We posit that either mode of cognition can contribute to creative production and that the balance between these two modes is dependent on both domain-specific expertise and the situational factors associated with a task. We tested this theory by giving jazz musicians of different levels of expertise explicit instructions to “be creative.”

Literature Review

Creative Processes: Type 1 Versus Type 2

The associative view holds that creative ideas emerge spontaneously from fluctuating patterns of activity in knowledge networks facilitated by defocused or broad attention (e.g., Bowden, Jung-Beeman, Fleck, & Kounios, 2005), cognitive disinhibition (Brown & Paulus, 2002), fixation-dissipating changes in context, and other factors (Kounios & Beeman, 2014, 2015). Supportive evidence links enhanced creative performance with attention deficit/hyperactivity disorder (White & Shah, 2006), lateral frontal lesions (Reverberi, Toraldo, D'Agostini, & Skrap, 2005), and cortical disinhibition from transcranial direct current stimulation (Chrysikou et al., 2013). The phenomena of incubation and spontaneous creative insights, particularly during or immediately following sleep, supports the unconscious associative view of creativity (Kounios & Beeman, 2014, 2015).

In contrast, the controlled-attention view proposes that creative ideas result primarily from top-down control and the deployment of analytical processes (e.g., Beaty et al., 2013) whereby sustained attention enables a person to systematically combine ideas in the service of a creative goal (Baas, Roskes, Sligte, Nijstad, & De Dreu, 2013; Nijstad et al., 2010). A growing body of research reports that individual differences in executive function (i.e., in-

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David S. Rosen, Department of Psychology, Drexel University; Youngmoo E. Kim, Department of Electrical and Computer Engineering, Drexel University; Daniel Mirman and John Kounios, Department of Psychology, Drexel University.

Daniel Mirman is now at Department of Psychology, University of Alabama at Birmingham.

Correspondence concerning this article should be addressed to David S. Rosen, Department of Psychology, Drexel University, 1523 Emily Street, Philadelphia, PA 19145. E-mail: Drosen@drexel.edu

hibition, working memory capacity, and fluid intelligence) predict scores on tests thought to measure creativity and even predict quality ratings over time on a music improvisation task (De Dreu, Nijstad, Baas, Wolsink, & Roskes, 2012). Furthermore, a preference for and ability to think analytically has been shown to improve overall performance on tasks that require a person to use remote associations and analogical reasoning (Barr et al., 2015). Thus, strong executive functioning appears to facilitate some forms of creative production by enabling individuals to deliberately inhibit irrelevant information, optimize strategies, and integrate and manipulate pieces of information (Nusbaum & Silvia, 2011). This notion emphasizes that the same cognitive mechanisms that underlie noncreative, analytical cognition underlie creative thought rather than characterizing creativity as relying on distinct processes that operate below the level of consciousness. The executive function view therefore offers a theoretically parsimonious account of creativity at the expense of a clear distinction between creative and noncreative thought.

The associative view does not easily accommodate findings that suggest contributions to creative performance from executive processes, nor can the executive-process view explain how decreased executive function can facilitate creativity or how executive processes could result in spontaneous insights.

Dual-process creativity models (Baas et al., 2013; Barr et al., 2015; Sowden, Pringle, & Gabora, 2015) suggest a bridge between these views. From this perspective, creativity is similar to other cognitive domains, such as reasoning and decision making, that involve a dynamic, situation-specific interplay between “System 1” and “System 2” (Stanovich & West, 2000). System 1 is an efficient, automatic, high-capacity system that rapidly utilizes implicitly acquired information, reflexively responding to events. System 2 uses focused attention and effort to perform abstract reasoning and hypothetical thinking (Kahneman, 2011).

Dual-process theorists have recently argued that the evidence does not support the existence of two separate systems; hence, they use the terms *Type 1* and *Type 2* to refer to loose collections of processes (Evans, 2008). These two types of processes correspond to the predominant theories of creativity: implicit, high-capacity, and defocused (*Type 1*) versus explicit, limited-capacity, and controlled (*Type 2*; Baas et al., 2013; Nijstad et al., 2010). Furthermore, dual-process models of both decision making and creativity propose that both systems and process types can be active concurrently (Kahneman, 2011; Nijstad et al., 2010) with different degrees of contribution depending on characteristics of the individual and his or her context (Stanovich, 1999).

In principle, the nascent dual-process theory could be a useful framework for integrating conflicting views about creative thought. However, to date, there has been little substantive evidence on which to base such integration. The present study helps to fill this gap by testing the hypothesis that *Type 1* and *Type 2* processes make differential contributions to creative performance depending on the situational factor of explicit task demands and the individual-differences factor of domain expertise.

Explicit Instructions: Be Creative

Many factors can influence the recruitment of executive control, such as fatigue (Nilsson et al., 2005), mood (Mitchell & Phillips, 2007), and goal activation (Nieuwenhuis, Broerse, Nielen, & de

Jong, 2004). In this study, we focus on goal activation via explicit instructions to “be creative,” an exhortation that has facilitated creative performance in more than 30 studies on a variety of divergent thinking (e.g., Runco & Okuda, 1991) and real-world tasks (e.g., Chen et al., 2005).

Setting an explicit goal boosts and sustains attention and heightens self-regulation (Locke & Latham, 2002). Of particular relevance, Nusbaum, Silvia, and Beaty (2014) showed that explicit instructions to “be creative” led to both greater executive control and improvement on a divergent thinking task. They also observed an interaction between explicit instructions and fluid intelligence that was associated with greater originality of responses. A functional MRI (fMRI) study by Green et al. (2015) showed that an explicit cue to think creatively was accompanied by both an increase in a measure of response creativity in a verb-generation task and increased activity in a number of frontal brain areas associated with executive (*Type 2*) function. Thus, a variety of evidence suggests that instructions to be creative facilitates some measures of creative performance at least partly by increasing executive control.

Individual Differences: Domain Expertise

Previous studies of explicit creativity instructions have used participants who are unlikely to be highly practiced at the divergent thinking or verb-generation tasks used in many of these experiments. Thus, these studies do not address the possibility of an interaction between level of executive control and domain expertise. Our study addressed this point by examining a domain for which there are quantifiable individual differences in expertise, namely, jazz improvisation.

Expert jazz musicians develop an elaborate associative network of musical ideas, riffs, and patterns that are accessed and woven into a cohesive, novel improvisation in real time. The neural basis of these rich associative networks is revealed by enhanced fMRI connectivity among prefrontal, premotor, and motor regions in experienced improvisers (Pinho, de Manzano, Fransson, Eriksson, & Ullén, 2014). Greater experience is also associated with widespread deactivation of prefrontal and parietal association cortices during improvisation (Pinho et al., 2014; Limb & Braun, 2008). Furthermore, fMRI studies of expert musical improvisation and composition have reported activation of the default mode network while engaged in spontaneous creativity compared to performing a memorized melody (Limb & Braun, 2008) and the resting state (Lu et al., 2015). These activation and deactivation patterns are thought to represent a shift from top-down control to more automatic, bottom-up processes, facilitating more efficient action planning, action representation, and task performance (Yang, 2015). Additionally, recent work indicates enhanced connectivity between executive control and default-mode networks during the production of creative and original ideas (Beaty et al., 2013). Thus, neuroimaging results are consistent with the role of expertise in modulating the relative recruitment of *Type 1* and *Type 2* processes during musical improvisation and align with dual-process creativity models which posit that optimal creative production may require a specific balance between the contributions of these two types of processes (Mayseless, Eran, & Shamay-Tsoory, 2015).

Pressing’s (1988) cognitive model of jazz improvisation is an example of automating domain-specific skills through training to

free up cognitive resources for ideation, execution, and evaluation of one's performance. In other work, Johnson-Laird (2002) described how both executive Type 2 and automatic Type 1 processes must be integrated when creating computational models of jazz improvisation. Thus, while some higher-level aspects of performance may benefit from conscious engagement and attention, other components must be automatized and unconscious to allow for creative idea generation and production. To emphasize this last point, Johnson-Laird (2002) highlighted that jazz musicians have a difficult time articulating how they improvise "because the underlying mental processes are largely unconscious." As Charlie Parker, the eminent jazz saxophonist, stated, "You've got to learn your instrument. Then, you practice, practice, practice. And then, when you finally get up there on the bandstand, forget all that and just wail" (Pugatch, 2006).

Since explicit creativity instructions, such as the exhortation to be creative, engage executive Type 2 processes, we hypothesized that domain expertise would interact with instructions to modulate creative performance. Specifically, we predicted that the "be creative" instruction would boost creative performance for participants with more modest levels of expertise because they rely heavily on controlled Type 2 processes and because their domain-specific Type 1 processes are relatively underdeveloped. In contrast, experts were predicted to show less benefit from creativity instructions because the creativity instruction would neither facilitate nor be superior to the optimal interaction between Type 1 and Type 2 processes that they typically use when improvising.

Method

Participants and Judges

Participants ($N = 23$) were jazz pianists recruited from local university music programs, seminaries, bands, and jazz associations in the Philadelphia, Pennsylvania, region. Due to the specificity of the sample population, we recruited as many jazz pianists as possible over several months, stopping after we could find no more musicians that met our criterion for participation. One pianist's performances were excluded from the study after admitting that she or he could not follow the jazz lead sheet. Upon reviewing the performance, this person showed no indication of the music or jazz training required for this study.

All other musicians ($N = 22$) met the study requirements, improvising in a live jazz concert setting at least three times and had at least 10 years of music training. All participants signed consent forms. The jazz musicians were 19–34 years of age ($M = 24.8$, $SD = 4.4$), and participants were predominantly male (two females). Expertise information was collected for years of music training ($M = 17.55$, $SD = 5.25$), years of jazz training ($M = 8.09$, $SD = 4.43$), and number of jazz gigs ($M = 125.64$, $SD = 129.91$). Participants' number of jazz gigs covered a large range (2 orders of magnitude; 3–400) and were skewed (skew = 1.25).

The number of professional jazz gigs is more representative of one's improvisational abilities, and past studies have shown that the number of hours of improvisational experience is predictive of distinct brain-activation patterns beyond years of music/jazz training or age (Pinho et al., 2014); yet reported hours of improvisational experience can be imprecise. Thus, we selected number of gigs as our expertise variable. We applied the natural logarithmic

transformation to the number of jazz gigs, since linear regression assumes that variables should be approximately linear, but the power law of practice stipulates that skill increases logarithmically. Empirical evidence shows that improvement with practice is linear in a log-log space (Newell & Rosenbloom, 1981). For example, a musician's second performance gives them twice as much experience over the first, but the 302nd performance is only a tiny increase over the 301st. A secondary motivation for logarithmic transformation was to improve model fit optimization for wide ranges of data with substantial skew (Zumel, Mount, & Porzak, 2014).

Four jazz experts were recruited as judges to evaluate the improvisations. These judges were directors/professors at college jazz programs or jazz pianists with at least 25 years of professional experience.

Study Design and Procedures

All trials were conducted at the Expressive and Creative Interaction Technologies Center at Drexel University in Philadelphia. This study was approved by the Drexel University institutional review board. Experimental sessions lasted approximately 45 min.

Musicians were told that they were taking part in a "music improvisation study" without any mention of creativity. Each participant completed four "takes" and was randomly assigned to an experimental group in a staggered baseline design (Beeson & Robey, 2006), which determined when explicit creativity instructions were introduced during the four "takes" (A = Take 2, B = Take 3, C = Take 4). Thus, one third of the musicians performed three takes with the "be creative" instruction, one third had two takes with this instruction, and one third had a single creativity instruction take. This staggered baseline design was implemented to disambiguate and account for the influence of practice effects (with or without instructions) on creative performance.

All recording sessions were conducted in a standardized environment that contained an 88-key semiweighted MIDI controller keyboard, sustain pedal, music stand, and studio-quality headphones. Apple's *Logic Pro 9* music software recorded improvisations, collected MIDI performance data, and provided musicians with a bass and drums audio accompaniment to an original 16-bar chord sequence. Accompaniments were created through *iReal b* for Mac OS X, a practice tool with a full rhythm section for any properly formatted jazz chart.

Musicians warmed-up and adjusted levels of the piano and accompaniment during a 2-min exercise. A jazz lead sheet was provided, representing the musical structure/chord changes of the audio stimulus (see Figure 1) 1 min prior to their first take. All participants completed four takes (~2 min and four chord cycles per take) and were given standard instructions on their first take: "Improvise with the music as you normally would in a jazz setting." After one, two, or three takes (depending on group assignment), explicit instructions were introduced:

That was great so far. Now, I want you to try to improvise even more creatively than your past performance(s). Creativity should be at the forefront of your mind. Based on your experiences and intuitions as a jazz musician, please try to perform as creatively as possible from this point forward.

(Medium Swing) **Study Stimulus**

4/4 C-7 | / | / | F-7 B^b₇ |
E^b_{Δ7}	E^b_{Δ7} E_o	F₇	/	
C-7 G-7	F₇ E^b_{Δ7}	A^b_{Δ7}	B^b₇	
E^b_{Δ7}	/	F₇	G₇	

Figure 1. Study stimulus. Pianists improvised to this jazz lead sheet, a series of novel chord changes with bass and drums accompaniment.

This particular phrasing was deliberately chosen, as we did not want to imply that participants' performances on their previous takes were not creative, which could increase anxiety or resentment and lower self-efficacy during future takes. Also, jazz experts may have varying approaches and criteria for what they deem to be creative; therefore, by avoiding specific guidelines and strategies, musicians were left to their own devices to improvise more creatively.

Once all 88 jazz improvisations were collected (44 with explicit instructions and 44 with standard instructions), each improvisation was normalized to ensure that the piano and accompaniment had the same relative levels across all subjects and takes (see supplemental materials for samples of jazz improvisations). Performances were pseudorandomized for judging with the constraint that the same musician could not be heard consecutively or more than twice within a single judging block. Each judge rated the 88 improvisations in four blocks of 22 improvisations each (~45 min). Using the Consensual Assessment Technique (Amabile, 1982), judges rated improvisations for creativity (CR), technical proficiency (TP), and aesthetic appeal (AA) on a 7-point Likert scale.

Judges were unaware of experiment details and research goals; specifically, explicit instructions were never mentioned to ensure that judges did not try to guess which performances were in the experimental condition. Instead, the study was presented as an analysis of jazz improvisation that required expert evaluations. As with the participants, judges utilized their jazz expertise to determine the criterion for their ratings.

Measures and Instruments

Consensual assessment technique (CAT). Expert judge ratings have been used in hundreds of creativity studies. The CAT is based on evaluations of actual creative products, is not dependent on any particular theory of creativity, and uses the same method for assessing creativity as most domains in the real world (Baer, 2010). The CAT tasks experts in a domain with rating creative products relative to one another. Judges rated improvisations on a 7-point Likert scale for CR, AA, and TP. The CAT has been used to assess the creativity of musical improvisation with high interrater reliability (Beatty et al., 2013; De Dreu et al., 2012).

Musician demographic data. After completing their jazz improvisations, all musicians completed a demographic survey and responded to various questions regarding their musical expertise, experiences, and influences. Essay questions were given to participants to gain further insight into the cognitive strategies they used during the task, performers' implicit definitions of creativity, musical features associated with creative improvisation, and self-assessment and elaboration of any especially creative or insightful moments during their own performances. All participants completed a mood survey before and after the improvisation task and two personality inventories at the end of the experiment; however, these variables were not included in the present analyses.

Results

Interrater Reliability Analyses

The intraclass correlation coefficient (ICC) measured interrater reliability for judges' ratings of creativity, technical proficiency, and aesthetic appeal. Reliability was calculated from single measurements rather than an average such that values were computed for consistency where systematic differences between raters are considered irrelevant (McGraw & Wong, 1996). Interrater reliability was calculated for creativity (ICC = .71, $N = 4$), technical proficiency (ICC = .81, $N = 4$), and aesthetic appeal (ICC = .73, $N = 4$). Conventionally, an ICC > .75 is excellent, .40 to .74 is adequate to good, and < .40 is poor (Fleiss, 1986). Thus, all scales had excellent to very good reliability.

Scale-Type Correlations

The three scale types had highly significant positive correlations after averaging the four judges' ratings for each improvisation: CR and AA, $r(86) = .84, p < .01$; CR and TP, $r(86) = .89, p < .01$; AA and TP, $r(86) = .87, p < .01$. These high correlations between creativity, technical proficiency, and aesthetic appeal may represent the interconnectedness of these three factors, such that one is needed to express the others, especially in the technically demanding domain of jazz improvisation. Thus, the individual CR, AA, and TP scale-type ratings were averaged to form a single "quality" rating for each improvisation. For further analyses and multilevel regression models, the overall quality rating after averaging across judges and scales was the dependent variable for each improvisation.

Descriptive Statistics

Each musician performed four improvisations, and an overall quality rating was calculated for each take ($M = 4.69, SD = 1.13$). Quality ratings were approximately normally distributed (skew = -0.85, kurtosis = 0.77) and were between 1.67 to 6.75, covering almost the entire range of the Likert scale extremes of 1 and 7. No single improvisation received the top score from all judges on all scales. Thus, the scores were not clustered at the top or bottom end of the range, avoiding ceiling or floor effects.

Method of Analysis

Multilevel regression. Multilevel regression (MLR) analyses were performed to test the impact of instructions and expertise on

improvisation ratings using the *lme4* package (Bates, 2010) for generalized linear mixed models in *R: A Language and Environment for Statistical Computing* (R Development Core Team, 2008). MLR simultaneously assesses group- and individual-level patterns within a single analysis, taking into consideration fixed and random effects. The fixed effects are the independent variables or factors (instructions, expertise, group, take) of interest. Random effects model the individual variability between participants, including the within-participant structure of the data (multiple takes per participant, both standard instructions and explicit creativity instructions). Models included maximal random-effect structures that allowed the model to converge (D. J. Barr et al., 2013). When simplification of random effects was required, we included participants' random variability (random "slopes") in response to instructions, our primary independent variable.

Model comparisons. MLR model comparisons were conducted to find the parameters that best predicted the improvisation ratings. Model comparisons use the log-likelihood and chi-square goodness-of-fit test to evaluate whether adding or removing a new parameter significantly improves the model (Mirman, 2014). For all model comparisons, the random effects structures were identical.

Table 1 displays the results of the model comparison difference tests. Age was the initial fixed effect entered into the model to assess whether the expertise variable outperformed it. Age failed to significantly predict improvisation quality, but expertise as an independent fixed-effect parameter significantly improved model. Keeping expertise in our model, we then added group, take number, and instructions to the model, one by one; however, as independent fixed effects, these variables failed to improve model fit beyond expertise (see Table 1). Since group and take number were not significant, there is no evidence of an order effect. Even though performance with explicit instructions always occurred after the standard instruction condition, the analysis shows that later takes and group assignment did not influence improvisation quality ratings.

To test our hypothesis that instructions would have differential effects for musicians with varying levels of expertise (with greater benefit to those with less experience), we tested the interaction between expertise and instructions, which revealed a significant increase in the model's predictive ability. The model below displays the parameters with the best model fit after all comparisons (terms in parentheses are random effects):

Table 1
Chi-Square Difference Tests for Jazz Improvisation Model Comparisons

Model parameters	Log-likelihood	χ^2	df	p
Age	-95.88	1.57	1	.210
Expertise	-87.15	19.03	1	<.001**
Expertise + Group	-87.15	0.01	2	.998
Expertise + Take no.	-86.69	0.92	1	.820
Expertise + Instructions	-87.14	0.03	1	.870
Expertise \times Instructions	-83.88	6.52	1	.011*

Note. All models took into account (Instruction | Subject) as a random effect. The best performing model included the interaction term Expertise \times Instructions.
* $p < .05$. ** $p < .001$.

Table 2
Multilevel Regression Model Parameter Estimate and T Tests

Model parameters	Parameter estimate	Standard error	T test	p
Expertise	.59	.09	6.63	<.001**
Instructions	.95	.36	2.66	.008*
Expertise \times Instructions	-.22	.08	-2.76	.006*

Note. Each model parameters' estimates, standard error, and significance level is shown here. While expertise and instructions both have a positive impact on improvisation quality ratings, the interaction of expertise and instructions is negative with explicit instructions facilitating quality of improvisations more for the less-experienced pianists.
* $p < .01$. ** $p < .001$.

$$\text{Quality Rating} = \text{Expertise} + \text{Instructions} + \text{Expertise} \times \text{Instructions} + (\text{Instructions} | \text{Subject}).$$

Analysis of fixed effect parameters. Coefficients for our model revealed expertise significantly increased improvisation ratings in the standard-instruction condition, and explicit instructions significantly increased quality ratings for those musicians with the least experience (see Table 2). The significant negative interaction between instructions and expertise reflects the beneficial effect of explicit creativity instructions for the least experienced musicians, which flattens, or even reverses, for the most expert musicians. Figure 2 displays the interaction effect of expertise and instructions on improvisation quality and ratings.

As part of a post hoc analysis, we also examined how each scale type contributed to the significant interaction. It is important to note that the results of this interaction hold for each of the scale types individually, with creativity having the highest degree of significance ($t = -2.62, p < .01$) compared to technical proficiency ($t = -2.24, p = .024$) or aesthetic appeal ($t = -1.91, p =$

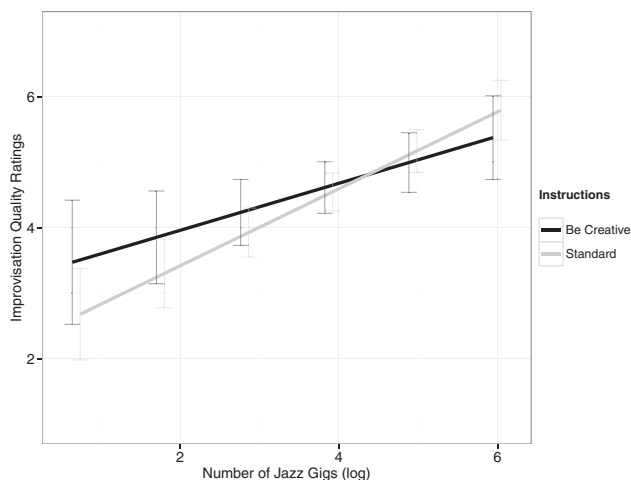


Figure 2. Improvisation quality ratings as a function of Instructions \times Expertise. This model-based estimation displays musicians with less performance experience (left side of the X axis) received higher ratings with explicit "be creative" instructions (black) than standard instructions (gray). For the most experienced musicians, this effect flattens and begins to reverse, though nonsignificantly. The error bars are 95% confidence intervals.

.055); therefore, all three rating scales are contributing to the interaction effect, further validating the creation of a composite quality score. Still these differences are minimal, and we would like to emphasize the results of the quality score and avoid separately interpreting the subscales due to the high correlations.

Discussion

A major debate concerns the relative contributions of Type 1 and Type 2 processes to creative cognition. We hypothesized that Type 1 processes play a more important role in expert creativity, while nonexperts rely more on Type 2 processes. To test this hypothesis, we instigated greater Type 2 executive control in jazz pianists by instructing them to be more creative in their next performance relative to their previous improvisations, an instruction that has been shown in prior research to recruit executive processes and improve creative production across a variety of domains. We examined the effect of this instruction on improvisations by pianists of different levels of expertise.

As predicted, the musicians with the most professional experience received the highest improvisation ratings, consistent with past jazz improvisation studies (Beaty et al., 2013; Pinho et al., 2014). However, there was an interaction between expertise and instructions to be creative. The overall improvement associated with the instruction was predominantly due to the less-experienced musicians. When asked to improvise more creatively, the more experienced pianists did not show comparable improvement. Furthermore, the data includes no ratings of the maximum improvisational quality score of 7, indicating that the failure to detect modulation in experts' improvisations was not due to a ceiling effect.

According to our dual-process model, creativity instructions benefited the less-experienced musicians more than the experts because the Type 2 processes that they instigated were no more effective and may have been somewhat inferior to experts' typical emphasis on Type 1 processes. Thus, these results may reveal that experts' Type 1 processes are relatively automatic, deeply engrained, and difficult to influence with a simple instruction.

No musicians showed evidence of a lack of motivation to perform more creatively when asked; therefore, we do not attribute their failure to improve to decreased effort. In addition, we collected qualitative feedback from the musicians to ensure that the emphasis on creativity was clear, inquiring about their interpretations of the explicit instructions and how this affected their performance. In response to "describe your focus and mindset after given explicit instructions to be creative," musicians' responses included

I felt totally freed. I felt like I'd been given license to go wherever my mind took me.

I tried other things that I wouldn't normally try, like using weird harmonies. I also left more space in my improvisation to give myself time to think more creatively.

I wouldn't use these techniques instinctively, so I had to actively choose to play more creatively with explicit instructions.

I considered new elements of my performance while improvising with explicit instructions.

Thus, musicians did actively engage processes in a conscious attempt to augment creativity. The instruction likely assisted the less-experienced musicians by prompting them to direct more attention to higher-level strategies that would empower them to avoid the pitfalls of cognitive fixation and entrenchment (Howard-Jones, 2002). Furthermore, musicians noted that when given explicit creativity instructions they felt they could take more risks, play more experimentally, decrease self-monitoring, perform more intuitively with less focus on jazz theory, be more expressive, and even enter a "zen, deep meditative state." These common themes emerged among our sample of pianists, helping us interpret the cognitive impact of explicit instructions. Additionally, one pianist mentioned, "I felt boxed-in and trying to think more creatively was a hindrance." The negative influence of explicit instructions was stated by a musician with high expertise and supports our theory that conscious attempts to be more creative facilitates amateur performance more than expert-level performance.

The musicians' qualitative responses corroborate many theories of creative cognition, and based on the qualitative and quantitative data, we believe explicit instructions can be a useful tool for allowing open-ended, experimental performance in a domain that can facilitate amateur or novice creativity. These findings could have powerful applications for music education and developing musical creativity.

We report highly significant positive correlations between scale types (CR, AA, and TP); therefore, we created a composite quality rating. Although the ratings may suggest that judges had difficulty differentiating the scales, each judge thought they were successfully able to apply certain criteria to each scale and conceptualize them independently; however, they did notice there was overlap in some of their ratings. Judges noted that technical proficiency was the easiest of the scales to isolate as examples showed finger dexterity but lacked "harmonic panache." Creativity was related to how much an improvisation surprised judges, especially in terms of melody. Aesthetic appeal was mentioned as being difficult to separate from creativity, yet the correlation between AA and CR was the weakest of the three comparisons.

We also collected anecdotal data from the judges about their rating criteria for awarding an improvisation a high or low score. For high pieces, judges noted that rhythmic, dynamic, and textural ingenuity were critical. Also, one judge noted one's familiarity with jazz history blended with risk taking and spontaneity was important. Another judge mentioned that several music features were important: "voice leading, chord voicing, technical agility, and familiarity with scales." Low improvisations were rated as such because they lacked a coherent melody, did not "swing," had limited technique, or failed to outline the chord changes.

Limitations

This study includes some limitations that future research will address. We did not include direct measurements of Type 1 and Type 2 processes, instead relying on previous research that shows that instructions increase and alter Type 2 processing via goal activation (Nieuwenhuis et al., 2004) and activate a network of brain regions associated with executive function and cognitive control (Green et al., 2015). However, it is possible that various Type 2 processes may be differentially affected by creativity instructions. These instructions could conceivably have caused an

increase in one type of cognitive control while relaxing another type of cognitive control that usually inhibits Type 1 processing. The result could have been disinhibition of Type 1 processing. Although there is much evidence for the facilitatory impact of cognitive disinhibition on domain-general creativity (e.g., Martindale, 1999; Vartanian, Martindale, & Kingery, 2002), this scenario seems unlikely in a domain-specific task such as jazz improvisation because it assumes that the less-experienced musicians' Type 1 processes were sufficiently developed to enable performance at a higher level and that disinhibition was all that was required to release this latent ability. If so, then the only difference between the less- and more-experienced musicians would be that greater experience enables more effective disinhibition. Nevertheless, we cannot rule out this possibility, and future neuroimaging studies should examine this possibility by directly measuring brain activity in areas underlying Type 1 and Type 2 processes.

Another limitation of this study is that we were only able to compare the effects of be creative and standard instructions. Future research will explore the effects of a variety of instructions. Other instructions would presumably introduce new constraints and have led to both additional goal activation (beyond those traditionally associated with music improvisation) and Type 2 processing. A key feature of the creative explicit instruction was its flexibility, providing musicians with the opportunity to adapt their performance in whatever ways they deemed necessary to achieve optimal creativity.

Furthermore, our sample of jazz pianists included only a moderate range of age and expertise because we were not able to recruit musicians who had even more performance experience. It is therefore unknown whether the present results can be extrapolated to the most experienced musicians, though there is no evidence that the inclusion of such experts would have changed the results. In fact, if we had been able to recruit such musicians, the nonsignificant crossover effect hinted at in our results may have been enhanced and revealed that creativity instructions can inhibit creative performance in the most experienced musicians. Future studies will examine this possibility.

Though our use of a real-world creativity task, jazz improvisation, was motivated by a concern for ecological validity, the ecological validity of this study may have been somewhat limited by the stimuli and setting. The chord sequence was novel to performers and did not include a written melody, or "head." Before improvising, jazz pianists typically familiarize themselves with a series of chord changes and often use the melody of a piece as a foundation from which to improvise. We chose a novel chord sequence and the absence of a melody to preclude confounding factors such as sight reading, melody memorization, and prestudy practice. Additionally, participants performed at a static tempo. This prevented improvisational influence of spontaneous interactions, familiarity, and cohesion among musicians. We made this choice because the experimental sessions were conducted over several months. A live-band accompaniment was therefore impractical.

Conclusions

The present study of the creativity of jazz improvisations showed evidence of differential engagement of Type 1 and Type 2 processes by experts and nonexperts to optimize creativity. For

less-experienced musicians, instructions had a beneficial effect, apparently by redirecting their attention to helpful strategies. Thus, explicit instructions to be creative may generally prove to be an effective technique for improving creative performance in people who are not experts in their domain. In contrast, creativity instructions did not show comparable enhancement, and may have slightly disrupted, the improvisations of more experienced musicians. Future research will determine the consequences of creativity instructions across other domains and for individuals at even higher levels of expertise.

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