New findings in the emotional chronology of a music performance: An empirical investigation evaluating the impact of a successful performance, facilitated by flow state achievement, on the performer's psycho-emotional profile

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ABSTRACT

This paper addresses the paucity of empirical scientific interest in the emotions a musician experiences throughout the chronology of a performance. Its focus is defined by six selected emotions and mood states (SEMS) within the broader two-dimensional affect model of Positive Affect (PA) and Negative Affect (NA). PA, NA and the SEMS are evaluated independently using self-report methods at three chronological markers (general psyche, post-performance, general psyche re-evaluated). The data on the arousal levels of the SEMS, PA and NA at these chronological markers enable the formation of an empirical baseline of a musician's psycho-emotional state before and after a successful performance facilitated by moderate or high flow state achievement. For all categories of flow achievement, the immediate effect of performing music is a significant inhibition of NA and NA SEMS investigated. PA and PA SEMS are stable across all three chronological markers, contradicting the field's theoretical framework suggesting flow achievement and successful performance result in an elevation in confidence and motivation. The study offers an initial methodology for how a baseline of this kind can be ascertained. Its contention with existing theoretical contributions to the field indicate a need for the redeployment of this methodology in a professional context.

1. INTRODUCTION

Music performance careers are surrounded by a stigma of mental health struggle (Ascenso et al., 2017; Guster, 2013; McGrath, 2016); and there is scientific basis for this. Diehl (2016) cites Brodsky (2006), who found musicians to be among the top five occupational groups at risk of mental illness. Kenny (2011) cites Lockwood (1989) and the International Conference of Symphony and Opera Musicians (ICSCOM) carried out in May 1986 which found that 17% of orchestral musicians in the United States suffer from depression; 13% from acute anxiety; and 14% from sleep disturbances. Numbers for anxiety are moreover likely to be underreported (Jordan, 2016; Kenny, 2011; Likar & Raeburn, 2009; McGrath, 2011) as per this historic trend (Diehl, 2016). Swart (2013) corroborates that musicians are more prone to anxiety and depression; and furthermore posits that they are more prone to obsessive-compulsive disorder, interpersonal sensitivity and hostility. The occupational demands of performing artists are a clear contributor to this psychological profile: heavy schedules (Willis et al., 2019), a requirement to "maintain a multiplicity of relationships," (Willis et al., 2019, p. 2) and financial and physical strain (Brodsky, 2006; Fishbein et al., 1988; Kenny, 2011) have the obvious potential to arouse negative affect (NA), symbiotic with many of the aforementioned conditions. Music Performance Anxiety (MPA), depending on the extent to which it is experienced, also forms a part of a performing musicians' psychological profile (Steptoe & Fidler, 1987; Van Kemenade et al., 1995; Kenny, 2011), given that performing is the whole basis of their career. It is difficult to rationalise the pursuit of music performance in this context.

Flow theory may offer an explanation for why musicians choose to pursue their careers (Ascenso et al., 2017; Csikszentmihalyi, 1990). Flow state is a temporary psychological state that is extremely enjoyable and elicits a "holistic sensation people feel when they act with total involvement (in an activity)" (Csikszentmihalyi, 1975, p. 36; Fritz & Avsec, 2007). The experience is such that high flow state achievement disassociates people from the context in which they are performing so that "nothing else matters while doing it, they take great pleasure in it and they are very intrinsically motivated" (Fritz & Avsec, 2007, p. 7). The concept of flow is a dimensional construct and can be highly, moderately or residually achieved (Cohen & Bodner, 2018a, 2018b, 2019; Csikszentmihalyi, 1990; de Manzano et al., 2010). There are three pre-conditions for flow: (i) Challenge-skill balance; (ii) clear goals; and (iii) clear, immediate feedback (Csikszentmihalyi, 1990; Fritz & Avsec, 2007). There are six experiential characteristics of flow: (i) focussed concentration, (ii) intrinsic reward, (iii) merging of action and awareness, (iv) sense of control, (v) lack of self-consciousness and (vi) distorted temporal experience (e.g. Csikszentmihalyi, 1990; Fritz & Avsec, 2007); the combination of which denotes a euphoric disassociation from negative affect stimuli. Significantly, musicians are especially prone to experiencing flow during performances (Cohen & Bodner, 2018b; Csikszentmihalyi, 1990), an escape from the scientific reality of the mental health stigma surrounding a musician's career. What this paper aims to reveal is how the emotions experienced during this euphoric disassociation charter onto a musicians' emotional psychological state post-performance; and how this compares with their emotional psychological state before they go backstage. This will reveal the emotional impact of a successful music performance.

In a previous article, Milnes (2024) conducted a systematic review of existing research on emotional fluctuation through the chronology of a performance as relevant to the experience of flow state. The article surveyed a large quantity of journal entries and books ($n = 114$) and foregrounded a lack of scientific interest in how the emotions experienced during a flow state in a performance charter onto musicians' general psyche (herein, psyche refers to emotional psychological state). Nonetheless, the article formed a conceptual network of associations between six selected emotions and mood states (SEMS); which, combined with current knowledge of MPA and flow state, was able to charter a theoretical baseline of emotional fluctuation throughout the chronology of a performance. The baseline offers a new contribution to the field, suggesting that the achievement of flow in performance should theoretically yield positive emotional reward in the form of a reduction in negative affect (NA) and an increase in positive affect (PA). The objective of the present investigation is to test these findings empirically on orchestral musicians and pianists at Durham University; and to build empirically on the theoretical contribution of Milnes's (2024) paper by deploying the same six SEMS and chronological markers (**Tables 1 and 2**).

Table 1. *Chronological markers deployed and their real-time equivalents.*

Chronological Marker	Real-time equivalent
General psyche	Between 2 and 7 days before the performance.
Pre-performance	Within 30 minutes before performing.
In-Flow	During the flow-state performance.
Post-performance	Within 30 minutes after the flow-state performance.
General psyche re-evaluated	Between 2 and 7 days after the flow-state performance.

Table 2. *Six Selected Emotions and Mood-States.*

N.	SEMS
1	State anxiety
2	Depressed mood-state
3	Situational stress
4	Enjoyment
5	Confidence
6	Motivation

Figure 1 (overleaf) is taken from Milnes (2024) and shows how the six SEMS are expected to fluctuate. Based on this, three primary hypotheses are conceived where a *more positive psyche* incorporates domains (a) higher overall PA; (b) higher PA SEMS arousal levels; (c) lower overall NA; and (d) lower NA SEMS arousal levels.

- **H1**. A more positive psyche will be evident at post-performance than at general psyche.

- **H2**. A more positive psyche will be evident at general psyche re-evaluated than at general psyche.

- **H3**. A more positive psyche will have a stronger positive association with high flow state achievement than moderate or low flow state achievement.

These three hypotheses are strongly founded in the euphoric disassociation a flow state elicits, as previously discussed; and in the theoretical baseline that was established by Milnes (2024) in a synthesis of current research.
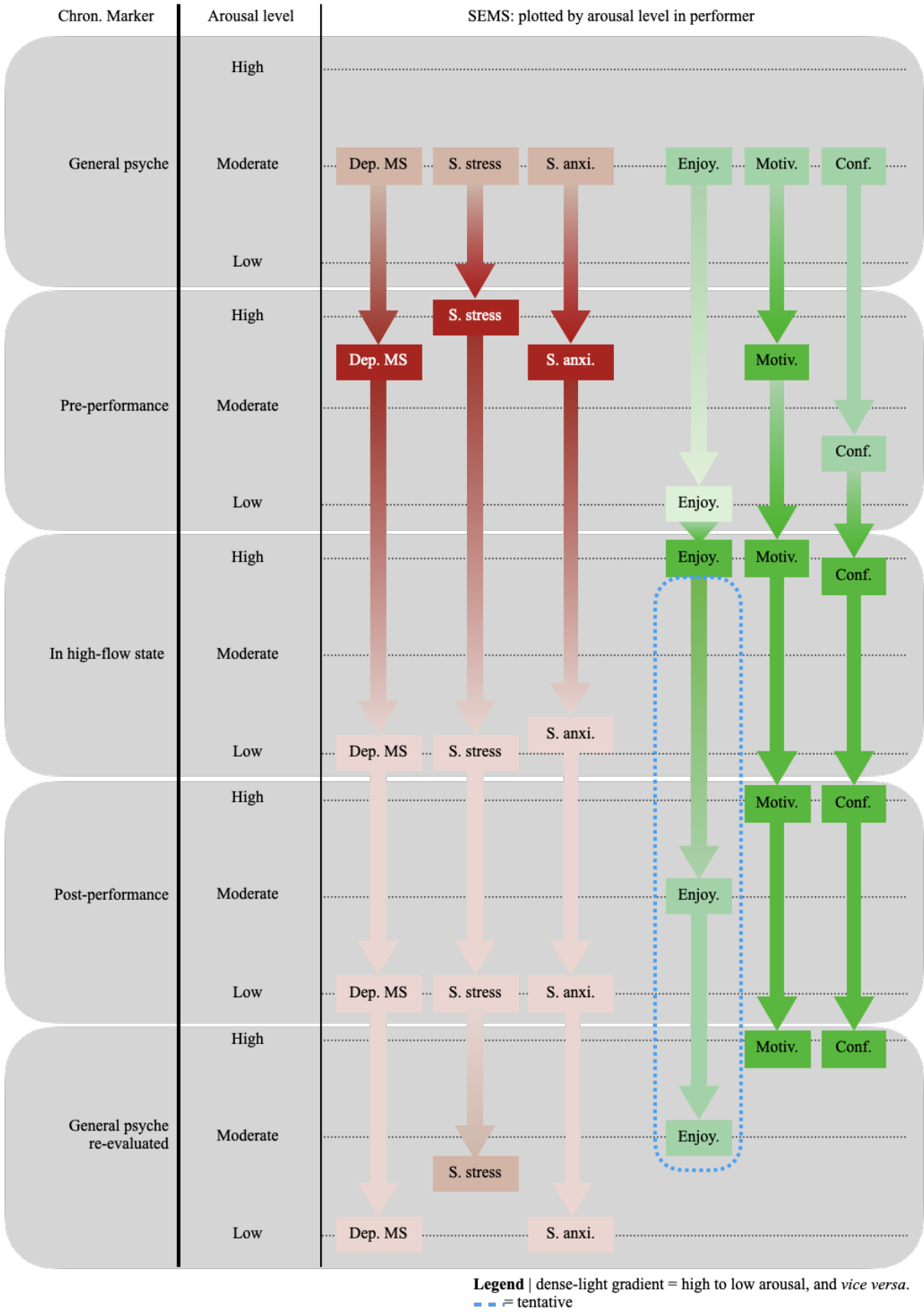
Figure 1. *Theoretical baseline of SEMS fluctuation throughout the chronology of a high-flow state performance (taken from Milnes, 2024, p. 9).*

2. METHOD

2.1 Participants. Participants were consenting adults and were trained musicians studying at Durham University. They were recruited (and participated) during the rehearsal time of Durham University Orchestral Society (DUOS), Durham University Palatinate Orchestra (DUPO) and Durham University Keyboard Instrument Society (DUKIS).

DUOS and DUPO (n = 47) are auditioned orchestras. Musicians from all sections of the orchestras took part. DUKIS were a group of five pianists playing at least Associate of Trinity College London (ATCL) Diploma-level repertoire.1

52 participants were recruited in total; 25 did not complete the final stage of the investigation. Data from all 52 participants is valuable for comparing valence indicator levels general psyche versus post-performance for the immediate impact of musical performance on psychological health, in comparison with the tIBSN. Data from participants who completed the full study (n = 25) and who met other inclusion criteria (n = 15; see Results) is analysed for the longer-term impact.

Participants partook under the guarantee of anonymity. This study does not concern discrepancies in emotional fluctuation as a result of gender or age in musical performance - though this is a potential direction for future research to take in this field. Gender and age were not recorded.

2.2 Instruments. PA, NA and the SEMS were measured using the Positive Affect Negative Affect Schedule (PANAS; Watson et al., 1988). The PANAS is used broadly in recent research across disciplines (e.g. Antunes et al., 2020; Gaudreau et al., 2006; Monica et al., 2019). It is designed to measure PA and NA. It consists of a 20-item list of adjectival descriptors that participants grade on a five-point Likert scale; indicating the extent to which they feel/felt these descriptors. The PANAS was chosen because of its breadth of deployment across disciplines since its conception, denoting a longstanding validity; as well as its explicit relevance as an indication of psychological health. PANAS values were subsetted into the broader SEMS categories in order to produce values for the SEMS (see **Data Analysis**). PA and NA levels were determined by descriptive statistics across relevant participant groups (see **Data Analysis**).

Flow achievement was measured using the condensed version of the Dispositional Flow Scale-2 (DFS-2; Jackson & Eklund, 2002, 2004), another self-report measure. The condensed version of the DFS-2 (cDFS-2) used in this study was derived from a list of first-person statements taken from Fritz & Avsec (2007, p. 10; see also **Appendix 1:** handout distributed to participants PANAS and cDFS-2 inclusive) that measure the three pre-conditional and six experiential dimensions of flow (see p.7-8 for definition). Participants were asked to rate nine statements (**Appendix 1**) on a Likert scale of 1-5; as opposed to the original 36-item model. The measuring of these nine characteristics with one statement is furthermore characteristic of the established DFS-2 (short) (Martin & Jackson, 2008). It was not possible to include the full 36-item DFS-2 scale for the purpose of this study: there was concern that this would disincentivise participants with a barrage of items to rate; and occupy too much time at the rehearsals. Future research with established incentives for participants could ask that they complete the full 36-item scale and be more certain about flow achievement level.

2.3 Procedure. Participants completed the PANAS three times: immediately before their rehearsal, immediately afterward and between 48 hours and one week post-performance. Also immediately after their performance, participants completed the cDFS-2. Participants were given information sheets and informed consent forms at their rehearsals/performances. Since the informed consent forms required names, they were collected separately to their responses and shuffled when handed back to the researcher. To compare data across the chronology and filter for inclusion criteria (see **Results**), anonymous participant codes were distributed.

The third PANAS questionnaire (distributed one week post-performance) was a Google Form. It was sent via BCC email listing to the names on the informed consent forms. Care was taken to preserve participant anonymity as the email forms did not collect any personal data - only anonymous participant codes.

Each of the PANAS questionnaires contained different temporal instructions, an established method for the PANAS (e.g. Kashden & Roberts, 2004; Watson & Clark, 1994). In the first questionnaire (assessing general psyche), participants were asked to consider how they felt *during the past week*; in the second (assessing post-performance) *right now, this second*; and in the third (assessing general psyche re-evaluated, issued between 48 hours and one week after their rehearsal/performance) *during the past week* again. Pre-performance values might have conceivably been gathered by deploying time descriptors *over the past week* followed immediately by *right now, this second* on the PANAS questionnaires (Watson & Clark, 1994) before participants began a rehearsal.

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[1]The ATCL is an established diploma and has a high standard of repertoire within its assessment components, including renowned works such as Beethoven's *Pathétique* Sonata and Rachmaninoff's *Prelude in Gm*.

However, asking participants to complete the same questionnaire twice in a row would likely yield flawed data. This is firstly due to the short time interval between responses (less than 4 minutes). According to Stone et al. (2007), it is likely that two self-reports would be more similar if the time interval between them was relatively short. Secondly, the element of tedium must be considered: if participants were asked to rate exactly the same adjectival descriptors for the PANAS twice in succession, it is likely that participants would become bored; a problem with the potential to impact the post-performance questionnaire as well.

It was decided that the potential difference between general psyche and post-performance was more pertinent than the difference between pre-performance and post-performance. This is because of this study's concern with the impact of musical performance on psychological health, for which general psyche provides a point of comparison. A pre-performance evaluation is affected by MPA and other cognitive, psycho-emotional, behavioural and physiological phenomena (Hallam, 2006; Jordan, 2016; Kenny, 2011; McAllister, 2013; McGrath, 2012, 2016). A comparison between pre-performance and post-performance was designated less relevant under this premise.

Attempting to measure the in-flow chronological marker using a questionnaire was deemed unnecessary for this study. The impact of flow state as a variable would be measured in the fluctuation of valence indicators at post-performance and at general psyche re-evaluated; indicating an impact on psychological health.

The final PANAS questionnaire included one additional item. It asked whether participants had experienced significant events since participating in-person which may have affected their final responses. Participants graded the impact of this on a Likert scale of 1-5 (discussion of purpose forthcoming).

2.4 Data analysis

2.4.1 Subsetting PANAS values into SEMS. "Researchers generally agree that conceptually similar affective states… represent the same dimension" (Merz & Roesch 2011, p.2). For the purposes of this study, it was necessary to map the PANAS descriptors onto the SEMS. Research by Merz & Roesch (2011) using the PANAS revealed that NA and PA as affective phenomena were generally associated with stress, anxiety, depression and self-esteem. Hence, descriptors from the PANAS, as constituents of the broader PA and NA scales (Watson et al., 1988), can be mapped onto the SEMS of the present study; the SEMS and PANAS descriptors representing "the same dimension." Furthermore, situational stress, state anxiety, depressed mood-state and confidence (treated as synonymous with self-esteem), as emotions/mood-states highlighted by Merz & Roesch (2011) to be intrinsically linked with PA and NA, can be assigned "conceptually similar affective states" within the PANAS framework. Each PANAS value was given equivalent weighting in contributing to each one of its corresponding SEMS (**Figure 2**). **Figure 3** (overleaf) subsets PANAS values into the SEMS.

$$Enjoyment = \frac{active + attentive + alert + excited + proud + interested}{6}$$

$$Motivation = \frac{inspired + determined + enthusiastic + proud + interested}{5}$$

$$Confidence = \frac{strong + enthusiastic + excited + proud + interested}{5}$$

$$State\ anxiety = \frac{scared + nervous + afraid + jittery}{4}$$

$$Situational\ stress = \frac{hostile + irritable + distressed}{3}$$

$$Depressed\ mood-state = \frac{ashamed + guilty + upset + distressed}{4}$$

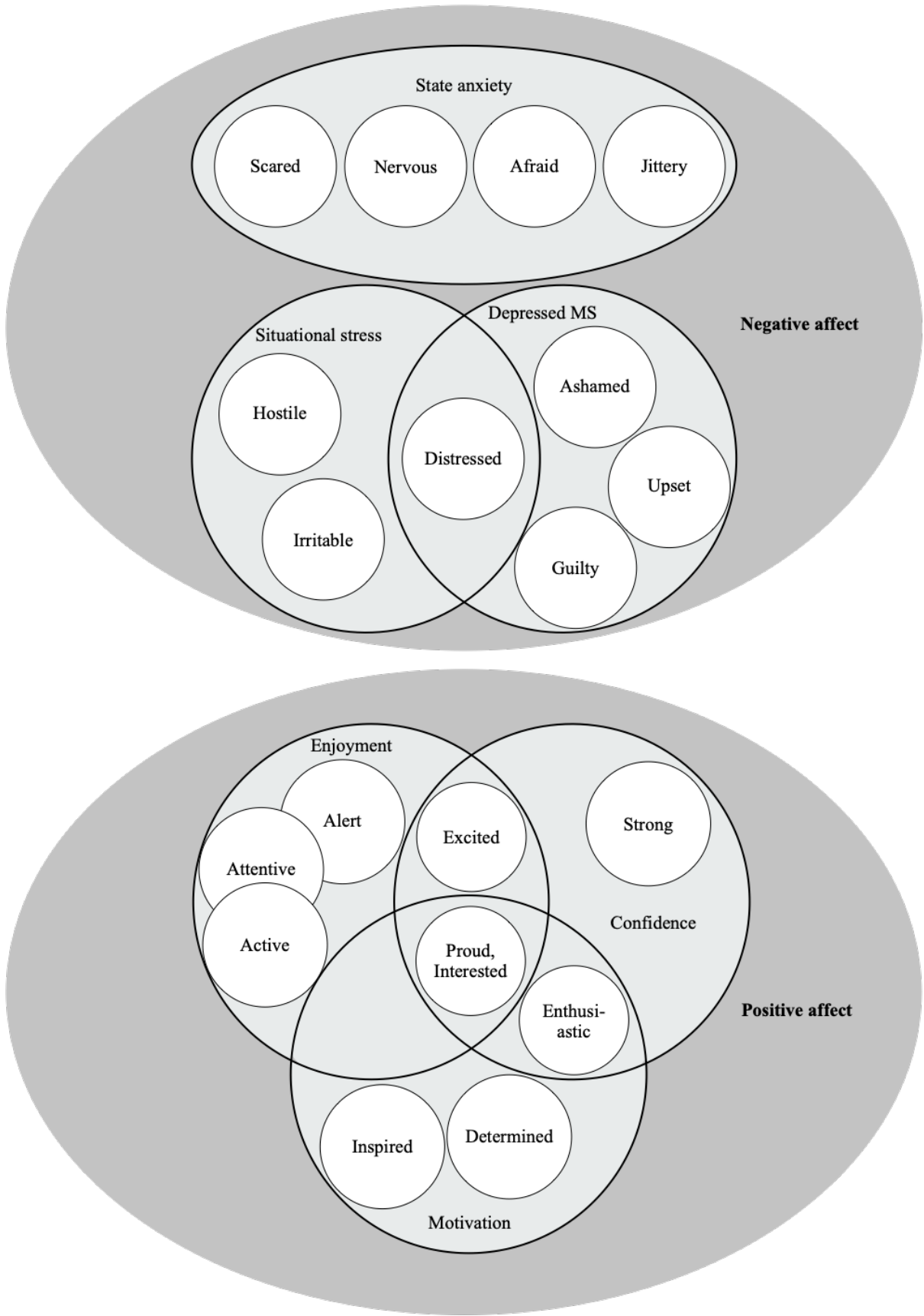Figure 2. *Formulae attributing PANAS values onto SEMS.*

Figure 3. *Subsetting PANAS descriptors into broader SEMS and affect frameworks.*

2.4.2 Participant exclusion from the Core Objective Group: attrition and significant events. Further inclusion criteria were devised in order to enable plausible comparative analysis for the three chronological markers investigated. 25 of the participants did not complete the final online questionnaire. It was not possible to compare

valence indicator levels for general psyche re-evaluated with general psyche and/or post-performance levels because of the differences in the degrees of freedom. For a long-term impact assessment, only the 25 participants who completed the study are eligible.

Participants who reported a significant events impact by ≥4 were also excluded ($n = 10$). Consequently, the complete chronological contour this study was targeting could only be chartered by 15 participants - termed the Core Objective Group (COG). Values for general psyche and post-performance are discussed with all 52 participants as an indicator of short-term impact.

2.4.3 Statistical analysis. Data was processed using RStudio version 2023.12.1+402. Valence indicator values for all relevant participants are analysed using t-tests and Analysis of Variance (ANOVAs). The confidence interval for the alternative hypothesis is 95%.

3. RESULTS

3.1 Flow state categorisations and findings

A mean was taken from participant responses to the cDFS-2 (**Appendix 1**). Participants were assigned a flow category according to this average (**Table 3**). No participants experienced low flow, in line with Kirchner et al.'s (2008) findings. Two participants did not complete the cDFS-2, but PANAS responses from these participants are included in *independent of flow* evaluations which neglect flow state achievement. **Table 3** also shows the number of participants in the Core Objective Group (COG, $n = 15$) in each flow category.

Table 3. *Flow state categorisations, all participants and Core Objective Group*

Flow category	Mean of cDFS-2	Number of participants in category [COG]
Independent of flow state	Any value (including null)	$n = 52$, null $n = 2$ [15, null $n = 2$]
High flow	≥ 4.00 *high flow* ≤ 5.00	$n = 20$ [7]
Moderate flow	≥ 2.50 *moderate flow* < 4.00	$n = 30$ [6]
Low flow	≥ 0.00 *low flow* < 2.50	$n = 0$ [0]

3.2 All participants: emotional impact, general psyche to post-performance

3.2.1 PA and NA variation. Independent of flow state categorisation, there is a statistically significant reduction in overall NA; but no significant fluctuation in PA (**Figure 4**, overleaf). T-tests yield $t(89.18) = 5.97$, $p = <.01$ for NA variation; yet, for PA variation, $t(94.67) = .07$, $p = .94$. A similar difference is observed in both high and moderate flow state categories:

- High flow PA variation $t(29.07) = -.47$, $p = .64$; NA variation $t(28.30) = 4.91$, $p = <.01$.

- Moderate flow PA variation $t(55.73) = 0.28$, $p = .78$; NA variation $t(53.41) = 4.01$, $p = <.01$.

Regardless of flow state achievement, musical performance results in an overall reduction in NA immediately post-performance; but no reduction in PA. This contradicts hypothesis 1 in domain (a) in that PA remains stable; but supports hypothesis 1 in domain (c) where NA shows a statistically significant reduction. Furthermore, it indicates that flow state categorisation is not relevant for investigating the impact of musical performance on psychological health through the two-dimensional affect model. Reinforcing this: there is no statistically significant difference for PA or NA between groups high flow and moderate flow at markers general psyche or post-performance (**Figure 5,** overleaf). This supports a null hypothesis for hypothesis 3.
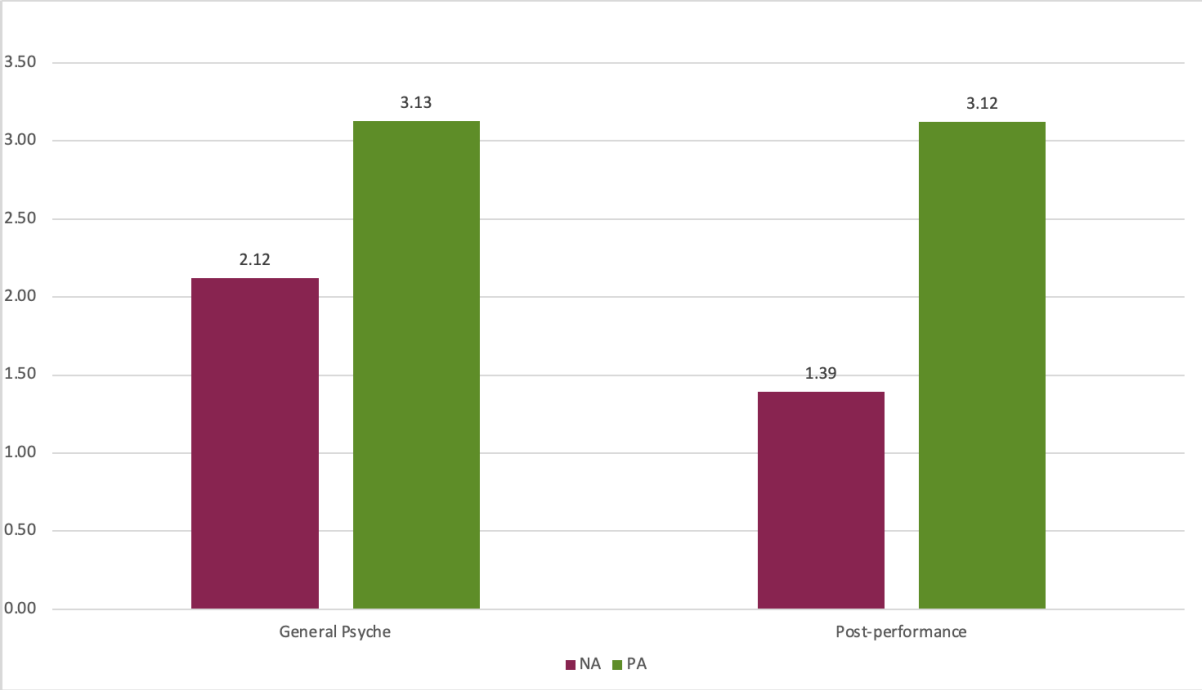
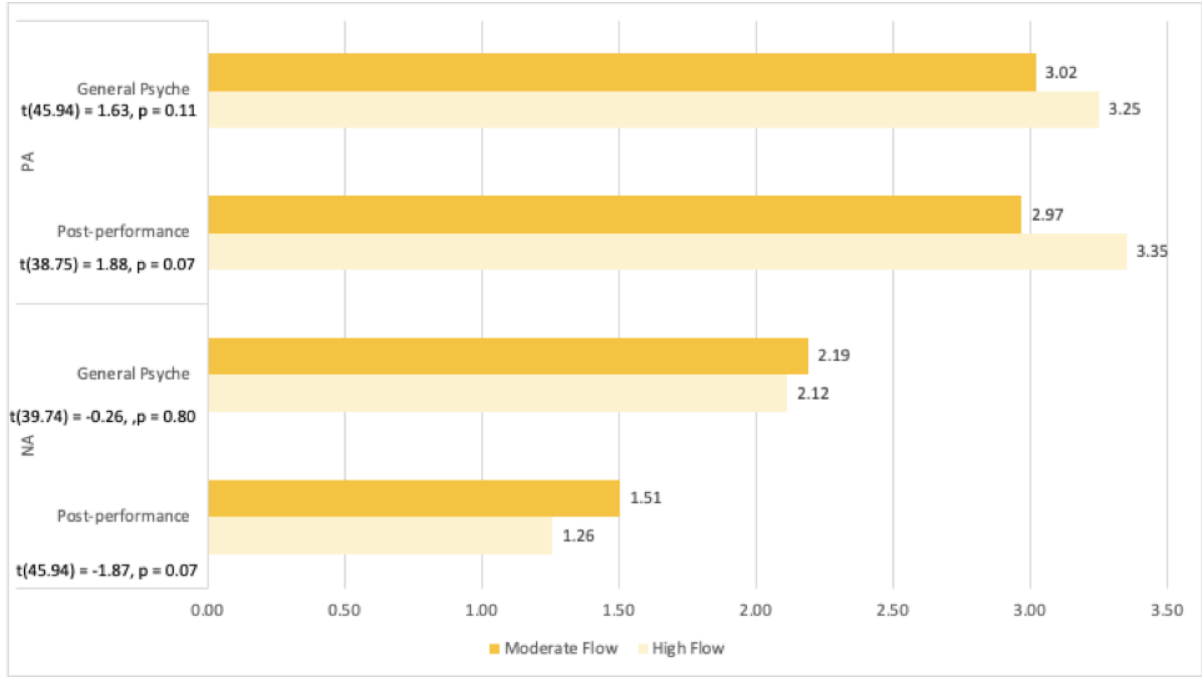Figure 4. *NA and PA variation independent of flow category (all participants).*

Figure 5. *Mean level of PA and NA general psyche and post-performance, moderate against high flow categories (all participants).*

3.2.2 SEMS variation. Independent of flow state categorisation, values for SEMS arousal levels charter the same contour as NA/PA variation (**Figure 6**). For all flow categories, the difference in mean values between general psyche and post-performance in NA SEMS depressed mood-state, situational stress and state anxiety is statistically significant; whilst any variation in mean values for PA SEMS confidence, enjoyment and motivation is not (**Table 4**). Hypothesis 1 is supported in domain (d); but not in domain (b), respectively.
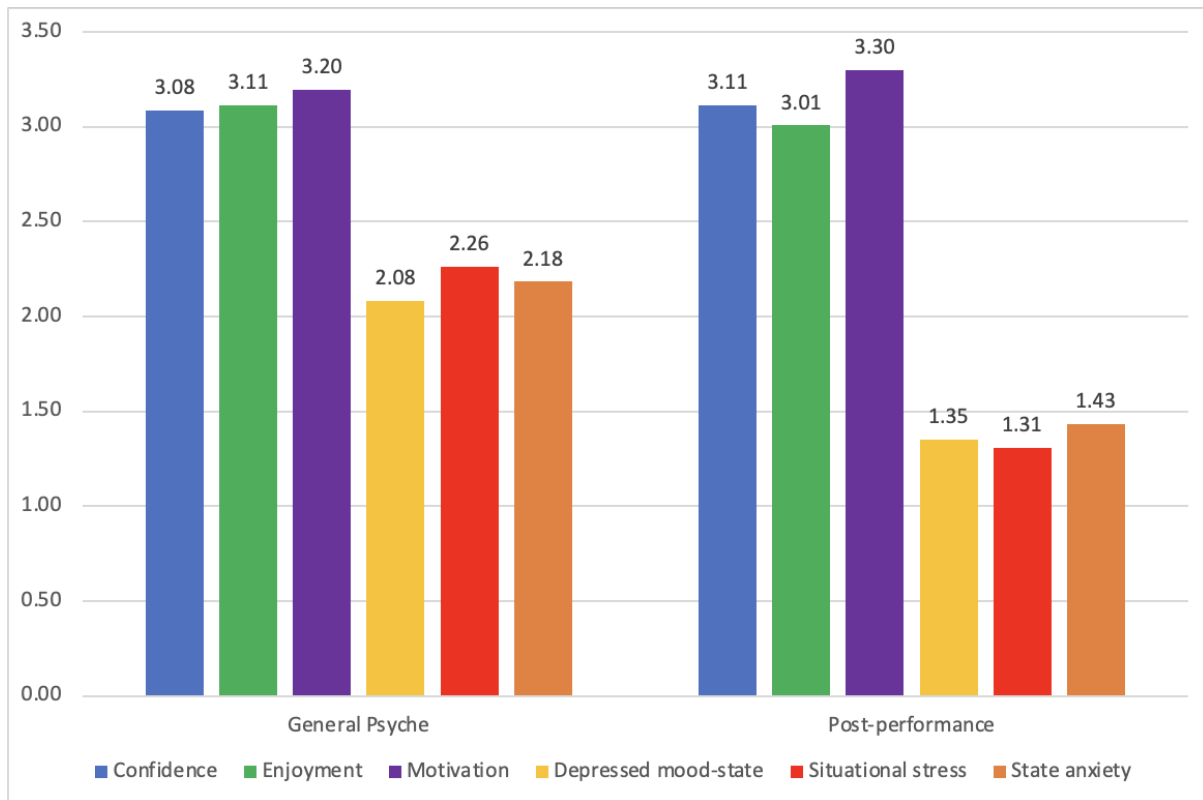

Figure 6. *SEMS variation general psyche and post-performance, independent of flow category (all participants).*

Table 4. *SEMS variation, All Participants by Flow Category*

SEMS	Statistical significance (*) of general psyche versus post-performance values		
	Independent of flow	Moderate flow	High flow
Confidence	t(89.87) = -.19, *p* = .85	t(55.43) = -.31, *p* = .76	t(26.50) = -.04, *p* = .97
Enjoyment	t(92.04) = .74, *p* = .47	t(55.99) = .60, *p* = .55	t(26.40) = .45, *p* = .66
Motivation	t(93.68) = -.65, *p* = .52	t(55.77) = -.58, *p* = .57	t(31.22) = 4.83, *p* = .01
Depressed Mood-state	**t(96.55) = 5.28, *p* = <.01***	**t(55.38) = 3.28, *p* = <.01***	**t(31.22) = 4.83, *p* = <.01***
Situational stress	**t(95.27) = 7.64, *p* = <.01***	**t(53.37) = 5.04, *p* = .01***	**t(36.51) = 6.10, *p* = .01***
State anxiety	**t(78.48) = 4.49, *p* = .01***	**t(45.01) = 3.25, *p* = .01***	**t(28.25) = 3.18, *p* = .01***

Applying a comparison of flow categories yield findings justifying this study's interest in the SEMS. Firstly: the mean level of depressed mood-state at general psyche showed no statistically significant difference between flow categories: t(41.02) = -.63, *p* = .53. The statistically significant difference t(46.98) = -2.91, *p* = <.01* at post-performance therefore indicates higher flow state achievement results in more considerable inhibition of a depressed mood-state post-performance (**Figure 7**). Hypothesis 3(d) is supported by depressed mood-state

variation, but a null hypothesis is supported by all other SEMS in that none evidence a statistically significant difference by flow category per chronological marker.[2]
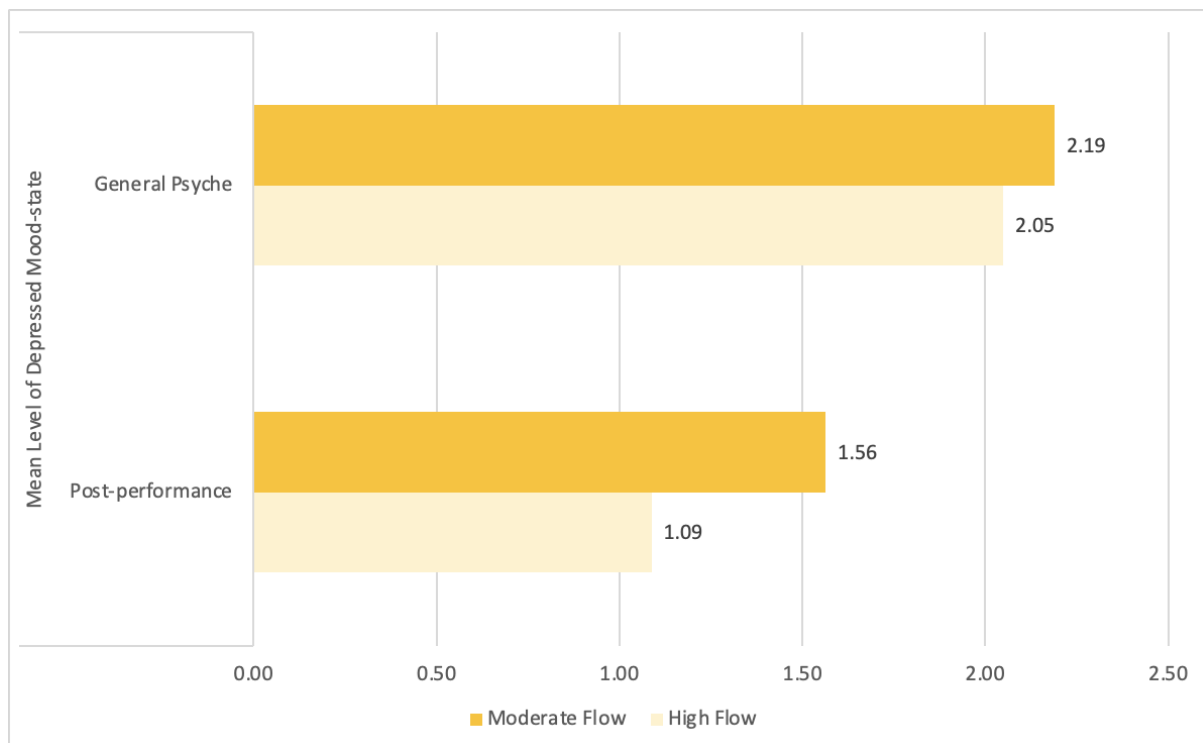

Figure 7. *Mean level of depressed mood-state at general psyche and post-performance, moderate against high flow (all participants).*

A second interesting finding was a statistically significant difference in confidence levels at general psyche between high and moderate flow categories (**Figure 8**), $t(45.25) = 1.98$, $p = .05$. This finding is initially confusing as a flow state has not yet occurred at this chronological marker; and thus would not be expected to affect differences in SEMS levels. This finding will be discussed in more detail in the **Discussion** section.
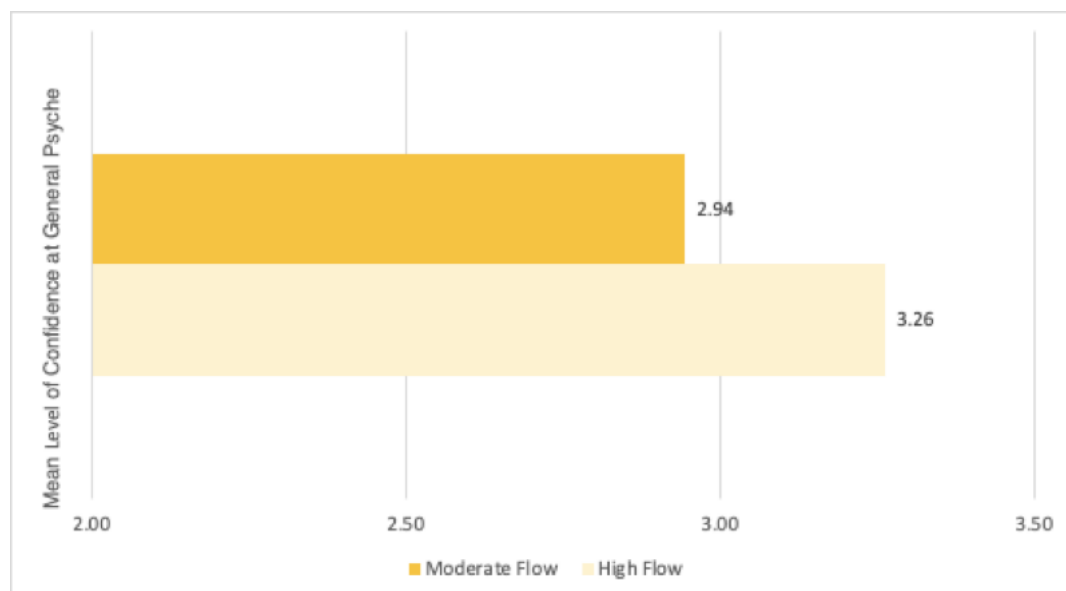

Figure 8. *Mean level of confidence at general psyche, moderate against high flow (all participants).*

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[2]T-tests are supplied as Appendix 2.

3.3 Core Objective Group (COG): emotional impact: general psyche, post-performance and general psyche re-evaluated

3.3.1 NA and PA variation. **Figure 9** shows the variation in NA and PA values across the three chronological markers, independent of flow category.
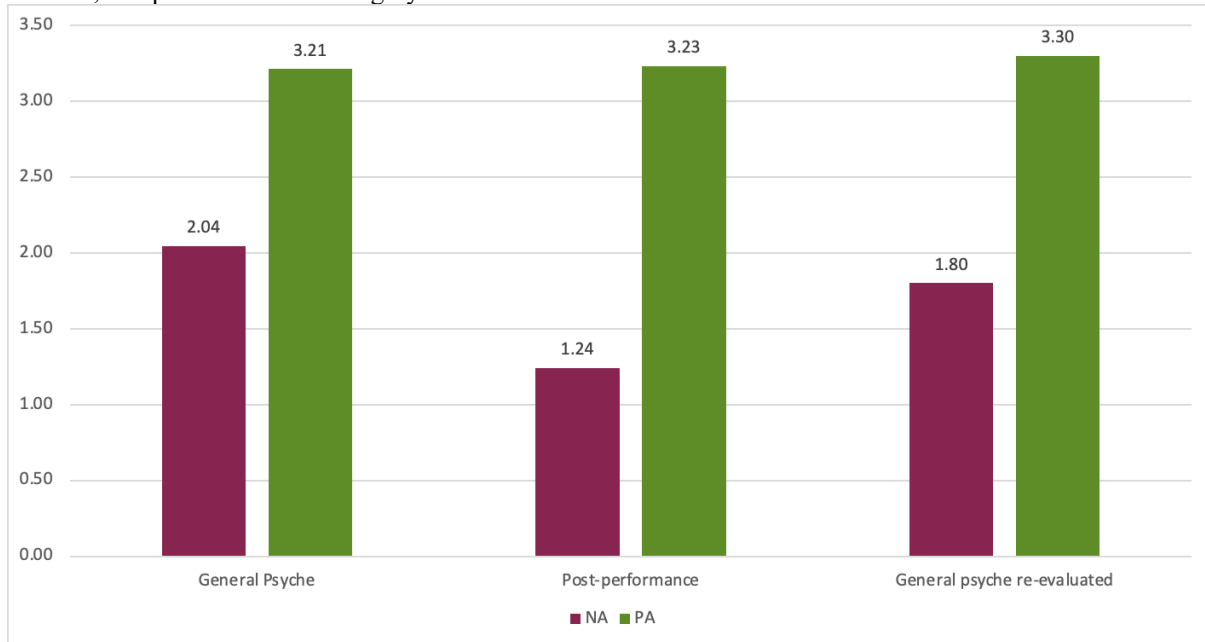

Figure 9. *NA and PA variation independent of flow category: general psyche, post-performance and general psyche re-evaluated (COG).*

Independent of flow category, ANOVA tests gave: for PA variation $F_{(2, 39)} = 0.06$, $p = .94$; and for NA variation $F_{(2, 39)} = 7.36$, $p = <.01*$. As with the all participants results for general psyche and post performance, flow categorisation does not manipulate whether variation is statistically significant for the three chronological markers:

- High flow PA variation $F_{(2, 18)} = 0.31$, $p = .74$; NA variation $F_{(2, 18)} = 11.93$, $p = <.01*$.

- Moderate flow PA variation $F_{(2, 15)} = .07$, $p = .94$; NA variation $F_{(2, 15)} = .80$, $p = .05*$.

Predictably, pursuant to the conclusions drawn from all participants results, PA variation across all three chronological markers was not statistically significant: differences in PA means (**Figure 9**) are minute and not statistically supported. NA variation indicates that musical performance does not have a long-term impact on the inhibition of overall NA. The pairwise t-test comparisons, independent of flow category, gave:

- General psyche to general psyche re-evaluated, $p = .26$.

- General psyche to post-performance, $p = <.01*$.

- Post-performance to general psyche re-evaluated, $p = .03*$.

There is no statistically significant difference or residual emotional impact of musical performance evidenced in NA or PA variation at general psyche re-evaluated compared to general psyche. A null hypothesis for hypothesis 2 cannot be ignored - hypothesis 2(a)(c) is unsupported. Reinforcing this: the significant difference between post-performance and general psyche re-evaluated contours overall NA levels re-attaining statistically similar levels to when general psyche was first assessed.

Hypotheses 1(a)(c) and 2(a) are unsupported by the COG. Hypothesis 2(c) is supported by both COG and all participants data.

3.3.2 SEMS variation. **Figure 10** shows the SEMS variation within the COG, independent of flow category. ANOVAs show the same binary outcomes of statistical significance regardless of flow state categorisation.3
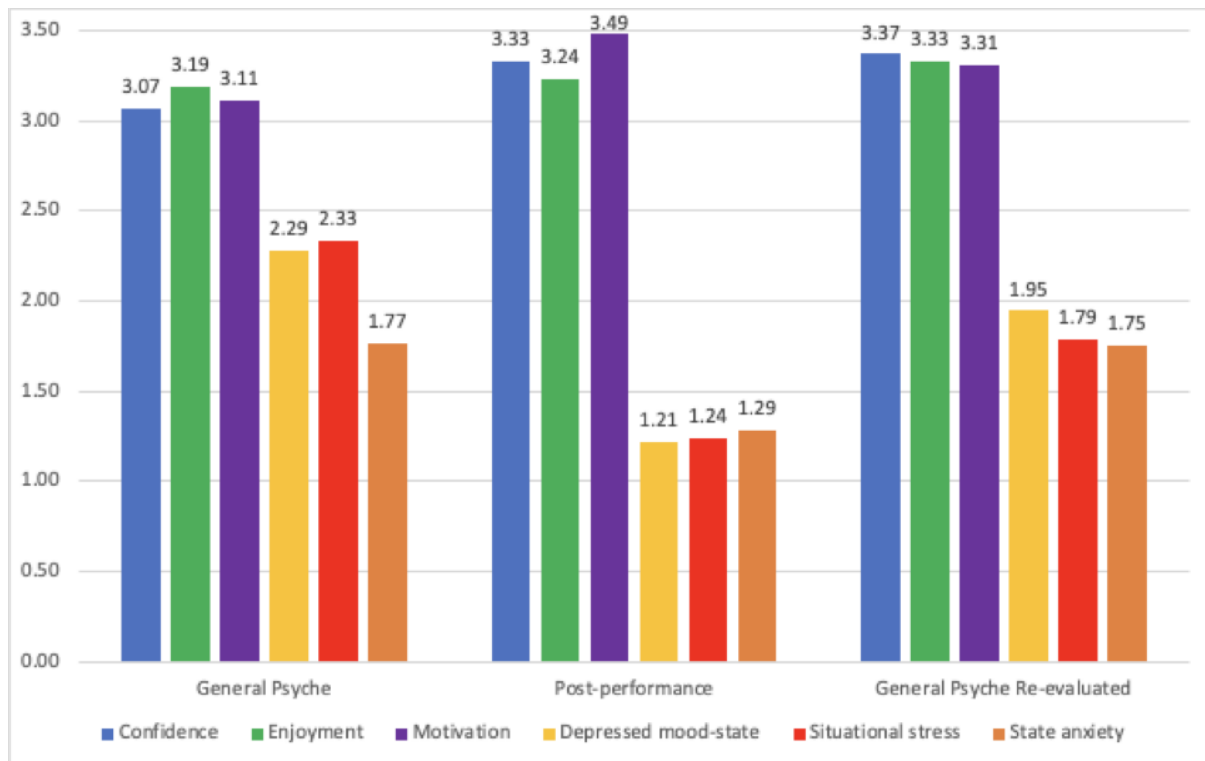

Figure 10. *SEMS Variation independent of flow category: general psyche, post-performance and general psyche re-evaluated.*

SEMS confidence, enjoyment and motivation show the same support for the null hypothesis as the PA variation: there is no statistically significant variation across the three chronological markers. It cannot be concluded that musical performance has any effect on these SEMS. A null hypothesis is supported in place of hypotheses 1(b) and 2(b).4

Depressed mood-state follows the same fluctuation as NA variation, where $F(2, 39) = 9.93$, $p = <.01*$. The significant differences are between general psyche and post performance ($p = <.01*$); and between post-performance and general psyche re-evaluated ($p = .01*$). This outlines an immediate inhibition of depressed mood-state post-performance, but also a return to its general psyche levels at general psyche re-evaluated as its long-term decrease (**Figure 10**) is not statistically supported ($p = .16$). Hypothesis 2(d) is unsupported by depressed mood-state fluctuation.

A salient difference between the COG and all participants data is that state anxiety has no statistically significant variation across any of the chronological markers: $F(2, 39) = 2.16$, $p = .13$. This appears to reject hypotheses 1 and 2 in domain (d); but the alternative hypothesis for 1(d) was already supported by the all participants data. The finding in the COG is interpreted as an anomaly consequent to the smaller data pool. The contour for all other SEMS from the all participants data is supported by the COG.

COG variation in situational stress draws a significant finding with relation to hypothesis 3(d). Independent of flow category, $F(2, 39) = 14.47$, $p = <.01*$. Pairwise t-tests show variation for situational stress as significant between all chronological markers:

- General psyche to general psyche re-evaluated, $p = .02*$;

- General psyche to post-performance, $p = <0.01*$;

- Post-performance to general psyche re-evaluated, $p = .02*$.

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[3]ANOVA outcomes for all insignificant SEMS variation across the chronological markers are supplied in Appendix 3.

[4]See above note.

The statistically significant difference between general psyche and general psyche re-evaluated suggests a residual inhibition of situational stress consequent to musical performance (irrelevant of whether a flow state is achieved); supporting hypothesis 3(d). This is despite the earlier indication pertaining to hypothesis 3(c): that NA variation was not statistically significant in the long term, comparing general psyche and general psyche re-evaluated (p = .26, **page 11**). None of the other SEMS exhibit this residual impact.5

Variation in situational stress is also the only SEMS variation evidencing significant differences across flow categories in the COG. Variation across all of the other SEMS as compared with flow achievement suggests no statistically significant difference between groups high flow and moderate flow.6 Although t-tests suggest an insignificance between flow categories *per chronological marker* (**Figure 11**), the ANOVA pairwise p-values in **Table 5** suggest that COG participants who achieved moderate flow experienced a significant reduction in situational stress at the re-evaluation of their general psyche (p = .04*); whilst participants who experienced high flow did not exhibit this impact (p = 0.26). This draws an alternative hypothesis contrary to hypothesis 3(d): the moderate flow group showed a more significant inhibition of situational stress (general psyche = 2.50; general psyche r-e = 1.72) than the high flow group (general psyche = 2.24; general psyche r-e = 1.86) in the long term (**Figure 11**).

Table 5. *ANOVAs for situational stress (COG)*

Moderate flow	High flow
$F_{(2, 15)} = 8.41$, p = <.001*	$F_{(2, 18)} = 4.78$, p = .02*

Gen. psyche   Gen. psyche

p = <.01*   Post-perf. p = .02   Post-perf.

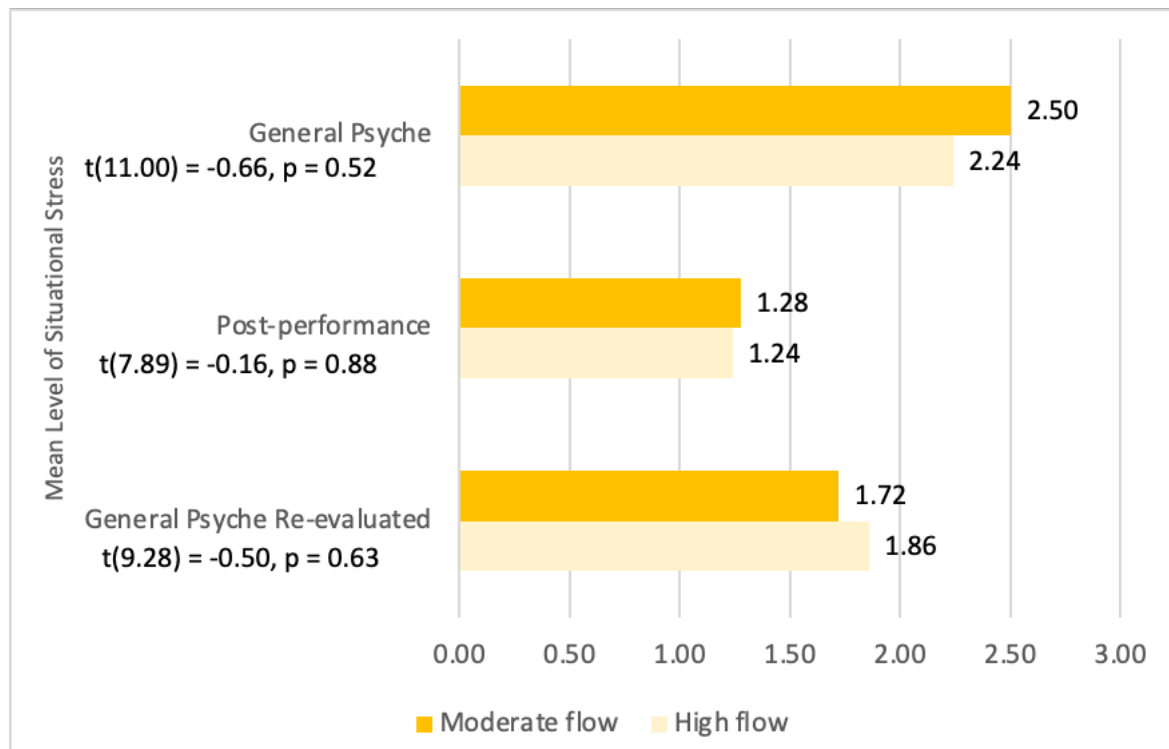p = .04* p = .16   Gen. p. r-e p = .26 p = .15   Gen. p. r-e

Figure 11. *Mean level of situational stress at general psyche, post-performance and general psyche re-evaluated, moderate against high flow (COG).*

5See Appendix 3.

6See Appendix 3.

4. DISCUSSION

4.1 Summary of results. Hypotheses 1 and 2 were tested in domains (a) and (c) using the two-dimensional affect model. There was no significant variation in overall PA evidenced as a consequence of musical performance, independent of flow categories; supporting a null hypothesis for hypotheses 1(a) and 2(a). NA showed a significant reduction post-performance, but a recalibration to general psyche levels at general psyche re-evaluated. This supports alternative hypothesis 1(c) but supports a null hypothesis for hypothesis 2(c). In the two-dimensional affect model, there was no apparent long-term positive impact of musical performance on psychological health. Whilst NA was inhibited post-performance, PA remained stable, regardless of flow achievement. Lower levels of NA do suggest a more positive psyche overall immediately post-performance, despite no improvement in PA levels. Therefore: hypothesis 1 is supported. A null hypothesis is supported for hypothesis 2.

Flow state was tested as an independent variable but had no significant impact on valence fluctuations in the two-dimensional affect model; supporting a null hypothesis for hypothesis 3(a)(c).

Interesting findings procured out of the study's interest in the SEMS (hypotheses domains (e)(d)). Within the all-participants data, the high flow group inhibited a depressed mood-state to a greater extent than the moderate flow group, supporting hypothesis 3(d). All other SEMS supported a null hypothesis for hypothesis 3(d): overall, hypothesis 3 is unsupported. The more significant inhibition of depressed mood state for high flow achievement is notable and is discussed in more detail (*4.3 Contextualisation of findings*). Participants who experienced moderate flow inhibited situational stress to a greater extent than the high flow group at the re-evaluation of their general psyche, suggesting an alternative hypothesis for situational stress variation as an aspect of hypothesis 3(d) and rejecting the hypothesis of the present study. Significant differences in confidence were observed at general psyche between high and moderate flow groups: the high flow group exhibited higher levels of confidence, which was surprising since flow state had not yet been achieved. This is discussed further (*4.3 Contextualisation of findings*).

4.2 Limitations. The chronological markers deployed fail to account for multiple performances, which would distort the targeted emotional continuum. Future studies could isolate participants from their routines in an effort to acquire a baseline. Enjoyment was found to be a broad paradigm to investigate. Future studies should disregard this term in place of a more precise indicator of a PA dimension. 'Proud,' for example, implies a concept of self-image - an important aspect of psychological health (Faber, 2003; Hallam, 2006; Markus & Ruvolo, 1989). Despite these limitations, a chronological and psycho-emotional framework was required in order to acquire the desired baseline.

The study was conducted using existing rehearsal times. The data gathered does not directly relate to a musical *performance*. However, that high or moderate flow was experienced by all participants supports this approach, indicating that there is a similar potential for flow state to be achieved in rehearsal.

Self-report measures are unreliable "in assessing psychological well-being or predicting health outcomes" (Cousineau & Shedler, 2006, p. 427). This is because they cannot evaluate subconscious emotional processes that may contribute to overall psychological health (Kenny, 2011). It is suggested that future studies use physiological measures such as heart rate, heart period, skin conductance and blood pressure to measure anxiety (Cheng et al., 2009). Potential measurements for affect could include electromyography (EMG) to measure activity in the zygomaticus major (ZM) - smile muscle - for PA; and activity in the corrulgator supercilii (CS) - frown muscle - for NA (e.g. de Manzano et al., 2010). In spite of the unreliability of self-report measures, this was the only realistic option for this study. Self-report measures are used widely in studies measuring affect, anxiety and flow by experts in the music psychology field (e.g. Cohen & Bodner, 2018a, 2018b, 2019; Kenny et al., 2014).

A ≈ 50% attrition rate was observed, likely due to lack of material incentive to complete the final survey. Participants were also excluded due to further exclusion criteria. Data gathered for the COG was less authoritative than for all participants due to a smaller sample size. Future studies should consider incentivising participants. Conclusions drawn from the COG are nonetheless valid, given published studies' dependence upon even smaller sample sizes to draw empirical conclusions (e.g. Ascenso et al., 2017; Cohen & Bodner, 2018a).

The participant demographic is limited to students from one University in one country, meaning the findings are not necessarily reproducible nationally or internationally. Although, professional studies are also conducted in this way (e.g. Cohen & Bodner, 2018a; Kirchner et al., 2008).

4.3 Contextualisation of findings. That the achievement of high flow does not elevate PA or PA SEMS contradicts existing theoretical reasoning, especially with regards to motivation and confidence (Milnes, 2024: **Sub-themes 3.4; 3.5**). One possible explanation for this is that the achievement of high flow was not related to a musical performance (rather: to rehearsals) and thus was not an exultation of extremely hard work building towards an important or career-changing performance. The literature related to flow state achievement elevating motivation

and confidence is largely in based on attaining performance goals (Kenny, 2011; Park, 2022) or performing well in a high-pressure situation (Ascenso et al., 2017; Hackett, 1995; Hallam, 2006; Jordan, 2016; McAllister, 2012; Millman, 2021; O'Neill & McPherson, 2002). The empirical findings in this study suggest, then, that in a non-high-pressure environment, flow state achievement does not elevate overall PA or indeed motivation or confidence.

The differences in continuums of emotional variability as related to these two musical environments is researched by only one study (Van Zijl & Sloboda, 2010), an exploratory investigation that does not produce empirical evidence for affect variability through a chronology in either scenario. There exists a rationale for further research into this, as Gruber et al.'s (2013) finding that greater positive emotional variability is associated with poorer psychological health may be tangible with emotional variability in practice versus performance; therein offering insight into why music performance careers are associated with poorer psychological health (Milnes, 2024; evidenced in introduction).

The immediate inhibition of NA and the NA SEMS post-performance as compared with a general psyche evaluation is in line with hypothesis 1(c)(d). As outlined in Milnes's (2024) theoretical baseline (p. 4), current research suggests an immediate reduction in overall NA (Blood et al. 1999; Guster, 2013; Hallam, 2006; Kenny, 2011). The finding that state anxiety specifically is immediately inhibited concurs with Kenny (2011) and McNally (2002).

That the inhibition of depressed mood-state post-performance is positively associated with flow achievement relates Guster's (2013) findings that a musical performance can "purge" (p. 147) a depressed mood-state to the achievement of flow. It suggests that enabling high flow achievement could be an (albeit temporary) escape from depression. This runs parallel to empirical research evidencing that enabling flow achievement helps with the inhibition of Music Performance Anxiety (MPA) (Kirchner, 2011; Cohen & Bodner, 2018a); but foregrounds that state anxiety is not the only mood-state within the framework of NA that might be treated by flow state achievement.

Milnes's (2024) tentative stabilisation of enjoyment in the theoretical baseline (p. 4) is confirmed empirically here, where enjoyment is stable across the three relevant chronological markers.

The achievement of high flow did not have any longer-term impact on the NA SEMS (general psyche re-evaluated compared with general psyche), contradicting existing research which is summarised by the theoretical baseline (Milnes, 2024). The finding that the inhibition of situational stress was significant in the moderate flow group, but not in the high flow group, offers an explanation for the re-attainment of NA SEMS levels from general psyche at general psyche re-evaluated. Milnes (2024) suggested that, for the theoretical baseline, situational stress would re-attain similar levels at general psyche re-evaluated given the stressors provoked by occupational demands (Willis et al., 2019), which continue to exist despite a successful performance. The present empirical findings suggest that these occupational stressors were more likely to impact those who achieved high flow than those who achieved moderate flow. The potential explanation for this is bi-layered. Participants who experienced high flow in the rehearsal environment were likely to be more dedicated musicians than those who experienced moderate flow. This is because, in order to achieve high flow, high levels of motivation and a resultant high quantity of hours deliberate practice is needed (Csikszentmihalyi, 1990; Guster, 2013; Parncutt, 2007). More dedicated musicians are likely to perceive music as a part of their being or self (Ascenso et al., 2017); meaning they will interpret the occupational demands and stressors of their musical participation as more significant. Participants who achieved high flow did not inhibit situational stress to the same extent because they are more emotionally committed participators in an environment which fosters continuous occupational stressors. For example: interpersonal demands such as competition with peers (Creech et al., 2008; Willis et al., 2019) may be exacerbated by intrapersonal perfectionistic strivings (Kenny et al., 2004; Willis et al., 2019), which are likely to be exaggerated in more dedicated musicians as perfectionism is associated with higher effort, intrinsic motivation and higher achievement (McGrath, 2012; Stoeber & Eismann, 2007). This underscores the need for a balance: an emotional overcommitment to music may reduce the positive emotional impacts of achieving flow, given the continuity of occupational stressors. All the more need, then, for further empirical research into a baseline of the emotional chronology of a performance in order to gather information on how this emotional balance might be achieved.

The significant discrepancy in confidence levels at general psyche, high against moderate flow, is explained by similar logic: musicians who experience high flow are likely to be more dedicated, practise more and consequently become more confident overall - especially in the environment of a music rehearsal, where the study was carried out. This finding suggests that confidence levels in Milnes's (2024) theoretical baseline should have been higher, given the assumption of high flow achievement.

This study's empirical contradiction of existing theoretical contributions to the emotional chronology of a performance as related to the achievement of flow state is a clear indication that there is an absence of scientific interest on the subject. Gruber et al.'s (2013) findings that greater positive emotional variability is associated with poorer psychological health; the self-perceived emotional instability in musicians (Ascenso et al., 2016; Van Zijl & Sloboda, 2010); and the proven scientific association of music performance careers with poor psychological health (Brodsky, 2006; Diehl, 2016; Kenny, 2011; Kenny et al., 2014; Kirchner, 2011; Lockwood, 1989; MacArthur, 2008; Swart, 2013; Willis et al., 2019) asks that music psychology and performance professionals with an interest in MPA severity classification, flow achievement and/or the general psychological health of musicians undertake empirical research to establish a baseline for emotional fluctuation throughout a performance. This empirical study provides an initial model of how this research might be executed.

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Appendix 1
Questionnaire handout distributed to participants

In-Person Questionnaires

Please complete **only questionnaire 1 before** your rehearsal/ performance.

Please fully complete **questionnaire 2** (which has two components) **after** your rehearsal/performance.

This page is here to safeguard your anonymity so that neither your participant code nor your responses are seen at any point during the data collection process.

Questionnaire 1

To be completed before performance/rehearsal

Please answer the following questions with complete honesty without fear of judgement or retribution as your identity is guarded as one hundred per cent anonymous.

Instructions

This scale consists of a number of words that describe different feelings and emotions. Please read each item and check the appropriate box in the space next to the word. It is crucial to this study that you indicate to what extent you have felt this way **during the past week**.

Please bear in mind that the numbers represent the following statements:

1 = very slightly or not at all

2 = a little

3 = moderately

4 = quite a bit

5 = extremely

Please try to rate the extent to which you have felt all of the words during the past week; but it you are unsure, feel free to leave the row blank.

If you change your mind, draw a line through the 'x' (✖), and place a new 'x' in the box you have decided on.

	1	2	3	4	5
Interested					
Distressed					
Excited					
Upset					
Strong					
Guilty					
Scared					
Hostile					
Enthusiastic					
Proud					

	1	2	3	4	5
Irritable					
Alert					
Ashamed					
Inspired					
Nervous					
Determined					
Attentive					
Jittery					
Active					
Afraid					

Questionnaire 2, Part 1

Please answer the following questions with complete honesty without fear of judgement or retribution as your identity is guarded as one hundred per cent anonymous.

Please place an 'x' in the square which best describes your experience of the following statements during your performance/rehearsal using the following pointers. If you were in a rehearsal, please try and describe the point at which you felt most 'in the zone' whilst playing.

1 = strongly disagree

2 = disagree

3 = neither agree nor disagree

4 = agree

5 = strongly agree

Please try to rate the extent to which agree with all of the statements; but it you are unsure, feel free to leave the row blank.

If you change your mind, draw a line through the 'x' (✗), and place a new 'x' in the box you have decided on.

	1	2	3	4	5
I was challenged during the performance/rehearsal, but I believe my skills allowed me to meet the challenges.					
During my performance/rehearsal, I made the correct movements without thinking about trying to do so.					
During my performance/rehearsal I knew clearly what I wanted to do.					
It was really clear to me how my performance/rehearsal was going whilst I was playing.					
My attention was focused entirely on what I was playing.					
I had a sense of control over what I was playing.					
I was not concerned with what others may been thinking of me whilst I was playing.					
Time seemed to alter, either slowed down or sped up as I was playing.					
I really enjoyed the experience whilst I was playing.					

Questionnaire 2, Part 2

To be completed immediately <u>after</u> performance/rehearsal

Please answer the following questions with complete honesty without fear of judgement or retribution as your identity is guarded as one hundred per cent anonymous.

Instructions

This scale consists of a number of words that describe different feelings and emotions. Please read each item and check the appropriate box in the space next to the word. It is crucial to this study that you indicate to what extent you feel this way **right now, this second**.

Please bear in mind that the numbers represent the following statements:

1 = very slightly or not at all

2 = a little

3 = moderately

4 = quite a bit

5 = extremely

If you change your mind, draw a line through the 'x' (⚹), and place a new 'x' in the box you have decided on.

If you are unsure, please just leave the row blank.

	1	2	3	4	5
Interested					
Distressed					
Excited					
Upset					
Strong					
Guilty					
Scared					
Hostile					
Enthusiastic					
Proud					

	1	2	3	4	5
Irritable					
Alert					
Ashamed					
Inspired					
Nervous					
Determined					
Attentive					
Jittery					
Active					
Afraid					

You have completed the questionnaires!

Please note that i will be in touch with the third questionnaire in one week.

Please, write down your participant code!

Thank you, again, for taking part.

Appendix 2
All participants, t-tests per chronological marker. High versus moderate flow.

SEMS	High versus moderate flow t-test outcome (of statistical significance = *)	
	General psyche	Post-performance
State anxiety	t(39.63) = -.38, *p* = .71	t(43.11) = -1.57, *p* = .12
Situational stress	t(44.37) = .03, *p* = .97	T(43.96) = -1.51, *p* = .14
Depressed mood-state	*Reported in results**	
Enjoyment	t(45.98) = 1.38, *p* = .18	t(38.35) = 1.84, *p* = .07
Confidence	*Reported in results**	t(36.58) = 1.88, *p* = .07
Motivation	t(43.71) = 1.28, *p* = .21	T(34.17) = 1.93, *p* = .06

Appendix 3

COG data, ANOVAs across chronological markers: SEMS, statistically insignificant variations

SEMS	ANOVA across chronological markers outcome (of statistical significance = *)		
	Independent of flow	High flow	Moderate flow
State anxiety	$F(2, 39) = 2.16, p = .13$	$F(2, 18) = .94, p = .41$	$F(3, 15) = 1.19, p = .33$
Situational stress		***Reported in results****	
Depressed mood-state		***Reported in results****	
Enjoyment	$F(2, 39) = .18, p = .83$		$F(2, 15) = .04, p = .96$
Confidence	$F(2, 39) = .91, p = .39$		$F(2, 15) = 2.82, p = .09$
Motivation	$F(2, 39) = .71, p = .50$		$F(2, 15) = .09, p = .92$