

Flow in Music Performance: From Theory to Educational Applications

Katarina Habe¹ and Michele Biasutti²

¹ University of Ljubljana, Academy of Music, Ljubljana, Slovenia

² University of Padova, FISPPA, Padova, Italy

Abstract

Flow is a specific state of consciousness when people are completely immersed and concentrated on a task, that they lose the sense of time, and feel as if doing things unconsciously. This article aims to provide a brief overview of the flow in music, focused on music performance, and shed light on aspects such as psychological correlates, occurrence and educational applications. Our objective is to build a bridge between theory and practice examining the implications of flow for improving the musical practice. Several studies analyse flow in various musical activities, including improvisation/composition, listening and performance. Music improvisation is considered one of the most crucial pedagogical tools for promoting flow from the early years of music education on. Flow in music performance is the most extensively studied, and practical implications to facilitate optimal experience and flow conditions could be developed. In the final part of the article, educational strategies for inducing flow are proposed based on the nine characteristics of flow (Csikszentmihalyi, 1990).

Keywords: flow, musicians, music performance, strategies for inducing flow, improvisation

Introduction

Flow is a multidimensional state of consciousness emerging when people feel in enough control to perform activities that are relevant to them (Csikszentmihalyi, 1990). While experiencing flow, individuals are entirely engaged in and focused on completing a pleasant and fulfilling task (MacDonald et al., 2006). Flow has been widely researched in the last three decades. Since the rise of positive psychology in the 1990's there has been an enhancement of studies oriented on positive aspects of psychological functioning in the field of psychology of music performance. Studies, investigating pre-performance excitement as an integral part of music performance – either in music beginners or in elite musicians – redirected their focus from exploring performance anxiety to flow (Tan & Sin, 2019).

✉ Katarina Habe, Academy of Music, University of Ljubljana, Kongresni trg 1, 1000 Ljubljana, Slovenia. E-mail: katarina.habe@ag.uni-lj.si

Our aim is to present an overview of some of the most important research outcomes focused on flow in music performance and its occurrence. First, we present an analysis of the flow-music studies regarding its prevalence in different music settings, with an emphasis on flow in music performance. Further, individual and contextual differences in experiencing flow are discussed, and the relationship between flow and improvisation is highlighted. Finally, educational strategies for promoting flow in musicians are outlined.

Flow in Musicians

Flow is a state of mind conveying cognitive, physiological, and affective aspects and corresponds to a peak psychophysical state (Biasutti, 2017). Performers who experience flow, such as musicians and athletes, describe it as high performance in an activity that demands high levels of focus (Antonini Philippe, Singer, et al., 2022; Habe et al., 2019, 2021). They are immersed in the activity, which fully absorbs their attention (Sinnott et al., 2020), and have a feeling of optimal experience and profound enjoyment (Csikszentmihalyi, 1990). Flow research highlights the following nine characteristics: challenge and skill balance, action and awareness merging, clear goals, unambiguous feedback, concentration on the task, a sense of control, loss of self-consciousness, a distorted sense of time, and autotelic (self-rewarding) experience (Csikszentmihalyi, 1990).

The challenge-skill concept is basic for the induction of flow and means that there has to be a balance between the complexity of the task and the performer's skills. The activity should be defined in accordance with the skills of the performer: when an activity is too easy it becomes boring, while a too difficult task discourages musicians to perform it successfully. Flow is controlled by the ability to find a balance between the complexity of the task and the performer's skills.

Flow occurs when the activity is intriguing and contains enough risk to stretch musicians' capacities (Chirico et al., 2015); musicians are intrinsically motivated by the quality of the experience they are having (Antonini Philippe, Kosirnik, et al., 2022).

Musicians describe flow as an ecstatic state in which the music appears spontaneously, and they feel a mysterious sense of harmony between body and mind. Music performers experience a state of trance when they produce their best performances, and flow appears a crucial condition for achieving high levels of performance quality and an expressiveness characterised by discovery. The optimal experience is related to emotional aspects and subjective well-being in music performance (Freer, 2009; Fritz & Avsec, 2007) and leads people to repeat the same actions (Antonini Philippe, Kosirnik, et al., 2022).

Several studies have considered the flow state in different musical activities, such as performance (Antonini Philippe, Kosirnik, et al., 2022; Cohen & Bodner, 2019; Iusca, 2015; Spahn et al., 2021; Wrigley & Emmerson, 2013), music practice,

improvisation/composition (Biasutti & Frezza, 2009; Forbes, 2021; Korošec et al., 2022; Landau & Limb, 2017), and listening (Diaz, 2011; Loepthien & Leipold, 2022).

Flow and Music Listening

Research on flow while listening to music is scarce. Listeners describe flow in music listening as being absorbed by the music and losing a sense of environment. Flow occurs in situations in which participants were fully concentrated on the music (Diaz, 2011). Moreover, the importance of concentration in inducing flow when listening to complex music was highlighted (Ruth et al., 2016). A high level of focus and involvement is considered a necessary condition for music to invoke flow, as one can scarcely achieve a state of immersion without it (Csikszentmihalyi, 2009). Loepthien and Leipold (2022) examined flow while listening to music in relation to subjective well-being, and the role a flexible self-concept plays in it. Their study confirms a stronger relationship between flow and subjective well-being in individuals with a highly flexible self-concept. In addition, while listening to music, flow depends on several characteristics such as the type of music. A type of music that is groovy (upbeat) and induces dancing creates better conditions for experiencing flow. Groove expresses the degree to which a certain piece of music urges the listener to generate movements (Witek et al., 2014). Groovy type of music is constructed in such a way it maximises motor affordances and sensorimotor entrainment. In addition, it also contains a certain degree of syncopation, which increases listener's expectations and maintains an optimal level of interest in listening. Spontaneous dance to groovy music especially facilitates flow while listening. When dancing to upbeat music, people may sense increased flow because their movements seem effortless, automatic, and almost unconsciously produced (Bernardi et al., 2018).

Flow and Music Practice

Flow is strongly connected to the quality of music practice (Chirico et al., 2015). Music learning requires acquiring basic skills involved in performance, and success in music demands endless amounts of time dedicated to practicing and rehearsing the most difficult passages; achieving a high standard of excellence takes an enormous amount of time. Skilled actions must be carefully refined by motor learning mechanisms, which involve both mental and physical practice. Musicians spend hours of practice completely absorbed in the score, which is a feature of flow (Sawyer, 2015). The performer must avoid loss of time and interruptions, because interruptions disturb concentration and prevent the attainment of flow (Biasutti, 2017).

Musicians have to employ an effective method for studying a musical score. The practice must be of high quality and develop performers' awareness of their abilities rather than being simply mechanical. Self-regulated learning strategies need to be adopted to master the processes, and practice must be internalised (Mazur &

Laguna, 2019). Musicians use their mental resources to focus on the piece, which involves motor, cognitive, and expressive aspects (Biasutti, 2013). Music has an expressive dimension that creates complex dynamics and determines the emotional meaning of a piece.

Flow and Music Performance

Music performance requires deep involvement in the task: while performing, musicians are entirely focused on the music (Chen, 2022). This state, thus, produces empathy and identification with the music piece that overcome the musicians profoundly (Antonini Philippe, Kosirnik, et al., 2022; Antonini Philippe, Singer, et al., 2022). High degrees of absorption and concentration are required to achieve perfect performance (Biasutti, 2013). While in flow, musicians focus on the creative moment and, in the best performances, report that they have overcome their cognitive limits (Csikszentmihalyi, 1990). The flow state increases the degree of expressiveness and imagination, and musicians are comfortable in experimenting with new musical ideas (Biasutti, 2012, 2015a, 2015b, 2015c).

Another requirement for performing music is being able to interact with the audience, which involves transferring the results of musical practice to the concert situation. Flow can happen during rehearsals and concerts, but it is the live performance with an audience that most readily creates the conditions to facilitate flow. Artists play at their best because the concert activates multifaceted processes with the audience in a transcendent experience. The concert context and the audience can be incentives for experiencing flow and thus inspiring artists. The audience attending live performances is tuned to capture all the details of the musical signal, establishing a complex auditory communication with the artists. The mutual immersion and the intensive attention to the music can create ideal conditions for entering flow. However, it is difficult to foresee when flow will appear due to less predictable conditions regarding different performing contexts. In addition, interpersonal variability can interfere with flow, and if elements such as stage fright come into play, feedback from an audience can impede the appearance of flow (Biasutti, 2017).

Individual and Contextual Differences in Experiencing Flow

Previous research has examined the individual and contextual differences in experiencing flow and reported different views about the issue of controlling flow. Jackson (1995) has argued that proper training can enable musicians, athletes, and dancers to develop some control over the flow experience. In a study of 28 elite athletes, it was highlighted that 71 percent of the participants considered both flow and the factors involved in inducing it are at least partly controllable. Conversely, the factors that disturbed the achievement of flow, such as meteorological changes and atmospheric phenomena, were considered uncontrollable.

Csikszentmihalyi (1990) argues that – while it is difficult to control the induction of flow – it is possible to develop a mental mindset that helps its achievement. For example, to reach experience flow, performers have to be convinced that nothing is more important than the activity being performed and that their skills are adequate for the task (Fullagar et al., 2013). Furthermore, musicians have to demonstrate the ability to manage the resources to carry out the activity by modulating the inspiration, commitment, and ability required.

Even allowing for interpersonal variability, there are individual differences and psychological characteristics that either facilitate or hinder flow process. Intrinsic motivation can be a key driver for entering flow, as well as enhance confidence and concentration while performing the activity.

Several external and internal circumstances can interfere with the appearance of flow (Jackson, 1995). External circumstances are contextual aspects and negative environmental conditions, while internal states include issues like anxiety and impatience.

A hectic and noisy setting can preclude achieving the concentration needed to obtain flow, although there is a wide variability between individuals (Csikszentmihalyi, 1990). Atmospheric conditions can pose problems, such as a windy and rainy day during an outdoor performance. Other relevant external conditions that can facilitate or inhibit flow include the social environment (Csikszentmihalyi, 1997). The surrounding social setting as an external condition can provide the performer appropriate support for achieving an optimal experience (Tan & Sin, 2019). It would be nice to verify if a friendly and sympathetic environment is crucial for developing confidence and facilitating flow.

With regard to internal factors, nervousness develops when performers question their abilities, or the situation causes them pain. Music performance anxiety could be considered an internal factor and flow may be a powerful tool to help alleviate music performance anxiety (Cohen & Bodner, 2019). In addition, impatience is a negative factor affecting concentration and may force musicians to take longer to get into what they are doing. It is relevant to concentrate on the task and focus all mental resources on the activity at hand (Csikszentmihalyi, 1997). Actions such as watching YouTube, frequently checking e-mail, and surfing the internet, in general, are all behaviours that distract from the central activity and the achievement of flow. Obviously, some interruptions are necessary for daily life, since it is not possible to perform tasks like playing the trombone 24 hours a day, and alternating demanding with more quotidian activities is common.

Other relevant internal conditions that can facilitate or inhibit flow include preparation and quality, attentional focus, awareness of one's abilities and self, and the connection to the body. Having enough time to organise the performance is vital to ensuring high-quality preparation (Williamon, 2004). There can be a specific attentional focus, as an internal condition, that directs all mental attitudes on the activity. Musicians have to develop awareness of their skills and self to develop

confidence in their capabilities. The connection to the body has to be developed in accordance with the current interactive and embodied approaches to human cognition (Schiavio et al., 2019, 2020).

The contextual and individual differences are also relevant during music improvisation, which is one activity deeply linked to flow.

Flow and Music Improvisation

Music improvisation is probably one of the most natural, spontaneous, creative, and developmentally based actions (Forbes, 2021). Music improvisation implies playfulness, authenticity, flexibility and originality, and represents a form of constant coping with fear of mistakes. When improvising, the musician has to let go to be successful.

Several studies have highlighted the importance of improvisation in experiencing flow (Berkowitz, 2010; Biasutti, 2017; Chirico et al., 2015; Csikszentmihalyi, 1997; Després et al., 2017). Dolan et al. (2018) claim that an “improvisatory state of mind” may have aspects of flow as characterised by Csikszentmihalyi (1997). Forbes (2021) reports that jazz singers experience flow when improvisation goes well. Music improvisation can be deployed as an educational method to enable musicians to overcome analytical thinking and to adopt a creative, holistic approach while performing. Overall, we may steer away from a fixed mind-set that is focused on getting it right and creating the best, highest quality performance, whilst emphasising playfulness and variation. We can then suggest that improvisation can help. Flow can lead to optimal experience and several techniques could be designed and refined to induce flow in musicians.

Music improvisation can be considered as one of the most effective didactic tools for promoting flow from the very beginnings of music learning (Korošec et al., 2022). Flow during improvisation enhances a sense of fluency and spontaneity and includes artists’ experiences of intense focus, control, and delight (Biasutti, 2015a) and it is a crucial component in improvisation (Kenny & Gellrich, 2002). Kenny and Gellrich (2002) define flow as one of the eight different mental processes that take place during improvisation. Neuroscience provides more support for the idea that flow may be a key component of improvisation. The dorsolateral prefrontal cortex (DLPFC), a part of the brain that is crucial for cognitive regulation, displays a strong deactivation during improvisation (Landau & Limb, 2017). Furthermore, as improvisation becomes less constrained and more sophisticated (De Manzano & Ullén, 2012; Limb & Braun, 2008; McPherson et al., 2016; Pinho et al., 2014), this deactivation becomes even more prominent. These decreases in activity could be a neurological correlate of flow, indicating a decrease in top-down control and self-awareness that could result in a different outcome.

There are also other strategies for promoting flow besides improvisation, which derive from the nine dimensions of flow (Csikszentmihalyi, 1990).

Strategies for Promoting Flow in Musicians

Flow research is not limited to a theoretical analysis of the intrinsic characteristics of flow; it could be used for developing applications to improve quality of life and promote wellbeing (Antonini Philippe, Kosirnik, et al., 2022; Fritz & Avsec, 2007; Habe et al., 2021). Flow could be an important tool that benefits music education by helping musicians to enhance the level of their practice and value of their performances (Biasutti, 2017; Chirico et al., 2015; Sawyer, 2015). In addition, flow principles can be used in music education to assess and regulate learning, and activities such as task planning are crucial to improve student engagement (Biasutti, 2017; Custodero, 2011; Korošec et al., 2022).

Several actions could be undertaken to increase the experience of flow, which are linked to the previously reported nine characteristics that determine flow (Csikszentmihalyi, 1990). To get into the flow state, music performers have to: (1) regulate the balance between performing competencies and performing challenges, (2) establish control over their performance and maintain attention on the activity at hand, (3) define clear and well planned authentic goals, (4) nurture self-reflection, (5) avoid distractions and concentrate on the necessary elements of a task, (6) be comfortable before starting to improve the feeling of control and create a relaxed atmosphere, (7) focus on the musical expression to engage all their senses to communicate with the other performers, (8) promote a sense of timelessness in which musicians can be immersed in playing for long periods of time without realizing it, and (9) create internally rewarding performing conditions that facilitate feelings of joy and fulfilment.

To follow, some more detailed examples of strategies for promoting flow based on the previous results are discussed:

1. For *challenge and skill balance*, a detailed task analysis is necessary to define the abilities required to perform a musical piece. Obviously, the musician has to have the necessary abilities; otherwise, there will be a gap between the challenges of the piece and the skills of its player (Fullagar et al., 2013). The activity must neither be too easy nor too difficult and should be shaped to the abilities of the performer. An activity that is too easy becomes boring, while an excessively difficult task discourages those who cannot perform it successfully. Flow is controlled by the ability to find the equilibrium between the complexity of the task and the performer's skills. Musicians need to develop the necessary skills involved in the activity and make the task challenging once it becomes boring. Activities have to be feasible and require abilities that are appropriately shaped to performers' capabilities, finding a balance between skill and challenge. This could be applied to music teachers giving adequate pieces to their students (Bakker, 2005). Regarding challenge and skill balance, psychological skills must be taken into consideration. A musician can be very technically and expressively skilled, but his personality might be more prone to experience anxiety. In that case, the music challenge has to be in accordance with his

psychological predispositions (Ford et al., 2020). Music teachers must take into account psychological characteristics of their students and provide them with some basic techniques for efficiently coping with pre-performance excitement (Gill, 2020; Tan & Sin, 2020). Aspects of job resources, such as performance evaluation, autonomy, social support, and supervisory coaching, with regard to music teachers and students, all have a favourable impact on the balance between teachers' challenges and skills and contribute to the sensation of flow (Bakker, 2005; Csikszentmihalyi, 1997).

2. The *action and awareness merging* process facilitates concentration and high performance. Participants must focus on the task and develop control over the performance. Linking body and mind (action and awareness) is of enormous importance in reaching optimal performance and flow (Altosaar et al., 2019; Tang & Bruya, 2017). Regarding action and awareness merging, strategies such as yoga, Alexander technique and Feldenkreis method (Schlinger, 2006), which derive from the assumption that change in a body can lead to a change in mind, can serve as facilitators of flow. To enter a flow state in music education through action and awareness merging, is important to support embodied learning (Leman et al., 2017). Music teachers should encourage their students to be aware of their body and to follow their inner wisdom (Bloom & Skutnick-Henley, 2005). If movements in musician's body are natural and authentic, the awareness is more likely to be merged with the action.

3. *Clear goals* are relevant factors in curriculum design; each activity should have a general objective and as many sub-objectives as it is realistic. All goals have to be clear and achievable (Csikszentmihalyi, 1990). The musician must have a distinct purpose and a precise idea of what to do and how to proceed. This should be the case in performance practice. The musician knows which notes he or she has to play in various passages of a piece and has to be guided by the progressive achievement of sub-objectives. Deliberate music practice should be encouraged (Ericsson & Harwell, 2019) for developing confidence during the performance, which includes designing a practice and performance plan with truthful goals. In an educational environment, collaboration between a music teacher and a music student in setting clear goals is crucial (Bakker, 2005). If a music student contributes to this process, he or she feels more responsible for the outcome, more in control of the educational process and consequently more relaxed and confident to experience flow. Considering setting performance goals in music education, the role of encouraging self-regulation of students in music practice and in music performance is of great value (Concina, 2019). Araújo (2016) examined self-regulated practice strategies in expert musicians and found three main categories of behaviours: organization of practice, management of personal resources, and management of external resources. The first category refers to planning, structuring and monitoring practice goals, the second category includes setting goals that need to be achieved, and the third category highlights the role of social support in achieving practice goals.

If the metacognitive skills are explicitly trained in music classes, they can help students become aware of the role of strategic behaviour in enhancing their learning process in music (Benton, 2013). The ability to self-regulate behaviours, such as using personal resources, is a function of flow in classically trained musicians. Flow experience is associated with indicators of musical skill, tasks, the clarity of goals and feedback, concentration, and control over the activities (Araújo & Hein, 2016).

4. Regarding *unambiguous feedback*, it is crucial to assess the progress of the activities by verifying the achievement of goals and the soundness of the overall plan. Feedback includes self-observation of our own efforts to master a new concept or skill to the comments and suggestions from our teacher, coaches, peers, and supervisors. Feedback helps us to improve our performance, boost our confidence, and handle even the most routine learning situations (McPherson et al., 2022). Feedback should be used to monitor the performance using real-time cues and then adjusting the performance as appropriate. Using real-time feedback musicians learn to monitor their playing and refine their abilities on specific passages. There are several strategies that can enhance the quality of feedback in music education: teachers should use more dialogue and less monolog, feedback should be specific and focused on the improvement, feedback should not be confused with praise and has to be meaningful. A teacher should verify if students correctly understood the feedback and whether it is effective, otherwise he or she should adapt it according to students' needs (MacPherson et al., 2022). In addition, performer's awareness to direct feedback during music activities should be encouraged and trained (Alto Saar et al., 2019; Zhang et al., 2019).

5. *Concentration on the task* requires musicians to develop the mindset to focus only on the relevant aspects of a task and avoid distractions. All attentional resources have to be used to execute the activity so that it becomes the exclusive content of the working memory buffer. Restricting the centre of awareness creates a sort of filter that keeps out irrelevant perceptions and thoughts. Remaining concentrated on the activity by avoiding distractions can only improve the quality of a performance. Aspects such as creating an ideal practice setting where distractions and interruptions are at a minimum can facilitate concentration. Nowadays, smartphones are the main distraction for youth (Zhao et al., 2022). Several studies have shown that the use of smartphones disrupts focusing on the main task, further interfering with cognitive processes and abilities (Marsh & Rajaram, 2019; Ward et al., 2017) and cognitive functioning (e.g., thinking, memory, attention, and regulating emotions) (Canale et al., 2019; Wilmer et al., 2017). Based on that evidence music students have to eliminate smartphones from their music practice environment to avoid distractions during musical training.

6. Trained musicians often have a considerable *sense of control* over the music they perform (Brown et al., 2015). They feel they can dominate the situation and not worry about failure or a possible loss of control because they are so deeply involved in the task. All external elements, including failure, are less relevant, so musicians

have consistent feelings of success (Pecen et al., 2017). Becoming comfortable before beginning to play could enhance the sense of control and develop a feeling of relaxation during the performance. Sense of control can be gained by quantity and quality of music practice. Sense of control might be considered as a predisposition for entering a flow state which could be regulated on physical and psychological levels. On a physical level, it comes with a deliberate practice of technical and expressive skills. However, psychological skills for cognitive and emotional self-regulation are very important.

7. The *loss of self-awareness* involves higher-order processes, with the activity absorbing most of the musician's mental and self-awareness resources. There are no residual intellectual capacities for processing other information, which means that the performer's focus is completely absorbed in playing the music. Musicians have to feel immersed in expressing themselves while playing, empathizing with and tuning into the music. They have to use all their senses to connect with other performers by focusing on the expressive dimension of the music. This dimension is closely related to experiencing transcendental feelings while being in flow (Bernard, 2009). The loss of self-awareness requires a long process of self-growth. The music teacher has to encourage students to the deeper meaning of music making.

8. As to a *distorted sense of time*, the perception of time is transformed during flow: it seems to fly when people carry out activities in which they are fully immersed. Conversely, time appears to slow down when people perform tasks to which they are not really committed. A sense of timelessness is also a characteristic of any altered state of consciousness. With an appropriate mixture of elements, musicians can easily become immersed in playing for long periods without realizing it. To access the dimension of timelessness, a musician has to be fully immersed in the "here and now" (Sinnet et al., 2020), a dimension that is closely related to the loss of self-awareness. Both dimensions can actually be referred to as consequences of a total focus and full immersion in the activity, so they come hand in hand with the dimension concentration on the task.

9. *Autotelic experiences* are those that provide incentives for intrinsic motivation to determine essential pleasure. Music performance is supposed to be a pleasant experience for a musician that becomes a reward on its own, connected to the activity itself. The goal is to develop conditions in which musicians are driven by an inner purpose and motivated by a strong sense of intention and curiosity. Musicians can enjoy learning challenging new music, exploring new musical styles, joining or forming new musical ensembles, and expanding the settings in which they perform. Musicians have to play pieces playfully, finding novel aspects and exploring expressive dimensions. It could be useful to develop imaginative ideas about music, discovering uncharted aspects and enriching a piece with feelings and imaginative ideas about what the music could express. The key is finding enjoyment in oneself. Kirchner (2011) suggested that there could be a tendency toward

experiencing flow if certain conditions are met that enable flow to occur, such as goal-setting, self-assurance, a drive to try new things and express oneself via an activity, the capacity for sustained attention, and the ability to perform without self-criticism.

Ultimately, flow can help musicians to produce a sense of well-being that could contrast with – and counteract – negative aspects. Musicians can experience psychological well-being while performing using flow as a source for optimal performance.

Conclusions

The current article presented a brief overview of the flow studies, focused on music performance, and a strategic planning of optimal conditions for enhancing it. Flow is a multidimensional concept involving deep engagement while performing music, characterised by total absorption and concentration, yet emotional expressiveness and creative imagination. Social interaction factors during music performance are important to facilitate flow.

Although it is challenging to manage the induction of flow, Csikszentmihalyi (1990) argues that a mental attitude that aids the achievement of flow could be cultivated. Performers have to believe that their work is essential and that their abilities are adequate for the task (Fullagar et al., 2013). In addition, musicians need to be aware that they can control the inspiration and commitment. Performers have to master the skills needed to manage the resources and to successfully complete the task. It is important to create flow friendly conditions during music practice. Although individual differences and psychological traits that either help or impede flow exist, performers can achieve flow based on their own capacities and devotion. Intrinsic motivation, confidence, and focus on the task at hand can all be important factors in triggering flow.

The current review stimulated several reflections, which call for further research. Future studies could explore the positive contribution of flow for enhancing the music performance in several contexts to better understand how the human potential could be expressed. In addition, several ideas can be proposed for defining educational applications of flow. Flow is multifaceted and can characterise musical experiences from very young childhood to late maturity. Therefore, flow is a transversal concept that can be applied at all levels. Flow theory could provide the ground for developing educational strategies to manage musical practice and to master techniques for decreasing levels of anxiety, increasing feelings of competence, self-efficacy, and promoting intrinsic motivation. Approaches such as work on bodily awareness, cognitive restructuring techniques, and the use of concentration control techniques could have an impact on attentional factors of music performance (Antonini Philippe, Kosirnik, et al., 2022). Ultimately, flow is a

psychophysiological state and a catalyst that could be systematically considered for enhancing the performance linking the mind and the body of the musicians in a holistic approach.

References

- Altosaar, R., Tindale, A., & Doyle, J. (2019). Physically colliding with music: Full-body interactions with an audio-only virtual reality interface. In *Proceedings of the Thirteenth International Conference on Tangible, Embedded, and Embodied Interaction* (pp. 553–557). Association for Computing Machinery.
- Antonini Philippe, R., Kosirnik, C., Ortuño, E., & Biasutti, M. (2022). Flow and music performance: Professional musicians and music students' views. *Psychology of Music*, 50(4), 1023–1038. <https://doi.org/10.1177/03057356211030987>
- Antonini Philippe, R., Singer, S. M., Jäger, J., Biasutti, M., & Sinnett, S. (2022). Achieving flow: An exploratory investigation of elite college athletes and musicians. *Frontiers in Psychology - Performance Science*, 13, 831508. <https://doi.org/10.3389/fpsyg.2022.831508>
- Araújo, M. V. (2016). Measuring self-regulated practice behaviours in highly skilled musicians. *Psychology of Music*, 44(2), 278–292. <https://doi.org/10.1177/0305735614567554>
- Araújo, M. V., & Hein, C. F. (2016). Finding flow in music practice: An exploratory study about self-regulated practice behaviours and dispositions to flow in highly skilled musicians. In L. Harmat, A. F. Ørsted, F. Ullén, J. Wright, & G. Sadlo (Eds.), *Flow experience: Empirical research and applications* (pp. 23–36). Springer.
- Bakker, A. B. (2005). Flow among music teachers and their students: The crossover of peak experiences. *Journal of Vocational Behavior*, 66, 26–44. <http://dx.doi.org/10.1016/j.jvb.2003.11.001>
- Benton, C. W. (2013). Promoting metacognition in music classes. *Music Educators Journal*, 100(2), 52–59. <https://doi.org/10.1177/0027432113500077>
- Berkowitz, A. (2010). *The improvising mind: Cognition and creativity in the musical moment*. Oxford University Press.
- Bernard, R. O. (2009). Music making, transcendence, flow, and music education. *International Journal of Education and the Arts*, 10(14), 1–22.
- Bernardi, N. F., Bellemare-Pepin, A., & Peretz, I. (2018). Dancing to “groovy” music enhances the experience of flow. *Annals of the New York Academy of Sciences*, 1423, 415–426. <https://doi.org/10.1111/nyas.13644>
- Biasutti, M. (2012). Group music composing strategies: A case study within a rock band. *British Journal of Music Education*, 29(3), 343–357. <https://doi.org/10.1017/S0265051712000289>

- Biasutti, M. (2013). Orchestra rehearsal strategies: Conductor and performer views. *Musicae Scientiae*, 17(1), 57–71. <https://doi.org/10.1177/1029864912467634>
- Biasutti, M. (2015a). Pedagogical applications of cognitive research on musical improvisation. *Frontiers in Psychology*, 6, 614. <https://doi.org/10.3389/fpsyg.2015.00614>
- Biasutti, M. (2015b). Assessing a collaborative online environment for music composition. *Educational Technology & Society*, 18(3), 49–63.
- Biasutti, M. (2015c). Creativity in virtual spaces: Communication modes employed during collaborative online music composition. *Thinking Skills and Creativity*, 17, 117–129. <https://doi.org/10.1016/j.tsc.2015.06.002>
- Biasutti M. (2017). Flow and optimal experience. In J. P. Stein (Ed.), *Reference module in neuroscience and biobehavioral psychology* (pp. 1–9). Elsevier. <https://doi.org/10.1016/B978-0-12-809324-5.06191-5>
- Biasutti, M., & Frezza, L. (2009). Dimensions of music improvisation. *Creativity Research Journal*, 21(2-3), 232–242. <https://doi.org/10.1080/10400410902861240>
- Bloom, A. J., & Skutnick-Henley, P. (2005). Facilitating flow experiences among musicians. *The American Music Teacher*, 54(5), 24–28.
- Brown, R. M., Zatorre, R. J., & Penhune, V. B. (2015). Expert music performance: Cognitive, neural, and developmental bases. *Progress in Brain Research*, 217, 57–86. <https://doi.org/10.1016/bs.pbr.2014.11.021>
- Canale, N., Vieno, A., Doro, M., Rosa Mineo, E., Marino, C., & Billieux, J. (2019). Emotion-related impulsivity moderates the cognitive interference effect of smartphone availability on working memory. *Scientific Reports*, 9(1), 18519. <https://doi.org/10.1038/s41598-019-54911-7>
- Chen, K. (2022). Musical interpretative practices as a way to improve the relationship between the flow theory and musical performance. *Psychology of Music*, <https://doi.org/10.1177/03057356221135667>
- Chirico, A., Serino, S., Cipresso, P., Gaggioli, A., & Riva, G. (2015). When music “flows”. State and trait in musical performance, composition and listening: A systematic review. *Frontiers in Psychology*, 6, 906. <https://doi.org/10.3389/fpsyg.2015.00906>
- Cohen, S., & Bodner, E. (2019). The relationship between flow and music performance anxiety amongst professional classical orchestral musicians. *Psychology of Music*, 47(3), 420–435. <https://doi.org/10.1177/0305735618754689>
- Concina, E. (2019). The role of metacognitive skills in music learning and performing: Theoretical features and educational implications. *Frontiers in Psychology*, 10, 1583. <https://doi.org/10.3389/fpsyg.2019.01583>
- Csikszentmihalyi, M. (1990). *Flow: The psychology of optimal performance*. Harper and Row.
- Csikszentmihalyi, M. (1997). *The masterminds series. Finding flow: The psychology of engagement with everyday life*. Basic Books.

- Custodero, L. A. (2011). The call to create: Flow experience in music learning and teaching. In D. Hargreaves, D. Miell, & R. Macdonald (Eds.), *Musical imaginations: Multidisciplinary perspectives on creativity, performance and perception* (pp. 369–384). Oxford University Press.
- De Manzano, Ö., & Ullén, F. (2012). Goal-independent mechanisms for free response generation: Creative and pseudo-random performance share neural substrates. *NeuroImage*, *59*, 772–780. <https://doi.org/10.1016/j.neuroimage.2011.07.016>
- Després, J. P., Burnard, P., Dubé, F., & Stévançe, S. (2017). Expert Western classical music improvisers' strategies. *Journal of Research in Music Education*, *65*(2), 139–162. <https://doi.org/10.1177/0022429417710777>
- Diaz, F. M. (2011). Mindfulness, attention, and flow during music listening: An empirical investigation. *Psychology of Music*, *41*(1), 42–58. <https://doi.org/10.1177/0305735611415144>
- Dolan, D., Jensen, H. J., Mediano, P. A. M., Molina-Solana, M., Rajpal, H., Rosas, F., & Sloboda, J. A. (2018). The improvisational state of mind: A multidisciplinary study of an improvisatory approach to classical music repertoire performance. *Frontiers in Psychology*, *9*, 1341. <https://doi.org/10.3389/fpsyg.2018.01341>
- Ericsson, K. A., & Harwell, K. W. (2019). Deliberate practice and proposed limits on the effects of practice on the acquisition of expert performance: Why the original definition matters and recommendations for future research. *Frontiers in Psychology*, *10*, 2396. <https://doi.org/10.3389/fpsyg.2019.02396>
- Forbes, M. (2021). Giving voice to jazz singers' experiences of flow in improvisation. *Psychology of Music*, *49*(4), 789–803. <https://doi.org/10.1177/0305735619899137>
- Ford, J. L., Vosloo, J., & Arvinen-Barrow, M. (2020). 'Pouring everything that you are': Musicians' experiences of optimal performances. *British Journal of Music Education*, *37*(2), 141–153. <https://doi.org/10.1017/S0265051720000078>
- Freer, P. K. (2009). Boys' descriptions of their experiences in choral music. *Research Studies in Music Education*, *31*(2), 142–160. <https://doi.org/10.1177/1321103X09344382>
- Fritz, B. S., & Avsec, A. (2007). The experience of flow and subjective well-being of music students. *Psihološka Obzorja / Horizons of Psychology*, *16*(2), 5–17.
- Fullagar, C. J., Knight, P. A. & Sovern, H. S. (2013). Challenge/skill balance, flow and performance anxiety. *Applied Psychology: An International Review*, *62*(2), 236–259. <https://doi.org/10.1111/j.1464-0597.2012.00494>
- Gill, A. (2020). *Enhancing music performance self-efficacy through psychological skills training*. [Unpublished doctoral dissertation]. University of Melbourne.
- Habe, K., Biasutti, M., & Kajtna, T. (2019). Flow and satisfaction with life in elite musicians and top athletes. *Frontiers in Psychology*, *10*, 698. <https://doi.org/10.3389/fpsyg.2019.00698>

- Habe, K., Biasutti, M., & Kajtna, T. (2021). Wellbeing and flow in sports and music students during the COVID-19 pandemic. *Thinking Skills and Creativity*, 39, 100798. <https://doi.org/10.1016/j.tsc.2021.100798>
- Iusca, D. (2015). The relationship between flow and music performance level of undergraduates in exam situations: The effect of musical instrument. *Procedia-Social and Behavioral Sciences*, 177, 396–400. <https://doi.org/10.1016/j.sbspro.2015.02.376>
- Jackson, S. A. (1995). Factors influencing the occurrence of flow in elite athletes. *Journal of Applied Sport Psychology*, 7(2), 135–163. <https://doi.org/10.1080/10413209508406962>
- Kenny, B. J., & Gellrich, M. (2002). Improvisation. In R. Parncutt & G. E. McPherson (Eds.), *The science and psychology of music performance: Creative strategies for teaching and learning* (pp. 117–134). Oxford University Press.
- Kirchner, J. M. (2011). Incorporating flow into practice and performance. *Work*, 40, 289–296. <https://doi.org/10.3233/WOR-2011-1232>
- Korošec, K., Susić, B. B., & Habe, K. (2022). Improvisation as the foundation of flow in music education: Connections to attitudes, gender and genre. *Journal of Elementary Education*, 15(3), 339–356. <https://doi.org/10.18690/rei.15.3.339-356.2022>
- Landau, A. T., & Limb, C. J. (2017). The neuroscience of improvisation. *Music Educators Journal*, 103(3), 27–33. <https://doi.org/10.1177/0027432116687373>
- Leman, M., Lesaffre, M., & Maes, P. J. (2017). Introduction: What is embodied music interaction? In M. Lesaffre, P. J. Maes, & M. Leman (Eds.), *The Routledge companion to embodied music interaction* (pp. 1–10). Routledge.
- Limb, C. J., & Braun, A. R. (2008). Neural substrates of spontaneous musical performance: An fMRI study of jazz improvisation. *PLoS One*, 3, e1679. <https://doi.org/10.1371/journal.pone.0001679>
- Loepthien, T., & Leipold, B. (2022). Flow in music performance and music-listening: Differences in intensity, predictors, and the relationship between flow and subjective well-being. *Psychology of Music*, 50(1), 111–126. <https://doi.org/10.1177/0305735620982056>
- MacDonald, R., Byrne, C., & Carlton, L. (2006). Creativity and flow in musical composition: An empirical investigation. *Psychology of Music*, 34(3), 292–306. <https://doi.org/10.1177/0305735606064838>
- Marsh, E. J., & Rajaram, S. (2019). The digital expansion of the mind: Implications of internet usage for memory and cognition. *Journal of Applied Research in Memory and Cognition*, 8(1), 1–14. <https://doi.org/10.1016/j.jarmac.2018.11.001>
- Mazur, Z., & Laguna, M. (2019). The role of affect in practicing a musical instrument: A systematic review of the literature. *Psychology of Music*, 47(6), 848–863. <https://doi.org/10.1177/0305735619861831>

- McPherson, M. J., Barrett, F. S., Lopez-Gonzalez, M., Jiradejvong, P., & Limb, C. J. (2016). Emotional intent modulates the neural substrates of creativity: An fMRI study of emotionally targeted improvisation in jazz musicians. *Scientific Reports*, 6, 18460. <https://doi.org/10.1038/srep18460>
- McPherson, G. E., Blackwell, J., & Hattie, J. (2022). Feedback in music performance teaching. *Frontiers in Psychology*, 13, 891025. <https://doi.org/10.3389/fpsyg.2022.891025>
- Pecen, E., Collins, D. J., & MacNamara, Á. (2018). “It’s Your Problem. Deal with It.” Performers’ Experiences of Psychological Challenges in Music. *Frontiers in Psychology*, 8, 2374. <https://doi.org/10.3389/fpsyg.2017.02374>
- Pinho, A. L., de Manzano, O., Fransson, P., Eriksson, H., & Ullen, F. (2014). Connecting to create: Expertise in musical improvisation is associated with increased functional connectivity between premotor and prefrontal areas. *Journal of Neuroscience*, 34, 6156–6163. <https://doi.org/10.1523/jneurosci.4769-13.2014>
- Ruth, N., Spangardt, B., & Schramm, H. (2016). Alternative music playlists on the radio: Flow experience and appraisal during the reception of music radio programs. *Musicae Scientiae*, 21, 75–97. <https://doi.org/10.1177/1029864916642623>
- Sawyer, K. (2015). Group flow and group genius. *NAMTA Journal*, 40(3), 29–52.
- Schlinger, M. (2006). Feldenkrais method, Alexander technique, and yoga – body awareness therapy in the performing arts. *Physical Medicine and Rehabilitation Clinics of North America*, 17, 865–875. <https://doi.org/10.1016/j.pmr.2006.07.002>
- Schiavio, A., Biasutti, M., van der Schyff, D., & Parncutt, R. (2020). A matter of presence: A qualitative study on teaching individual and collective music classes. *Musicae Scientiae*, 24(3), 356–376. <https://doi.org/10.1177/1029864918808833>
- Schiavio, A., van der Schyff, D., Biasutti, M., Moran, N., & Parncutt, R. (2019). Instrumental technique, expressivity, and communication: A qualitative study on learning music in individual and collective settings. *Frontiers in Psychology*, 10, 737. <https://doi.org/10.3389/fpsyg.2019.00737>
- Sinnett, S., Jäger, J., Singer, S., & Antonini Philippe, R. (2020). Flow states and associated changes in spatial and temporal processing. *Frontiers in Psychology*, 11, 381. <https://doi.org/10.3389/fpsyg.2020.00381>
- Spahn, C., Krampe, F., & Nusseck, M. (2021). Live music performance: The relationship between flow and music performance anxiety. *Frontiers in Psychology*, 12, 725569. <https://doi.org/10.3389/fpsyg.2021.725569>
- Tan, L., & Sin, H. X. (2019). Flow research in music contexts: A systematic literature review. *Musicae Scientiae*, 25(4), 399–428. <https://doi.org/10.1177/1029864919877564>
- Tang, Y. Y., & Bruya, B. (2017). Mechanisms of mind-body interaction and optimal performance. *Frontiers in Psychology*, 8, 647. <https://doi.org/10.3389/fpsyg.2017.00647>

- Ward, A. F., Duke, K., Gneezy, A., & Bos, M. W. (2017). Brain drain: The mere presence of one's own smartphone reduces available cognitive capacity. *Journal of the Association for Consumer Research*, 2(2), 140–154. <http://dx.doi.org/10.1086/691462>
- Williamon, A. (Ed.). (2004). *Musical excellence: Strategies and techniques to enhance performance*. Oxford University Press.
- Wilmer, H. H., Sherman, L. E., & Chein, J. M. (2017). Smartphones and cognition: A review of research exploring the links between mobile technology habits and cognitive functioning. *Frontiers in Psychology*, 8, 605. <https://doi.org/10.3389/fpsyg.2017.00605>
- Witek, M. A., Clarke, E. F., Wallentin, M., Kringelbach, M. L., & Vuust, P. (2014). Syncopation, body-movement and pleasure in groove music. *PLoS One*, 9(4), e94446. <https://doi.org/10.1371/journal.pone.0094446>
- Wrigley, W. J., & Emmerson, S. B. (2013). The experience of the flow state in live music performance. *Psychology of Music*, 41(3), 292–305. <https://doi.org/10.1177/0305735611425903>
- Zhang, X., Shan, G., Wang, Y., Wan, B., & Li, H. (2019). Wearables, biomechanical feedback, and human motor-skills' learning & optimization. *Applied Sciences*, 9(2), 226. <https://doi.org/10.3390/app9020226>
- Zhao, X., Hu, T., Qiao, G., Li, C., Wu, M., Yang, F., & Zhou, J. (2022). Psychometric properties of the smartphone distraction scale in Chinese college students: Validity, reliability and influencing factors. *Frontiers in Psychiatry*, 13, 859640. <https://doi.org/10.3389/fpsyg.2022.859640>

Received: December 27, 2022

