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Mind-wandering facilitates creative performance in a musical improvisation task

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ABSTRACT

Mind-wandering is widely assumed to impair ongoing task performance, yet findings from creative cognition research suggest that it can be beneficial under some conditions — an inconsistency rooted in coarse mental state classifications and low-ecological-validity tasks. We tested whether mind-wandering during active creative production facilitates or impairs real-time creative output in the ecologically valid setting of live jazz improvisation. 52 musicians performed a musical improvisation task while random thought-probes sampled ongoing mental states: focused attention, mind-wandering, mind-blanking, and task-related interference. Expert judges rated each performance for creativity and overall improvisational quality. Mental states were phenomenologically distinct across dimensions of intentionality and meta-awareness, and critically, this phenomenological heterogeneity translated into functional heterogeneity in their associations with creative output. Mind-wandering predicted higher creativity than focused attention, task-related interference suppressed creativity, and mind-blanking was neutral to modestly positive. Overall quality was mainly driven by expertise. State × expertise interactions revealed that the creative benefits of mind-wandering were strongest for less- and mid-experienced improvisers. These findings show that during improvisatory creative action, mind-wandering need not derail performance. Instead, it may mark adaptive loosening of cognitive control that supports generative spontaneity and flexibility crucial to creative expression.

1. Introduction

At any given moment, conscious experience fluctuates between being on-task — directed toward the immediate environment or goals — and being off-task, in which thoughts drift away from the task at hand. This ubiquitous off-task space encompasses a variety of mental states (Van den Driessche et al., 2025), yet previous research has often equated it with mind-wandering, which refers to spontaneous, dynamic, and associative thought (Christoff et al., 2016), encompassing processes such as perceptual decoupling, mental improvisation, and mental navigation (Gonçalves et al., 2020). In laboratory settings, it is typically operationalized as task-unrelated thought (Smallwood & Schooler, 2015). Crucially, mind-wandering represents the phenomenological dimension of a large segment of attentional lapses (Andrillon et al., 2019), and has accordingly been associated with mostly negative functional outcomes (Smallwood & Schooler, 2015). A notable exception is creative cognition, for which mind-wandering poses a double-edged sword: on the one hand, mind-wandering during incubation periods can enhance subsequent creative performance (Baird et al., 2012; Leszczynski et al., 2017), though recent attempts at replication have produced inconsistent results (Murray et al., 2024; Smeekens & Kane, 2016; Steindorf et al., 2021); on the other hand, when it occurs *during* the active execution of a creative task, mind-wandering seems to suppress immediate response fluency and originality (Hao et al., 2015). These results suggested that, at least in standardized laboratory-based creative tasks, the effects of mind-wandering on creativity depend critically on timing within the

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creative process. These tasks, however, have been shown to have weak predictive and ecological validity (Said-Metwaly et al., 2024; Zeng et al., 2011).

These timing-dependent effects illustrate well-established views of creative cognition as a dynamic process unfolding across multiple stages and timescales (Beaty et al., 2016; Girn et al., 2020), rather than as a discrete mental state. Indeed, classical models distinguish stages such as problem definition, knowledge acquisition, incubation, idea generation, combination, selection, and externalization (e.g., Sawyer, 2012). Standardized laboratory tasks, however, typically focus on isolating limited segments of this broader process. While valuable, this approach often captures only a partial cross-section of the fluctuating mental states that characterize creative thought in naturalistic contexts. Jazz improvisation offers a compelling alternative for studying creative cognition in more ecologically valid contexts (for a detailed theoretical rationale, see Palhares et al., 2024). By requiring performers to conceive and realize a coherent musical product in real time, improvisation reliably instantiates the dynamic interplay between generative and evaluative processes central to creative cognition (Beaty, 2015; Da Mota et al., 2020; Girn et al., 2020). Neurocognitive studies demonstrate that improvisation engages mechanisms shared with domain-general creativity, such as divergent thinking and cognitive flexibility (Beaty, 2015; Beaty et al., 2016), further supporting its validity as a model for creative cognition. Importantly, improvisation produces a continuous stream of observable and quantifiable creative behaviour, from macrostructures (phrases and note sequences) to microstructures (complete compositions), affording substantial methodological leverage (Palhares et al., 2024).

In a preliminary study, Palhares and colleagues (2022) explored the real-time effects of mind-wandering on creative expression during a musical improvisation task. By embedding experience-sampling probes into musical improvisation exercises, the authors assessed whether naturally occurring instances of mind-wandering — as opposed to focused attention — modulated real-time creative expression. Surprisingly, results showed that mind-wandering was associated with higher musical creativity compared to focused attention, without detriment to overall performance quality. This challenged assumptions of uniformly negative effects of mind-wandering during creative tasks.

The present study seeks to replicate and extend these findings by addressing two key limitations. First, the earlier study relied on a binary classification of mental states, contrasting focused attention (on-task attention) with mind-wandering (off-task attention). However, recent advances in the taxonomy of mental states highlight the heterogeneity of off-task experiences (Van den Driessche et al., 2025; Weinstein, 2018), which include not only mind-wandering, but also mind-blanking (i.e., instances of perceptual decoupling marked by the absence of thought, or failure to recall just-occurred thoughts; Andrillon et al., 2025; Ward & Wegner, 2013) and external distraction (thoughts related to external and task-unrelated salient stimuli). In addition, task-related interference (interfering thoughts related to side aspects of the task, such as worrying about mistakes, how long the solo is taking, or physical discomfort) has been classified as an 'on-task' state that is distinct from focused attention (Robison et al., 2019; Van den Driessche et al., 2025). In sum, these states differ in phenomenology, cognitive function and functional outcomes, and collapsing them into a single on/off contrast risks oversimplifying the dynamics of thought. Accordingly, the present study distinguishes four mental states — focused attention, mind-wandering, mind-blanking and task-related interference (external distraction was initially considered but excluded after pilot testing, as it was never reported) — enhancing the experience sampling validity and enabling us to disentangle how each state relates to ongoing creative output.

A second extension concerns the role of individual differences in creative expertise. The aforementioned study involved a small sample of jazz musicians of intermediate expertise, where limited variance in training precluded any systematic investigation of how expertise might modulate the effects of mental state on creative performance. This is a relevant omission, given that both the frequency and functional consequences of mind-wandering are known to vary with cognitive control capacity and domain-specific skill (McVay & Kane, 2009; Spelke et al., 1976). Accordingly, seasoned improvisers — who are provided with a training-induced optimization of executive functioning (Berkowitz & Ansari, 2010; Pinho et al., 2014) — might experience mind-wandering more frequently or handle off-task thoughts more productively than novices, as suggested by expertise-based attention regulation theories (Smallwood & Schooler, 2015). Therefore, the present study expanded the sample size fourfold and included improvising musicians from a wider range of instruments and experience levels, enabling the assessment of whether the creative impact of mind-wandering and other mental states varies with improvisational expertise.

Because musical creativity may encompass multiple dimensions (Schiavio & Benedek, 2020) and levels of analysis (Palhares et al., 2024) — including creative cognition, the aesthetic qualities of performance, observable creative behaviour, and the phenomenology of the creative process — the present empirical approach requires careful positioning. According to the Dynamic Framework of Thought, creative thought emerges from dynamic fluctuations between constrained and spontaneous thought (Girn et al., 2020), making it inherently elusive to capture as a discrete state through thought-probes. Instead, what we capture are constituent states (e.g., mind-wandering, focused attention) that potentially contribute to the creative process. Creative cognition, the underlying neural and cognitive mechanisms, continuously generates behavioural output in the case of improvised performance, which can be observed and evaluated. We assess this creative *product* using Amabile's (1982) Consensual Assessment Technique, a sociological approach which sidesteps definitional debates by operationalizing creativity as what expert musicians recognize as creative within jazz improvisation contexts. This approach treats judge-rated creative products not as proxies for creative thought per se, but as the behavioural manifestation of creative cognition operating across varying mental states.

In summary, the aim of the present study is twofold: first, to replicate and consolidate previous findings of a positive real-time effect of off-task attention on musical creativity. To do so, we significantly increased sample size and moved beyond a simple on-task vs. off-task distinction by adopting a finer-grained taxonomy of mental states, allowing us to identify which specific states are associated with creative benefits. The second aim is to examine how these effects interact with improvisational expertise by including a broader and more varied sample of musicians.

2. Method

2.1. Participants

52 jazz musicians (9 female) participated in this experiment. Encompassing levels of improvisational expertise from beginner to proficient, this sample included novices from music academies, students from high school/conservatory jazz programs, students from university jazz programs (undergraduate and graduate), professional jazz musicians and jazz instructors. Musical instruments included piano (n = 8), guitar (n = 14), bass (n = 8), saxophone (n = 8), trumpet (n = 4), trombone (n = 2), flute (n = 1), vibraphone (n = 3), and voice (n = 4). Ages ranged from 15 to 55 ($M = 28.19$, $SD = 10.42$), musical training ranged from 4 to 42 years ($M = 16.00$, $SD = 8.31$) and the number of live jazz performances ranged from 3 to 1700 ($M = 234.79$, $SD = 413.39$). Inclusion criteria required the ability to improvise over novel chord progressions on the spot, as depicted in jazz notation, and having performed and improvised in a live jazz setting at least three times. Eleven additional musicians were tested but excluded from data analysis due to failure to meet the study's inclusion criteria (e.g., inability to improvise over the provided chord progressions in a jazz style) or failure to complete the full task procedure (e.g., due to time constraints or technical issues). Given the specialised nature of the population, we adopted a feasibility-based strategy and recruited all eligible jazz improvisers we

could access during the project period, resulting in the final sample of 52 musicians.

Two university jazz instructors (male) were also recruited to evaluate the recordings of the improvisations. Both had extensive experience leading jazz big bands–an important criterion, as they would be rating improvisations from a wide range of instruments–and a minimum of 30 years of professional jazz performance experience.

Convenience sampling was used, with recruitment involving outreach to conservatories, university jazz programs, and other relevant institutions. Participants were recruited via announcements and email invitations at 10 institutions spanning North, Centre and Lisbon regions of Portugal: Escola de Jazz de Braga, Escola Superior de Música e Artes do Espetáculo (ESMAE, Porto), Associação Porta-Jazz (Porto), Escola de Música Valentim de Carvalho (Porto), Conservatório de Música do Porto, Núcleo Artístico Ermo do Caos (Porto), University of Aveiro's Department of Communication and Art, Conservatório de Música de Coimbra, Escola Superior de Música de Lisboa (ESML), and Hot Clube de Lisboa. Additional participants were recruited via informal contacts in the local jazz communities of Lisbon and Porto.

Monetary compensation was not provided. All participants – or, in the case of minors, their legal guardians – signed an informed consent form, and the study was carried out under the ethical standards defined by the Institutional Ethics Committee and the Code of Ethics of the World Medical Association (Declaration of Helsinki).

3. Design

Following a within-subject design, participants individually performed a musical improvisation task in which musical performance was randomly and periodically interrupted by thought-probes across six *takes*. The main within-subject factor was the self-reported mental state at each probe (focused attention, mind-wandering, mind-blanking, task-related interference), and the primary outcome was expert-rated creativity for the preceding improvisation segment.

4. Materials

4.1. Thought-probes

During performance, participants were randomly and periodically interrupted by a fixed set of questions (60–180 s after the presentation of each lead sheet, random uniform jitter) sampling their conscious experience. First, they indicated which of four possible mental states best described their experience at the moment of interruption: "I was focused on the task" (classified as focused attention), "I was focused on something unrelated to the task" (mind-wandering), "My mind was blank" (mind-blanking),"I don't remember" (mind-blanking) or "I was focused on secondary and interfering aspects of the task" (task-related interference). Next, participants characterized their selected mental state by rating, on a 5-point Likert scale, its degrees of intentionality ("To what extent did you engage in this mental state on purpose?"; Seli et al., 2016) and *meta*-consciousness ("To what extent were you aware of your own mental state?"; Winkielman & Schooler, 2011). Finally, participants answered three additional single-item questions, each on a 5-point Likert scale, indexing perceptual decoupling ("My mind often disconnected from what surrounded me"), mental improvisation ("My thoughts jumped easily from one subject to another"), and mental navigation ("My thoughts travelled frequently through time [past or future]"). These items were selected from the European Portuguese version of the Mind Wandering Inventory (MWI; Gonçalves et al., 2020), a 10-item scale that showed good internal consistency in its validation study (Cronbach's $\alpha = 0.85$ for the European Portuguese version) and supported a three-component solution interpreted as perceptual decoupling, mental improvisation, and mental navigation, with the three probe questions used here corresponding to the highest-loading exemplar item for each of these components in that analysis. In the present study, however, these three phenomenological dimensions were only analysed for the subset of trials in which the primary state report was mind-wandering, in line with the intended use of the MWI as a mind-wandering measure.

4.2. Jazz lead sheets

Jazz lead sheets (notated chord progressions used as a framework for improvisation) were composed by a professional jazz musician specifically for this study, aiming to create unique 16-bar sequences of equal difficulty, time signature (4/4), tempo (120 beats per minute) and duration (180 s, consisting of four rotations through the chord changes). The sequences incorporated familiar jazz patterns and were accompanied by a jazz backing track featuring piano, bass and drums (for pianists the backing track omitted the piano; for bassists it omitted the bass). Lead sheets were displayed dynamically: after an initial two-measure metronome count-in, a yellow cursor highlighted the active measure in sync with the backing track (Fig. 1). The dynamic display and backing tracks were generated using iReal Pro v.2022.2, then embedded in OpenSesame (version 3.3.10; Mathôt et al., 2012).

4.3. Apparatus

Data acquisition sessions took place in sound-attenuated rooms, specifically the rehearsal spaces of conservatories, universities, and other typical environments for musical performance. The experimental task was programmed and presented on OpenSesame (version 3.3.10; Mathôt et al., 2012) via laptop computer. Auditory stimuli were delivered through an external speaker with stereo output. A separate laptop computer recorded musical performances using a USB stereo condenser microphone, positioned as a room microphone to capture both the participant's instrument and the auditory stimuli presented during the task. Each participant performed on their own instrument, except for those playing larger instruments — piano, vibraphone, and double bass — who used the instruments available at the recording location.

4.4. Post-experiment questionnaires

Beyond basic demographic information (e.g., age, sex), participants provided details on their educational background and musical training, the latter including years of formal music education, years of training, years of improvisation experience, daily practice hours, primary instrument, estimated number of live jazz performances, and dominant musical genre. In addition, participants filled a trait mind-wandering questionnaire (Mind Wandering Inventory; Gonçalves et al., 2020; data not reported here).

4.5. Procedure

After providing informed consent and receiving preliminary instructions about the task, participants completed a warm-up improvisation exercise during which they adjusted instrument and backing track volume levels and responded to a practice thought probe. During this practice period, the experimenter reviewed the probe statements together with the participant, clarified any doubts using informal examples, and ensured that the response format was fully understood. Afterwards, participants completed six improvisation takes. Across these six takes, participants performed on-the-spot improvisations over unique harmonic grids. Each take featured a different harmonic grid and was accompanied by a backing track. Participants were given 10 s to examine the chord sequence of each take before starting. Then, after a two-measure metronome count-in, they began improvising. Their performance was randomly interrupted by a thought-probe (Fig. 2). After responding, the next lead sheet was presented. Afterwards, they completed sociodemographic, musical background, and trait mind-wandering questionnaires.

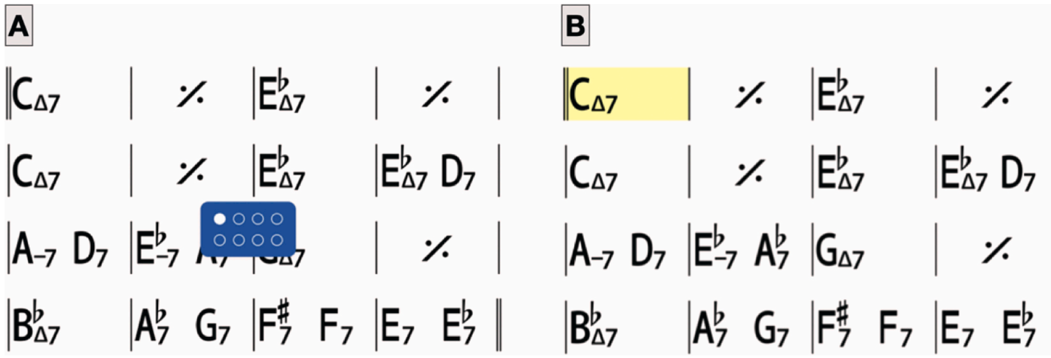

Fig. 1. Example of the dynamic display of the metronome count-in (A) and the moving bar cursor (B).

Fig. 2. Trial structure overview: improvisation → random thought-probe → next improvisation.

5. Analysis

5.1. Assessment of musical performance

Each recorded take was processed to ensure consistent loudness and balance between main instrument and accompaniment across all participants. Audio files were first adjusted for loudness normalization, followed by peak-level control, mixing, compression, and subtle saturation using Reaper digital Audio workstation (version 7.06). Only the 30 s preceding the probe interruption were selected for analysis, and the recordings were randomized for judging. Two judges independently rated the Audio recordings of the participants' improvisations using the Consensual Assessment Technique (CAT) for creative products (Amabile, 1982). CAT treats creativity as a socially agreed property of a product. When domain-specific expert judges independently converge in rating a work as creative, that consensus itself constitutes validity. To ensure this, judges must possess domain expertise, rate each performance relative to the full set (rather than against an external ideal), apply their own internally generated criteria (as no definition of creativity is provided), and work in isolation, blind to experimental condition. Within this framework, convergent expert ratings are treated as the primary validity criterion for the creativity construct, and interrater reliability provides the key quantitative index of rating quality, with values of ≥ 0.70 typically considered evidence that the rating procedure is valid.

For each recorded take, five parameters were rated on a 7-point Likert-type scale: creativity, originality, effectiveness, expressiveness, and overall improvisational quality. Creativity was the holistic judgment of musical creativity, formed entirely on the judges' own criteria. The remaining parameters were included to provide a complementary, theory-driven view of the same performances. Here we departed from strict CAT procedure and supplied concise, operational definitions so that the judges would evaluate specific facets of creativity already highlighted in the improvisation literature (Runco & Jaeger, 2012). Originality was defined for the raters as the degree to which the solo sounded new, unexpected, or unusual in its melodic, harmonic, rhythmic, or timbral ideas. Effectiveness referred to musical coherence and functional success, namely whether the solo worked stylistically and had aesthetic appeal. Expressiveness captured the clarity and nuance of emotional or intentional communication conveyed through phrasing, dynamics, and energy. Overall improvisational quality focused on technical execution, namely fluency, control, and instrumental command, offering a competence benchmark distinct from creativity per se. For each recorded take and each rating dimension, the two judges' scores were then averaged to yield a single value per performance, which served as the outcome measure in all subsequent analyses.

We computed intraclass correlation coefficients (ICC) using a two-way mixed-effects model for consistency (ICC(3,1)) to assess interrater reliability between the two judges, who were treated as fixed effects since they were the only raters in the study. Inter-rater reliability was excellent for all rating scales, as estimated by the intraclass correlation coefficient (ICC) for creativity ($ICC = 0.77$, 95% CI [.72, 0.82]), originality ($ICC = 0.81$, 95% CI [.76, 0.85]), effectiveness ($ICC = 0.86$, 95% CI [.83, 0.89]), expressiveness ($ICC = 0.82$, 95% CI [.78, 0.86]) and overall improvisational quality ($ICC = 0.88$, 95% CI [.85, 0.91]). These ICC values (range 0.77–.88) indicate excellent agreement between raters and, in line with CAT, support the reliability and validity of the expert-based creativity assessments used as outcome measures in this study.

5.2. Statistical analyses

All analyses were conducted in R (version 4.4.2). To obtain a single continuous measure of improvisational expertise, four objective indicators — years of formal training, years of improvisation, average daily practice hours, and lifetime number of improvisation concerts —were first inspected for skew. Variables with $|skew| > 0.50$ were Box–Cox- or log-transformed to approximate normality (Osborne, 2010; years of formal training and years of improvisation were log-transformed, whereas daily practice hours and number of improvisation concerts received Box-Cox transforms), after which all indicators were z-scored. The standardized variables entered a one-factor maximum-likelihood exploratory factor analysis with oblimin rotation using the psych package (Revelle, 2025). All loadings exceeded 0.30, indicating a coherent latent factor, so we computed the expertise score as the loading-weighted sum of the four indicators and re-standardized it. This composite approximated normality and parsimoniously captured shared variance in musical expertise, serving as the continuous expertise covariate in later mixed-effects models.

Thought-probe ratings were analysed first. Intentionality and *meta*-consciousness were each submitted to a linear mixed-effects model, implemented using the lme4 package (Bates et al., 2015), that treated mental state as a fixed effect and included a random intercept for participant. Pairwise contrasts were Holm-corrected (Holm, 1979). An additional parallel model examined the three phenomenological dimensions of mind-wandering to characterise the configuration of mind-wandering states across participants. These preliminary tests established qualitative differences among states that informed interpretation of the performance analyses.

Creative-performance ratings were then modelled at the trial level. We initially specified models with a random slope of State by participant, of the form.

$$Outcome = \beta_0 + \beta_1 \cdot State + \beta_2 \cdot Expertise + \beta_3 \cdot (State \times Expertise) + (1 + State \mid \text{Participant}) + \varepsilon,$$

where *State* used focused attention as the reference and *Expertise* was the standardized composite described above. The model included a random slope for State by participant to account for inter-individual variability in how different mental states influence creative performance (Baayen et al., 2008). Expertise was treated as a between-participants predictor and therefore entered only as a fixed effect. However, the full random-slope version frequently produced singular fits, so we refitted those models with a random intercept only — (1 | Participant) (Barr et al., 2013; Bates et al., 2015), keeping the fixed-effects structure unchanged. Thus, all four-state models reported in the Results use a random-intercept structure (1 | Participant). Fixed effects were evaluated with Kenward–Roger degrees of freedom (Kenward & Roger, 1997), and simple slopes of *Expertise* within each *State* were extracted from estimated marginal trends using the emmeans package (Lenth et al., 2025). This model tested our central question: whether off-task states, particularly mind-wandering, confer an immediate creative advantage and whether that advantage varies with improvisational expertise.

Because task-related interference was rare and mind-blanking paralleled focused attention, a confirmatory model compared only mind-wandering with focused attention, incorporating intentionality and *meta*-consciousness as covariates. Covariates were retained when their removal raised AIC (Akaike Information Criterion) by ≥ 2, and only *meta*-consciousness met that criterion (Burnham & Anderson, 2004). Reducing the factor to two levels also resolved the singular-fit problems of the previous model and let us retain the originally intended random slope of State by participant. The final confirmatory specification was

$$Outcome = \beta_0 + \beta_1 \cdot State + \beta_2 \cdot Expertise + \beta_3 \cdot Meta\text{-}consciousness + \beta_4 \cdot (State \times Expertise) + (1 + State \mid Participant) + \varepsilon.$$

Together, these models quantified state-related creativity effects, tested their moderation by expertise, and verified that the effects were not better explained by moment-to-moment phenomenological differences.

6. Results

6.1. Frequencies of mental state

Across all participants, 80.1% of responses reflected on-task states, a pattern driven primarily by focused attention (74.8%), with task-related interference contributing only a small proportion (5.3%). In contrast, off-task states accounted for 19.9% of responses and were more evenly distributed between mind-blanking (10.5%) and mind-wandering (9.4%) (see Fig. 3). When parsed by expertise tertile, off-task states accounted for 17.2% of trials in the Low-expertise group (MW 7.5%, MB 9.7%), 15.5% in the Mid-expertise group (MW 6.0%, MB 9.5%), and 27% in the High-expertise group (MW 14.6%, MB 12.4%). To formally test whether off-task frequency varied with expertise, we computed each participant's proportion of off-task trials (MW + MB) and regressed this on the continuous expertise composite. This analysis revealed no reliable association between expertise and off-task propensity ($\beta = 0.01$, SE $= 0.04$, $p = 0.81$, $R2 < 0.01$), suggesting that the descriptive differences across expertise tertiles should be interpreted with caution.

6.2. Thought-probe data

6.2.1. Intentionality and meta-consciousness across mental states

Intentionality differed sharply across mental states (Fig. 4, left panel;

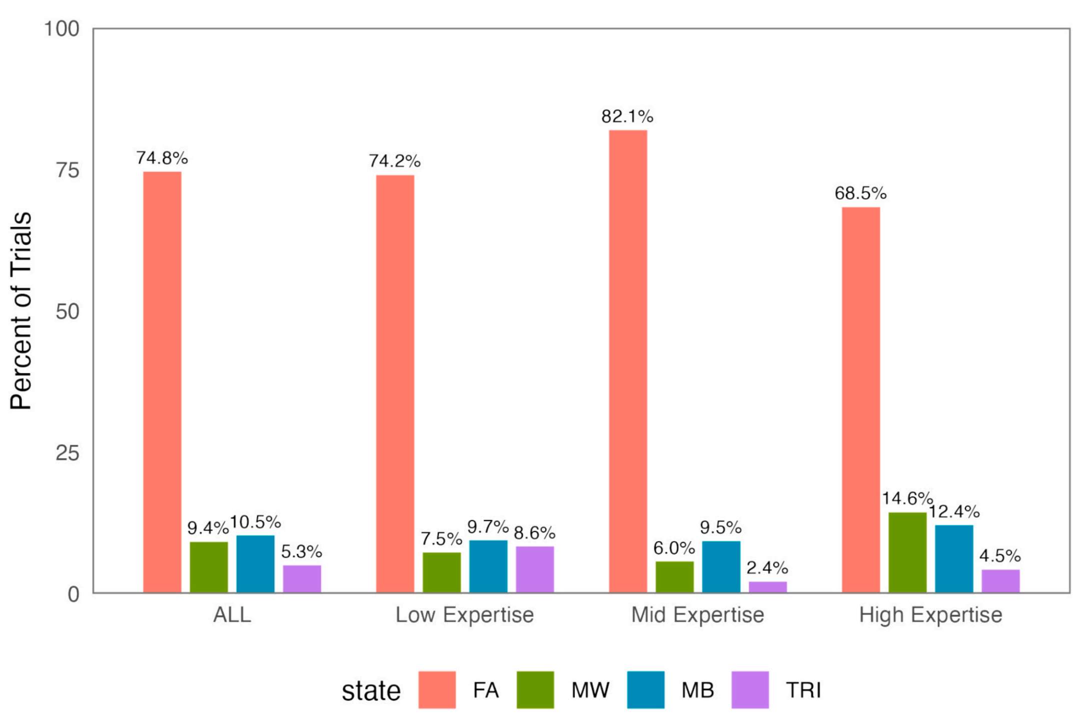

Fig. 3. *State distribution by mental state and expertise group. Note.* Dodged bar chart showing the percentage of trials in which participants reported each state — focused attention (FA), mind-wandering (MW), mind-blanking (MB), and task-related interference (TRI) — for the full sample (ALL) and within Low, Mid, and High expertise tertiles. Bars represent trial-level proportions aggregated across all participants within each group. Variability in state frequency across individuals is not depicted here but is quantified in the mixed-effects models reported in the text, which account for participant-level random effects.

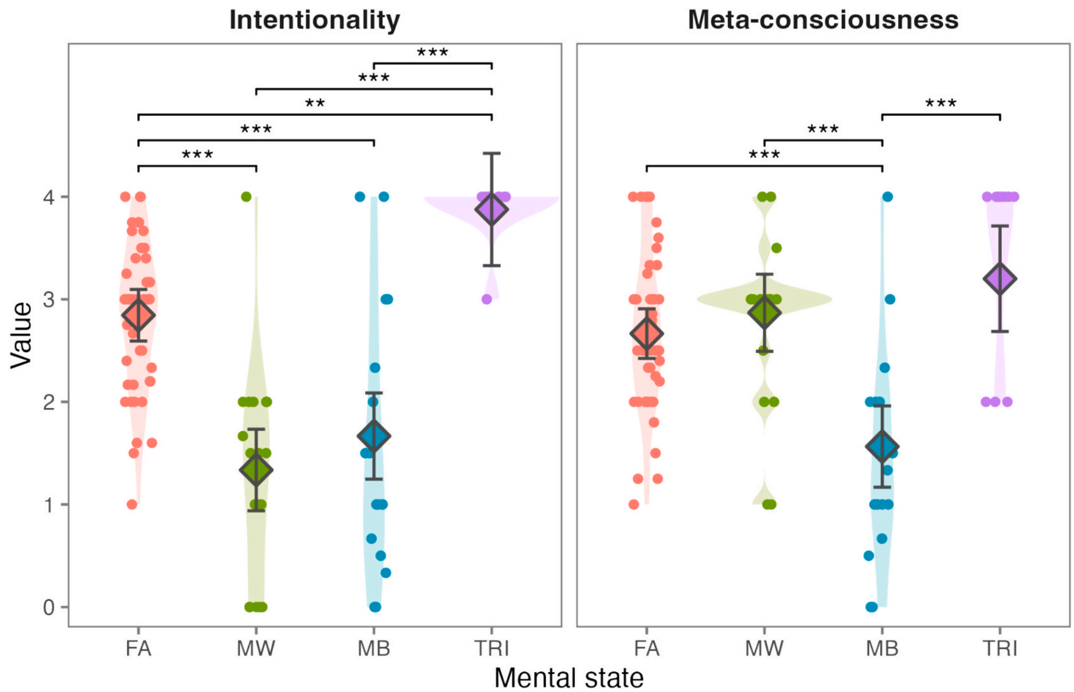

Fig. 4. Intentionality and *meta*-consciousness across mental states. *Note.* Violin plots of participant-level means for intentionality (left) and *meta*-consciousness (right) across mental states. Dots are each participant's mean within a state. Filled squares and 95% *CIs* are model-based marginal means from linear mixed-effects models with random intercepts for participants (1 | ID). Holm-corrected significant pairwise contrasts are annotated. FA = focused attention; MW = mind-wandering; MB = mind-blanking; TRI = task-related interference.

Supplementary Table 1). Focused attention showed a moderate/high mean intentionality ($M = 2.83$, $SD = 0.71$), whereas both mind-wandering ($M = 1.27$, $SD = 1.02$) and mind-blanking ($M = 1.58$, $SD = 1.28$) were markedly lower. Task-related interference was the most intentional state ($M = 3.90$, $SD = 0.32$). Pairwise mixed-effects contrasts (Supplementary Table 2) confirmed these patterns: intentionality was significantly higher in focused attention than in mind-wandering (estimate = 1.51, $SE = 0.22$, $p < 0.001$) or mind-blanking (estimate = 1.18, $SE = 0.23$, $p < 0.001$), and task-related interference exceeded all other states ($ps \leq 0.001$). Meta-consciousness showed a complementary profile (Fig. 4, right panel; Supplementary Table 1). Task-related interference yielded the highest mean ($M = 3.40$, $SD = 0.97$), followed by mind-wandering ($M = 2.79$, $SD = 0.80$) and focused attention ($M = 2.66$, $SD = 0.75$). Mind-blanking was lowest ($M = 1.46$, $SD =$

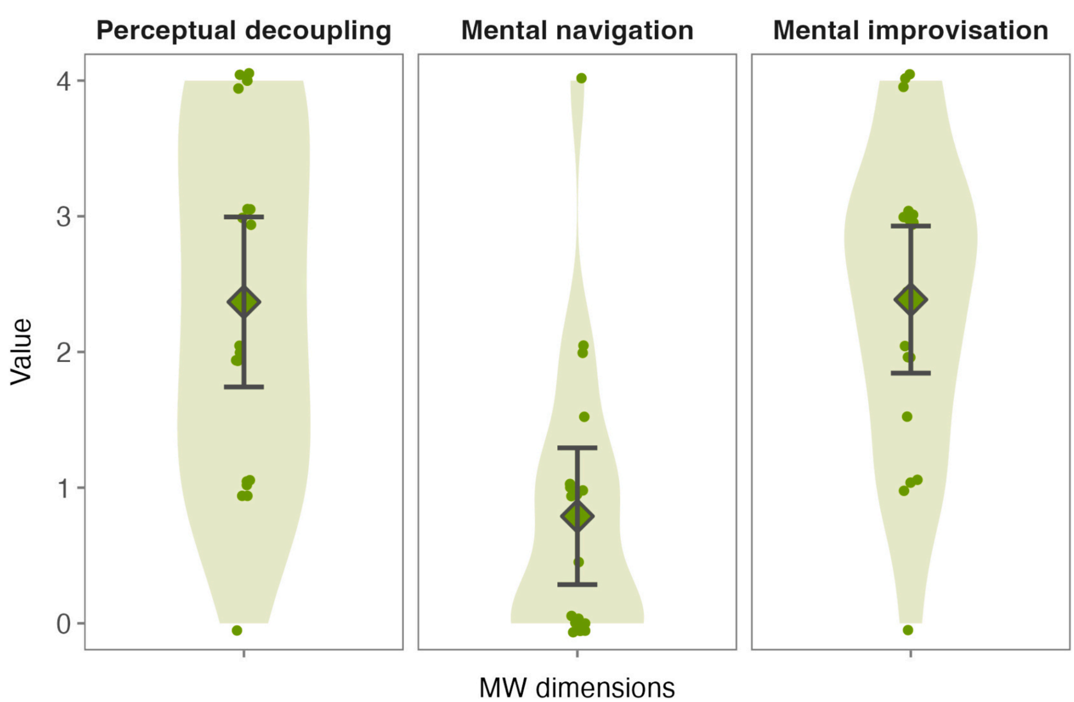

Fig. 5. Phenomenological profile of mind-wandering episodes. *Note.* Values are participant-level means within mind-wandering episodes. *SE* and 95% *CIs* are computed across participants using the *t* distribution. PD = perceptual decoupling; MN = mental navigation; MI = mental improvisation.

1.04). Mixed-effects contrasts (Supplementary Table 2) indicated that *meta*-consciousness in focused attention exceeded mind-blanking (estimate = 1.10, SE = 0.21, $p < 0.001$), and mind-wandering exceeded mind-blanking by a similar margin (estimate = 1.30, SE = 0.25, $p < 0.001$). No other pairwise differences reached significance after Holm correction.

Together, these findings highlight qualitative differences within off-task states: mind-wandering combines low intentionality with relatively high *meta*-consciousness, whereas mind-blanking is low on both dimensions. In contrast, the two on-task states — focused attention and task-related interference — share a common profile of high intentionality and high *meta*-consciousness and thus stand apart from the less intentional off-task states.

6.2.2. Mind-wandering phenomenology

Using the selected items from the Mind Wandering Inventory (Gonçalves et al., 2020) in the thought-probes, we characterized mind-wandering episodes across three dimensions — perceptual decoupling, mental navigation, and mental improvisation (Fig. 5; Supplementary Table 3). Perceptual decoupling (M = 2.37, SD = 1.30) and mental improvisation (M = 2.39, SD = 1.12) were both situated in the upper half of the scale, indicating that mind-wandering episodes typically involved moderate-to-strong disengagement from external sensory input and a dynamic train of thought characterized by fluency, spontaneity, and variability in thought content. By contrast, mental navigation was weak (M = 0.79, SD = 1.05), suggesting that these thoughts lacked spatiotemporal travel, episodic-memory content. In sum, the average mind-wandering episode was characterised by decoupled, improvisatory thought with minimal narrative roaming (i.e., largely anchored to the here-and-now), providing a baseline phenomenological profile against which mind-wandering episodes can be interpreted in later analyses.

6.3. Mixed-effects model

Here, we employed linear mixed-effects models to assess how each mental state influenced creative performance while jointly modelling individual differences in improvisational expertise. Although random-slope models were initially specified to capture variation in state effects across participants, all models returned singular fits and were therefore replaced by simpler random-intercept models (i.e., outcome = $\beta_0 + \beta_1$·State + β_2·Expertise + β_3·[State × Expertise] + [1 | Participant] + ε). Full fixed-effects results are reported in Supplementary Table 4, simple slopes in Supplementary Table 5, and marginal and conditional R^2 values in Supplementary Table 6.

6.3.1. Overall creativity

Fig. 6 displays model-predicted creativity trajectories across expertise for each mental state. Both mind-wandering and mind-blanking were associated with significantly higher creativity than focused attention (MW: $\beta = 0.59$, $SE = 0.16$, $p < 0.001$; MB: $\beta = 0.34$, $SE = 0.15$, $p = 0.023$), whereas task-related interference predicted significantly lower creativity ($\beta = –0.80$, $SE = 0.20$, $p < 0.001$). Expertise exerted a strong positive main effect ($\beta = 0.63$, $SE = 0.08$, $p < 0.001$), and no significant interaction emerged between mental state and expertise. In terms of model fit, fixed effects accounted for 44% of trial-level variance in creativity (Marginal $R^2 = 0.44$), increasing to 60% when accounting for participant-level variability (Conditional $R^2 = 0.60$).

6.3.2. Originality, effectiveness and expressiveness

For originality, mind-wandering again predicted higher ratings (β = 0.66, SE = 0.17, $p < 0.001$), while mind-blanking showed a small positive coefficient that did not reach statistical significance ($\beta = 0.29$, SE = 0.16, $p = 0.071$). Task-related interference suppressed originality (β = -0.77, $SE = 0.22$, $p < 0.001$), and expertise remained a strong predictor (β = 0.62, SE = 0.08, $p < 0.001$). There was also a negative, non-significant mind-wandering × expertise interaction (β = -0.40, SE = 0.22, p = 0.073). Effectiveness followed a similar pattern: mind-wandering boosted ratings (β = 0.63, SE = 0.18, $p < 0.001$), while mind-blanking had no effect ($\beta = 0.02$, $SE = 0.16$, $p = 0.887$), and task-related interference lowered effectiveness (β = –0.59, SE = 0.23, p = 0.009). Expertise again had a strong positive impact (β = 0.67, SE = 0.09, $p < 0.001$), and a negative, non-significant MW × expertise interaction was observed (β = –0.432, SE = 0.23, p = 0.067). Expressiveness likewise showed a benefit from mind-wandering and mind-blanking (MW: β = 0.68, SE = 0.18, $p < 0.001$; MB: β = 0.35, SE = 0.17, p = 0.041), a negative, non-significant effect of task-related interference (β = –0.45, SE = 0.23, p = 0.054), and a robust effect of expertise ($\beta = 0.74$, $SE = 0.08$, $p < 0.001$), alongside another negative, non-significant MW × expertise interaction (β = –0.44, SE = 0.24, p = 0.067). Model fit was comparable across subdimensions, with fixed effects explaining 38–44% of trial-level variance (Marginal R^2), and total variance explained reaching 56–60% when including participant-level effects (Conditional R^2). Taken together, mind-wandering was consistently associated with higher scores on all three subdimensions of creativity, task-related interference suppressed them, and expertise exerted broad positive effects across states.

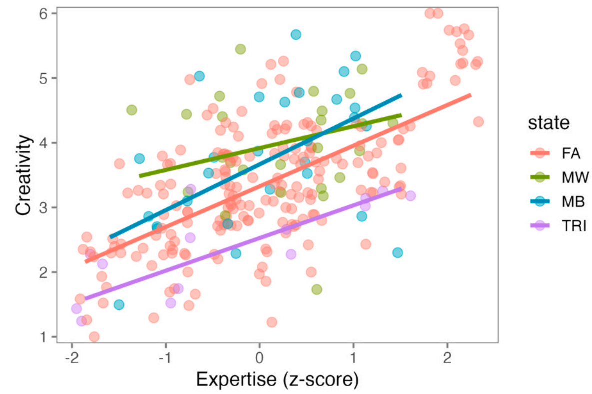

Fig. 6. *Predicted creativity by mental state and expertise. Note.* Lines show model-predicted creativity from a linear mixed-effects model (Creativity = β_0 + β_1·State + β_2·Expertise + β_3·[State × Expertise] + [1 | Participant] + ε), with raw trial-level ratings overlaid (jittered). FA = focused attention; MW = mind-wandering; MB = mind-blanking; TRI = task-related interference.

6.3.3. Overall improvisational quality

In contrast, ratings of overall improvisational quality were explained primarily by expertise ($\beta = 0.70$, $SE = 0.17$, $p < 0.001$). Mind-wandering and mind-blanking had no significant effects (MW: $\beta = 0.37$, $SE = 0.23$, p = 0.124; MB: β = 0.09, SE = 0.20, p = 0.656), and task-related interference was again associated with poorer performance (β = –0.60, SE = 0.21, p = 0.007). No interactions with expertise reached significance (all $p > 0.711$). The model for overall improvisational quality showed the highest total variance explained (Conditional R^2 = 0.66), with a modest marginal contribution of mental state (Marginal R^2 = 0.37).

6.3.4. Simple slopes of expertise within states

To further probe the state × expertise interaction observed in several outcomes, we conducted simple-slope analyses estimating the effect of expertise separately within each mental state. These analyses revealed that expertise reliably predicted higher creativity during focused attention ($\beta = 0.63$, $SE = 0.08$, $p < 0.001$), mind-blanking ($\beta = 0.71$, SE = 0.17, $p < 0.001$), and task-related interference ($\beta = 0.51$, $SE = 0.17$, p = 0.003). In contrast, the expertise slope during mind-wandering was smaller and did not reach significance ($\beta = 0.34$, $SE = 0.21$, $p = 0.109$).

This difference in slope magnitude helps explain the observed interaction between mind-wandering and expertise: although creativity tends to be higher during mind-wandering, the relationship between expertise and performance is markedly attenuated in this state. A similar pattern held across subdimensions such as expressiveness, where expertise was a strong predictor during FA, MB, and TRI (*ps* $\le$ 0.003), but not during MW (*ps* $\ge$ 0.101). This indicates that while expertise was generally associated with more creative performance, this effect was diminished or absent when performers entered a mind-wandering state.

In sum, mixed-effects models reveal a consistent, state-dependent pattern in creative performance. Mind-wandering reliably boosted creativity — both overall and across its subdimensions — while task-related interference suppressed it. Expertise exerted a robust positive effect across all outcomes. In contrast, ratings of overall improvisational quality were driven primarily by expertise.

6.4. Confirmatory mixed-effects model

To home in on our core hypothesis — that mind-wandering enhances creativity relative to focused attention — we next fitted a streamlined two-state mixed-effects model. In our initial four-state analysis, mind-blanking yielded nearly identical outcomes to focused attention, while task-related interference, though exhibiting a pronounced suppressive effect, occurred too infrequently (<6% of trials) to support reliable inference. By reducing the fixed-effect factor to only mind-wandering and focused attention, we retained the full random-effects structure – allowing each musician a unique baseline (intercept) and sensitivity to state shifts – while avoiding singular fits and maximizing power for the mind-wandering effect.

Because every thought-probe also yielded continuous phenomenological ratings for intentionality and *meta*-consciousness, we assessed whether these trial-level ratings might explain additional variance or interact with state and expertise. Across the five mixed-effects models (creativity, originality, effectiveness, expressiveness, overall quality), we counted for each candidate covariate how often its removal increased AIC by $\ge$ 2 (i.e., "worsened fit") (full results in Supplementary Table 7). Meta-consciousness was the only covariate to meet that retention criterion in at least one model (1 of 5), with a mean ΔAIC of 0.51 (mean χ^2 (1) = 2.51). The pre-specified state × expertise interaction met the threshold in 2 outcomes as well (mean ΔAIC = 1.09, χ^2 = 3.09). Intentionality never once improved fit (ΔAIC < 2 in all five models, mean ΔAIC = -1.68). Therefore, we retained meta-consciousness (and continue to include the a priori state × expertise interaction) but dropped intentionality from our final two-state (MW vs FA) mixed-effects models. Refitting the final model under REML gave: *Creativity* = β_0 + β_1·*State* + β_2·*Expertise* + β_3·*Meta-consciousness* + β_4·*(State* × *Expertise)* + *(1* + *State* | *Participant)* + ε (see Supplementary Table 8 for fixed-effects estimates, Supplementary Table 9 for state-specific simple-slope estimates, and Supplementary Table 10 for marginal and conditional R^2 values).

6.4.1. Overall creativity

Fig. 7 shows the two-state model-predicted creativity trajectories across expertise for mind-wandering and focused attention. Mind-wandering remained a significant predictor of creativity (β = 0.62, *SE* = 0.16, p < 0.001), and musical expertise continued to exert a robust positive effect (β = 0.63, *SE* = 0.08, p < 0.001). In addition, *meta*-consciousness showed a positive, non-significant effect (β = 0.09, *SE* = 0.05, p = 0.065). The mind-wandering × expertise interaction this time was significant (β = –0.47, *SE* = 0.21, p = 0.039). The model explained 41% of the fixed-effect variance (Marginal R^2) and 62% when including participant-level random effects (Conditional R^2). Simple-slopes analyses indicated that expertise strongly predicted creativity under focused attention (β = 0.63, *SE* = 0.08, p < 0.001) but had a weaker, non-significant association during mind-wandering (β = 0.17, *SE* = 0.21, p = 0.429). These results confirm that the creative boost observed in

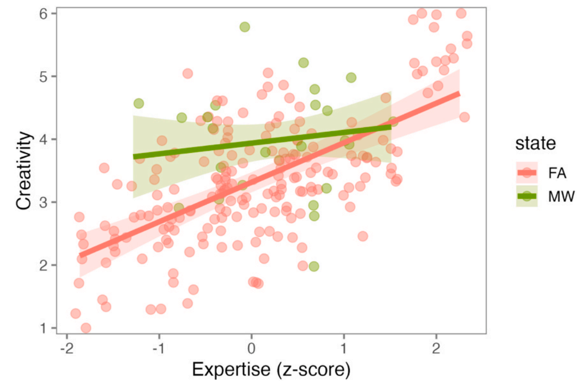

Fig. 7. *Predicted creativity by mental state and expertise (confirmatory model). Note.* Lines depict model-predicted values over the observed range of expertise for each state, with trial-level ratings overlaid. Shaded ribbons indicate 95% confidence intervals. FA = focused attention; MW = mind-wandering.

mind-wandering is both reliable and modulated, albeit modestly, by individual expertise.

6.4.2. Originality, effectiveness, and expressiveness

The mind-wandering advantage persisted across all three creativity subdimensions. Mind-wandering significantly boosted originality (β = 0.69, *SE* = 0.19, p = 0.001), effectiveness (β = 0.72, *SE* = 0.21, p = 0.003), and expressiveness (β = 0.74, *SE* = 0.22, p = 0.004). Expertise consistently predicted higher scores across outcomes (βs = 0.63–0.74, *SEs* = 0.08–0.09, all p < 0.001). Meta-consciousness showed a positive effect for originality (β = 0.11, *SE* = 0.05, p = 0.022), a non-significant trend for effectiveness (β = 0.10, *SE* = 0.05, p = 0.067) and a non-significant trend for expressiveness (β = 0.05, *SE* = 0.05, p = 0.362). Crucially, the mind-wandering × expertise interaction was significant for all three outcomes (βs = -0.52 to −0.60, *SEs* = 0.24–0.29, p-values < 0.05), indicating that the creative benefit of mind-wandering was reduced among more experienced improvisers. Simple-slopes analyses confirmed strong expertise effects under focused attention (βs = 0.63–0.74, *SEs* = 0.08–0.09, all p < 0.001), but attenuated, non-significant slopes during mind-wandering (βs = 0.08–0.14, *SEs* = 0.25–0.29, all $p \ge$ 0.634). Fixed effects explained 40–44% of variance (Marginal R^2), increasing to 63% with participant-level random effects (Conditional R^2).

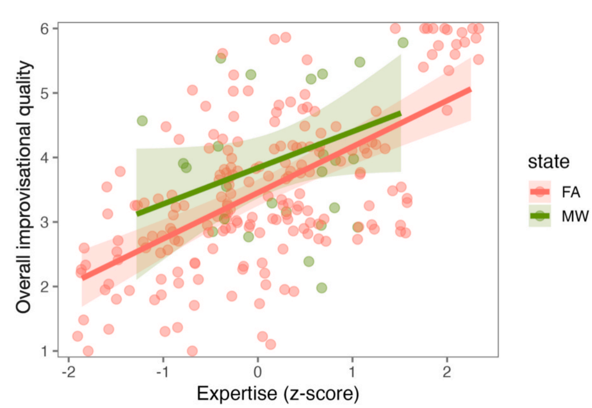

Fig. 8. *Predicted overall improvisational quality by mental state and expertise (confirmatory model). Note.* Lines depict model-predicted values over the observed range of expertise for each state, with trial-level ratings overlaid. Shaded ribbons indicate 95% confidence intervals. FA = focused attention; MW = mind-wandering.

6.4.3. Overall improvisational quality

In contrast, overall quality was driven primarily by expertise (β = 0.71, SE = 0.10, p < 0.001), with no significant benefit of mind-wandering (β = 0.39, SE = 0.23, p = 0.106) (see Fig. 8). Meta-consciousness (β = 0.09, SE = 0.05, p = 0.102) and the mind-wandering × expertise interaction (β = –0.15, SE = 0.30, p = 0.614) had non-significant effects. Simple-slopes showed that expertise predicted overall quality under both focused attention (β = 0.71, SE = 0.10, p < 0.001) and mind-wandering (β = 0.56, SE = 0.32, p = 0.098), though only the former reached significance. Marginal R^2 was 0.36, and Conditional R^2 reached 0.68.

In sum, these results offer converging evidence that mind-wandering was reliably associated with increased creativity in musical improvisation. This effect held for both overall creativity scores and across all three creativity subdimensions — originality, effectiveness, and expressiveness — even after controlling for trial-level variations in *meta*-consciousness and allowing each participant a unique intercept and slope. However, this creative benefit was modulated by expertise: novice and intermediate-level participants gained the most from mind-wandering, with the advantage diminishing as experience increased. Meta-consciousness, in turn, emerged as a modest but consistent co-variate, positively contributing to creativity in some outcomes. By contrast, overall improvisational quality was driven almost exclusively by expertise, with no reliable modulation by mental state or *meta*-consciousness.

7. Discussion

Our primary goal was to determine whether mind-wandering during an active creative task could facilitate creative performance. In line with our predictions, mind-wandering was associated with higher creative output than focused attention. Mind-blanking did not significantly impair performance and even showed a modest positive trend on some creativity measures, while task-related interference consistently reduced creative output. Expertise moderated these effects, with novice and intermediate-level musicians deriving the largest creative benefit from mind-wandering. Importantly, these effects were selective to creativity, as ratings of overall improvisational quality were driven primarily by expertise and showed little reliable modulation by mental states.

These results challenge traditional views of mind-wandering as uniformly detrimental to ongoing performance (Hao et al., 2015). We replicate the findings of Palhares and colleagues (2022) and, with a larger sample and methodologically updated state taxonomy (Robison et al., 2019; Van den Driessche et al., 2025; Weinstein, 2018), yield results that are consistent with the claim that spontaneous thought phenomena can contribute to ongoing performance rather than merely support later creative incubation. Taken together, these findings suggest that mind-wandering is not invariably harmful during creative action and under the right conditions it may be associated with richer artistic output.

Why might mind-wandering be linked to higher improvisational creativity yet hinder laboratory tasks? One explanation may be that the creative process in jazz improvisation differs fundamentally from that in constrained problem-solving. Pressing's seminal theory of improvisation (1988) posits that improvisatory performance relies on a long-practised repertoire of motor programs and stylistic schemata organised around an internal referent (e.g., the chord grid). Once the referent is in place, production proceeds through highly automated generative and associative mechanisms that can run with minimal executive oversight. A momentary attentional drift therefore does not necessarily halt the perception–action loop and may instead modulate the dynamics of thought, potentially increasing spontaneity and fluidity and, in turn, further broadening the focus of perceptual attention, all while output monitoring keeps task execution on track. By contrast, in a *de novo* problem-solving task such as the Alternate Uses Test (as in Hao et al., 2015), the absence of a well-learned referent forces continuous top-down control, so any off-task thought competes directly with the cognitive resources needed for idea generation. In short, when a creative skill can operate "on autopilot," brief episodes of mind-wandering may serve as a low-cost source of spontaneous variation rather than a disruptive distraction.

Indeed, growing evidence suggests spontaneous, fast-shifting thought patterns (i.e., cognitive flexibility) are reliably associated with greater creativity (e.g., Calic et al., 2020; Wu & Koutstaal, 2020), raising the possibility that the effects of mind-wandering on creative cognition are driven by these underlying thought dynamics rather than thought content itself (de Rooij et al., 2024). This aligns with our observed phenomenological profile of mind-wandering, characterized by a high degree of mental improvisation (i.e., a free-associative, dynamic train of thought) and perceptual decoupling, but low mental navigation (little temporal or autobiographical drifting). In other words, mind-wandering episodes tended to be spontaneous and fluid (driven by its dynamics), yet relatively here-and-now (less driven by its contents) (Gonçalves et al., 2020).

From the perspective of the Dynamic Framework of Thought (Christoff et al., 2016), episodes of spontaneous cognition signal transient relaxations of deliberate cognitive control, allowing thoughts to unfold with fewer constraints and thus potentially facilitating novel combinations and associations. This framework positions thought along a continuum ranging from highly deliberately controlled (e.g., goal-directed thought) to highly spontaneous (e.g., dreaming, mind-wandering), with creativity optimally emerging from a dynamic interplay between these poles (Girn et al., 2020). Specifically, while increased deliberate control enables efficient selection, refinement, and evaluation of creative outputs, spontaneity permits generative flexibility, novelty, and divergent exploration. Our findings suggest that the creative benefits observed during mind-wandering may stem from transient attentional drifts that momentarily tip the cognitive balance toward greater spontaneity without significantly impairing task execution. Rather than mind-wandering directly causing heightened creativity, we propose that the experience of mind-wandering acts as a phenomenological marker of decreased deliberate cognitive control. Thus, we suggest that mind-wandering during skilled improvisatory practices may be best understood not as a disruption but as an indicator of beneficial fluctuations in cognitive control dynamics, facilitating creative performance through its association with greater cognitive flexibility.

Why did mind-blanking episodes not impair performance, and even yield a modest creative advantage? As with mind-wandering, one interpretation is that improvisers' extensive practice optimizes executive resources, enabling momentary lapses of conscious attention without disrupting highly automatized sensorimotor routines (Beaty, 2015; Pressing, 1988). The fact that creativity didn't collapse in those moments suggests that a minimal level of conscious awareness is not always necessary for competent, even creative, performance. A deeper explanation could be that the observed mind-blanking episodes represent a qualitatively different phenomenon stemming from conditions distinct from those studied under previous paradigms. At the phenomenological level, these episodes seem to partially overlap with states of deep musical absorption (Høffding et al., 2024; Høffding & Montero, 2020; Vroegh, 2019) — marked by reduced self-referential processing, diminished reflective monitoring, and heightened immersion in the ongoing task. This interpretation aligns with participants' reports of significantly decreased *meta*-consciousness during mind-blanking. Thus, rather than signalling detrimental attentional lapses (Andrillon et al., 2025) — which we term *sleep-like mind-blanking* — the mind-blanking observed in our improvisational contexts — termed here *absorptive mind-blanking* — may reflect adaptive and potentially creativity-enhancing shifts toward spontaneous, automatic modes of cognition relatively insulated from both endogenous distractions and exogenous interference.

Conversely, although infrequent in our sample, task-related interference (TRI) was associated with poorer performance, compared with focused attention. Like the latter, TRI is a form of on-task thought, as its content remains anchored in the performance. The two states also share a similar phenomenological profile — high *meta*-awareness and intentionality — with TRI marked by even greater intentionality. Yet despite these overlaps, their functional outcomes diverge, which could be explained by TRI's likely association with unproductive self-monitoring or attentional narrowing on less relevant task features (Høffding, 2018). Therefore, TRI seems to represent an excessively task-focused state characterized by heightened deliberate cognitive control, which may disrupt the dynamic interplay between generative and evaluative processes required for creative thinking by tipping cognition disproportionately toward evaluation and self-monitoring (Girn et al., 2020).

Experienced improvisers reported more frequent off-task states compared to novices, consistent with literature indicating that increased task-expertise is associated with increased mind-wandering (Smallwood & Schooler, 2006, 2015; Spelke et al., 1976). More interestingly, expertise inversely affected mind-wandering's creative benefits. This aligns with findings from Rosen and colleagues (2016), who showed that anodal transcranial direct current stimulation (tDCS) to right dorsolateral prefrontal cortex (DLPFC) facilitates creativity in novices by streamlining the re-engagement of evaluative processes after generative phases. Our findings capture a complementary side of that cycle: brief, spontaneous lapses of control associated with better creative performance, potentially through their association with greater cognitive flexibility. Despite a mechanistic difference, both sets of findings support a common principle: creativity in novices may benefit from enhanced fluidity between generative and evaluative cognitive modes. Expert performers, by contrast, may already operate near this optimal dynamic balance (Pressing, 1988), rendering external or internal shifts — whether toward or away from control — either unnecessary or disruptive.

We acknowledge several limitations that suggest directions for future work. First, improvisations were generated on-the-spot, minimizing practice effects but likely increasing focused attention and self-monitoring. Our observed state frequencies and state-linked effects may therefore be conservative, and the relatively modest number of mind-wandering trials makes these estimates more susceptible to sampling noise and potential outliers. Second, experience-sampling probes captured sparse snapshots of conscious states. Performance was indexed to the preceding 30-s interval, yet the true onset, offset, and duration of that state within the window are unknown, so rapid state transitions could introduce noise and dilute effects. In addition, in a complex task such as jazz improvisation, attention is naturally distributed across playing, planning, and listening, so the boundary between task-related and task-unrelated thought is not always sharp. In our taxonomy, mind-wandering refers specifically to probe responses where performers experienced their thoughts as primarily detached from musical performance, and future work should develop finer-grained state taxonomies to more clearly distinguish such experiences from instances of distributed and/or fluctuating attention (Høffding et al., 2024). Third, creativity ratings were provided by only two expert judges. While inter-rater reliability was excellent (ICC = 0.77–.88), a larger panel would have strengthened the generalizability of the creativity assessment. Computational methods (e.g., entropy, harmonic surprise metrics) could provide objective measures of creative output (Daikoku, 2024). Fourth, our effects were observed in a specific task context (solo jazz improvisations over unfamiliar chord progressions) and generalizability beyond this form of real-time musical improvisation remains untested. Similar real-time improvisational practices (e.g., spoken word, freestyle rap, dance and theatre) may yield parallel findings, whereas creative acts that unfold over extended, stage-segmented timelines (e.g., composition, long-form writing) may engage different cognitive dynamics. Lastly, our sample, though diverse in instruments and expertise, was predominantly male and unevenly distributed across instrument families, and drawn from unpaid volunteers in formal jazz-training institutions, which constrained the generalisability of the findings and precluded reliable instrument-specific tests. Future work should test for gender, genre, instrument-family, and cultural influences on conscious states during creative performance.

8. Conclusion

The present study consolidates previous preliminary findings (Palhares et al., 2022), providing novel evidence that mind-wandering can enter the creative process without derailing it — and under some conditions may be associated with enhanced creative expression — namely in an artistic improvisatory context. Relative to focused attention, mind-wandering was reliably associated with higher creativity ratings — both in holistic assessments of creativity and across its subdimensions of originality, effectiveness, and expressiveness — whereas task-related interference was associated with lower creativity ratings and mind-blanking was associated with little to modest change. These effects were selective: overall improvisational quality — a broader competence index — was driven primarily by accumulated expertise and was comparatively insensitive to transient conscious state. Expertise also shaped the expression of these state effects: more experienced improvisers reported off-task states more frequently, yet the immediate creative advantage of mind-wandering was largest for less- and mid-experienced musicians and diminished with expertise.

These present results underscore the value of moving beyond binary on-task/off-task distinctions: phenomenologically distinct states (mind-wandering, mind-blanking, task-related interference, focused attention) are not functionally interchangeable. By coupling probe-caught conscious state sampling with expert creativity judgments, our findings are consistent with the possibility that mind-wandering — long framed as disruptive for creative task performance — may serve as an adaptive source of cognitive flexibility that feeds into ongoing creative production, that mind-blanking outside low-arousal contexts may index absorption compatible with skilled automaticity, and that over-controlled, self-monitoring task-related interference may be associated with reduced creative output. While situated in a creative context, the present study informs broader theoretical accounts of the adaptive functions of spontaneous mental states and establishes a tractable framework for mapping how moment-to-moment fluctuations in mental states shape behaviour in complex, skilled tasks.

Ethics approval statement.

This study was approved by the Ethics Committee of Faculty of Psychology and Educational Sciences, University of Coimbra (reference code: CEDI/FPCEUC:57/3).

CRediT authorship contribution statement

Pedro T. Palhares: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data curation, Visualization, Writing – original draft, Writing – review & editing, Project administration, Funding acquisition. **Diogo Branco:** Writing – review & editing, Software, Methodology, Data curation. **Óscar F. Gonçalves:** Writing – review & editing, Supervision, Resources, Project administration, Methodology, Conceptualization.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.concog.2026.104048.

Data availability

Datasets, analysis scripts and materials supporting this study are available at: https://osf.io/6t4hx/overview?view_only=31d2bf93cc65438ab421a6318c03d746

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