

Psycho-sensorial categories: Actions and behaviors of piano practice at different levels of expertise

Michele Rosita Mantovani
(Federal University of Rio Grande do Sul – UFRGS, Porto Alegre-RS, Brasil)

Regina Antunes Teixeira dos Santos
(Federal University of Rio Grande do Sul – UFRGS, Porto Alegre-RS, Brasil)

Abstract: In the current literature, instrumental practice dealing with elementary levels of expertise tends to be underestimated compared to that of professional musicians. Therefore, the purpose of the present research was to investigate actions and behaviors in piano practice carried out by pianists belonging of different levels of expertise. In a case-study approach guided by phenomenological principles, four participants were selected according to their potential representativeness at different levels of expertise, their received formal piano instruction, and accumulated practice time. The participants were asked to record one practice session of two piano pieces from their current repertoire. They were instructed to select one piece that they considered more challenging (piece 1) and another piece that they considered less challenging (piece 2). Semi-structured interviews provided information about their strategies. Nine categories were proposed as characteristic actions and behaviors of piano practice within the scope of the classical Western music tradition, namely, testing, repeating, isolating, alternating, exploring, adjusting, pausing, straggling, and slipping. Such categories proved to be common for all participants, exemplified by the practices of four participants (precollege, undergraduate, graduate students and professional pianists), and provided evidence of the nuances of deliberation, such as the procedures to approach and improve the repertoire (and their effectiveness), the effort to stay engaged and on task, and some of the limits in attention to practice.

Keywords: Instrumental practice. Piano. Expertise. Deliberate practice.

Categorias Psicossensoriais: ações e comportamentos inerentes à prática pianística em diferentes níveis de expertise

Resumo: Na literatura, a prática instrumental relacionada aos níveis elementares de expertise tende a ser subestimada quando comparada à prática de músicos profissionais. O objetivo da presente pesquisa foi categorizar ações e comportamentos inerentes à prática pianística de pianistas em diferentes níveis de expertise. Numa abordagem de estudo de caso, orientada por princípios fenomenológicos, quatro participantes foram selecionados de acordo com suas potenciais representatividades de níveis distintos de expertise, instrução formal ao piano recebida e tempo de prática acumulada. Foi solicitado aos participantes que gravassem uma sessão de prática de duas peças de seus repertórios atuais. Os participantes foram instruídos a selecionar uma peça que eles considerassem mais desafiadora (peça 1) e outra que eles considerassem menos desafiadora (peça 2). Entrevistas semiestruturadas forneceram informações sobre as estratégias utilizadas pelos participantes. Nove categorias foram propostas como tipologias das ações e comportamentos da prática pianística no âmbito da tradição da música de concerto ocidental, a saber: testar, repetir, isolar, alternar, explorar, ajustar, parar, dispersão e lapso. Tais categorias mostraram-se comuns para todos os participantes, aqui exemplificadas na prática de quatro participantes (extensão universitária, graduação, pós-graduação, e pianista profissional), evidenciando nuances de deliberação como: procedimentos para abordar e aprimorar o repertório (e a eficácia destes), o esforço para manter-se engajado na tarefa, bem como alguns limites da atenção para praticar.

Palavras-chave: Prática instrumental. Piano. Expertise. Prática deliberada.

Instrumental practice has been described as a series of multifaceted behaviors that comprise practice (systematic training) to learn or to acquire proficiency and expertise on the instrument (LEHMANN et al., 2007a: 61). It has also been described as a deliberative study to develop musical interpretation or to prepare for performance (ERICSSON et al., 1993: 368), a systematic activity to acquire technical skills (BARRY; HALLAM, 2002: 151), a time-demanding repetitive (or even monotonous) activity to learn new repertoire or to memorize a piece (WISE et al., 2017: 143), metacognitive strategies (planning monitoring and evaluation of learning) to reduce mindless repetition (JØRGENSEN; HALLAM, 2016: 456), and creative processes focusing on increasing strategies to improve fluency and increasing the liability of personal choices and production (WISE et al., 2017: 143-164), among other definitions.

From a psychological point of view, instrumental practice can be seen as the transition from a controlled cognitive process to an automatic one, in which musical information is processed in growing extension and complexity chunks to perform the task more easily. It allows complex physical and cognitive activities to be performed with little conscious attention, thus releasing cognitive processing capacity for other aspects, such as the communication of interpretation (ANDERSON, 1983: 34. BARGH, 2000: 357. BARRY; HALLAM, 2002: 155). The effects of practice on automatization show a negatively accelerated curve in which early practice effects are more substantial than those seen moments later as practice progresses (STERNBERG; STERNBERG, 2012: 173). During this process, complex physical (i.e., the physiological response to the body, such as neuroplasticity) and mental adaptations (such as mental representations in terms of musical patterns retained in memory) may occur, acting as anticipatory mechanisms for the quick recognition and assimilation of new patterns during learning (LEHMANN et al., 2007a: 67). Such learning processes may lead to long-term skill acquisition, which in turn contributes to expertise development.

A milestone in research on instrumental practice and expertise is the work of Gruson (2000: 91-112), a scholar who examined the rehearsal behaviors and practice strategies of 40 piano students and 3 professional pianists in terms of changes in musical expertise over time across the practice sessions. Errors, repetition, and pauses decreased, while self-guiding speech, playing with each hand separately, repetition of sections, and practice time increased, as the level of expertise also increased. According to Lehmann et al. (2007b: 98), people at elementary levels of expertise tend to learn the notes first and only later add some interpretive intention, whereas experts create their interpretive intentions from the early moments of their practice. Hallam (1997: 89-107) found that experts acquire an overview of the music, practice the music according to its structure, develop performance plans (according to musical and technical considerations), and employ cognitive analysis strategies, while novice musicians try to play notes correctly with continuous repetition of the entire piece and a lack of awareness of their errors. This expert holistic approach has also been discussed by Oller et al. (2009: 331) in the practice of flute players. Hastings (2011: 369-374) compared 175 pianists at different levels of expertise on their interpretation of musical notation of the 17th–19th centuries and found that “experts practice technical passages with a musical purpose in mind, while students focus on playing the notes correctly and lack a musical goal to their practice” (HASTINGS, 2011: 371). In the context of error management, Kruse-Weber and Parncutt (2014: 1-14) concluded that novice musicians tend to ignore errors frequently, while experts tend to set creative goals and explore different

techniques and musical parameters to solve errors quickly, with less effort. In another study, Hallam et al. (2019: 745-765) associated the use of ineffective strategies with more elementary levels of expertise, while more systematic strategies (such as repeating complex sections, gradually increasing tempo, and studying short excerpts) were related to higher levels of expertise, as well as to increased practice time and the use of recordings and a metronome.

In the context of instrumental practice, the concept of deliberate practice, a term coined by Ericsson et al. (1993: 363-406), is defined as a highly structured activity that aims at improving performance. Specific tasks are designed to overcome weaknesses and to monitor performance carefully. This concept has been recently employed in the description of the practice of professional musicians (e.g., HAMBRICK et al., 2020: 1-21. KEGELAERS; OUDEJANS, 2020: 1-13. SONG; KIM, 2020: 260-269). As demonstrated by these studies, practice among those with elementary and intermediate levels of expertise tends to be constantly underestimated due to comparisons with professional instrumentalists, whose deliberate practice has been more widely explored. On the other hand, the trend of listing and describing actions and behaviors (e.g., GRUSON, 2000: 91-112. HALLAM, 1997: 89-107. HALLAM et al., 2012: 652-680) could be systematized in terms of nature and finality, as well as by nuances of deliberation. Thus, the following questions have driven the present research: Which behaviors are recurrent during practice sessions, independent of the level of expertise? Which purposes are implicit in certain behaviors? Do such behaviors provide cues of deliberation? Based on these questions, the objective of the present research was to categorize actions and behaviors associated with piano practice among pianists within different levels of expertise.

1. Method

To investigate piano practice under environmental conditions, neither requiring the participants to perform any new musical piece nor engage in practice conditions that would be different from what is usually employed, phenomenological principles were used to guide the methodological design. According to Giorgi and Giorgi (2008: 27-28), phenomenology avoids interventionist procedures of data collection to observe and describe the phenomenon as it manifests itself. Phenomenon is conceived as an experience resulting from the interaction between the subject and the object (CLIFTON, 1983: 9-10); thus, piano practice can be seen as a phenomenon since it is an experience (in cognitive, visual, auditory and motor ways) of the participants (subjects) with musical works (objects).

From a total of 18 participants that were previously assessed, four cases were selected, considering their engagement in the research and their potential representativeness of different levels of expertise, the formal piano instruction they had received, and their accumulated practice during their lifetime. Four participants were labeled **PC**, **UG**, **GR**, and **PR**, representing a piano student from a precollege (**PC**), undergraduate (**UG**), or graduate (**GR**) music course. **PR** is a professional pianist/professor. The participants were asked to record one practice session of two piano pieces from their current repertoire. They were instructed to select one piece that they considered more challenging (piece 1) and another one considered less challenging (piece 2) to check if there were differences between the participants' ways of approaching

these pieces. To minimize interventions, a digital video camera Sony© (HDR-CX560) was provided so that the participants could record themselves, avoiding inhibition with the presence of an outside observer. Some of them preferred recording from their homes and with their own devices, while others preferred recording at the university where they are students. They also had the flexibility to record their practice sessions as many times they wanted and to choose which one they considered to be representative of their usual practice. Semi-structured interviews provided information about their strategies. Table 1 describes the participants' profile, the two chosen piano pieces, and the practice time recorded during data collection.

	PC (precollege)	UG (undergraduate)	GR (graduate)	PR - professional	
	(3 rd semester)	(4 th semester)	(2 nd semester/doctorate)	(PhD)	
Profile	Age/gender	16 years/M	26 years/M	25 years/F	54 years/M
	Formal instruction on piano	1.5 years	8 years	18 years	41 years
	Musical work/composer	<i>Sonata</i> KV545 – <i>Allegro</i> (W. A. Mozart, 1756–1791)	<i>Sonata</i> KV310 – <i>Allegro maestoso</i> (W. A. Mozart, 1756–1791)	<i>Pour le piano – Prélude</i> (C. Debussy, 1862–1918)	<i>Prelude</i> Op. 23 n. 1 (S. Rachmaninoff, 1873–1943)
Piece 1	Time of practice (min)	19 min 06 s	22 min 47 s	32 min 54 s	33 min 05 s
	Musical work/composer	<i>Consolation</i> S.172 (F. Liszt, 1811–1886)	<i>Balade</i> op.10 No.3 (J. Brahms, 1833–1987)	<i>Impromptu</i> Op.90 No.1 (F. Schubert, 1797–1828)	<i>Sonata in b minor</i> S.178 (F. Liszt, 1811–1886)
Piece 2	Time of practice	27 min 00 s	29 min 56 s	29 min 24 s	18 min 01 s

Tab. 1: Participants' profiles and descriptions of the recorded musical works

Data were analyzed according to the phenomenological approach by Giorgi and Giorgi (2008: 34-46) in four steps. The first step was a whole data description, which occurred through a transcription of the interviews and practice sessions in terms of the events that occurred. The second step was the organization of units of meaning, or the segmentation of the descriptions into units according to the research purpose, here called units of practice (labeled A, B, C, etc.). In this research, the segmentation occurred according to the focus of attention shown by the participant(s) in their interaction with the musical work(s) during practice; the actions taken during practice; their organization in terms of the selection of excerpts to study; time spent; strategies adopted; and recurrent behaviors and actions. The third step refers to units of meaning connection, which means the links between units are established and are then articulated to extract the objectivity of the implicit phenomenon (the essence). These essences were found in the categorization and synthesis of common and/or similar aspects seen in the practice routines of the four cases. Thus, for each category, the number of events were tabulated, organized, and analyzed in terms of descriptive statistics with OriginLab® 8.5 software¹. Such descriptions of practice situations provided evidence for segmenting them into units of pursued thoughts, whether or not these thoughts were intentional. The fourth and final step was the description of the phenomenon and its essences, which materialized in the discussion of the results of this research. To illustrate how these categories interact with different levels of expertise and providing cues of deliberation, the results of four cases are discussed in detail below.

The design involved volunteers who were reporting and recording their regular instrumental practice (ecological conditions), and they chose the data provided for analysis. To acquire consent from participants, the interview transcripts were given back to the participants for approval.

2. Results and discussion

The first approach to describe the data were detailing the participants' focus of attention extracted from their practice: Where did they start or stop? Which bars were repeated more? The left side of Figure 1 shows the piano practice profiles of the four participants (exemplified here only for piece 1) in terms of where they started and stopped relative to each piece as a whole.

Figure 1 shows that the time of the session and the total incidence increased with expertise, probably as a gain of resistance to practicing. Common patterns among the participants were noted, such as an approach to practice that was directed from the beginning of the piece toward the end, as well as the emphasis of certain fragments through the action of repeating. The participants used repetition for different reasons, but they aimed to retain, in some way, what they were practicing, regardless of the result they achieved.

¹ <https://www.originlab.com/>

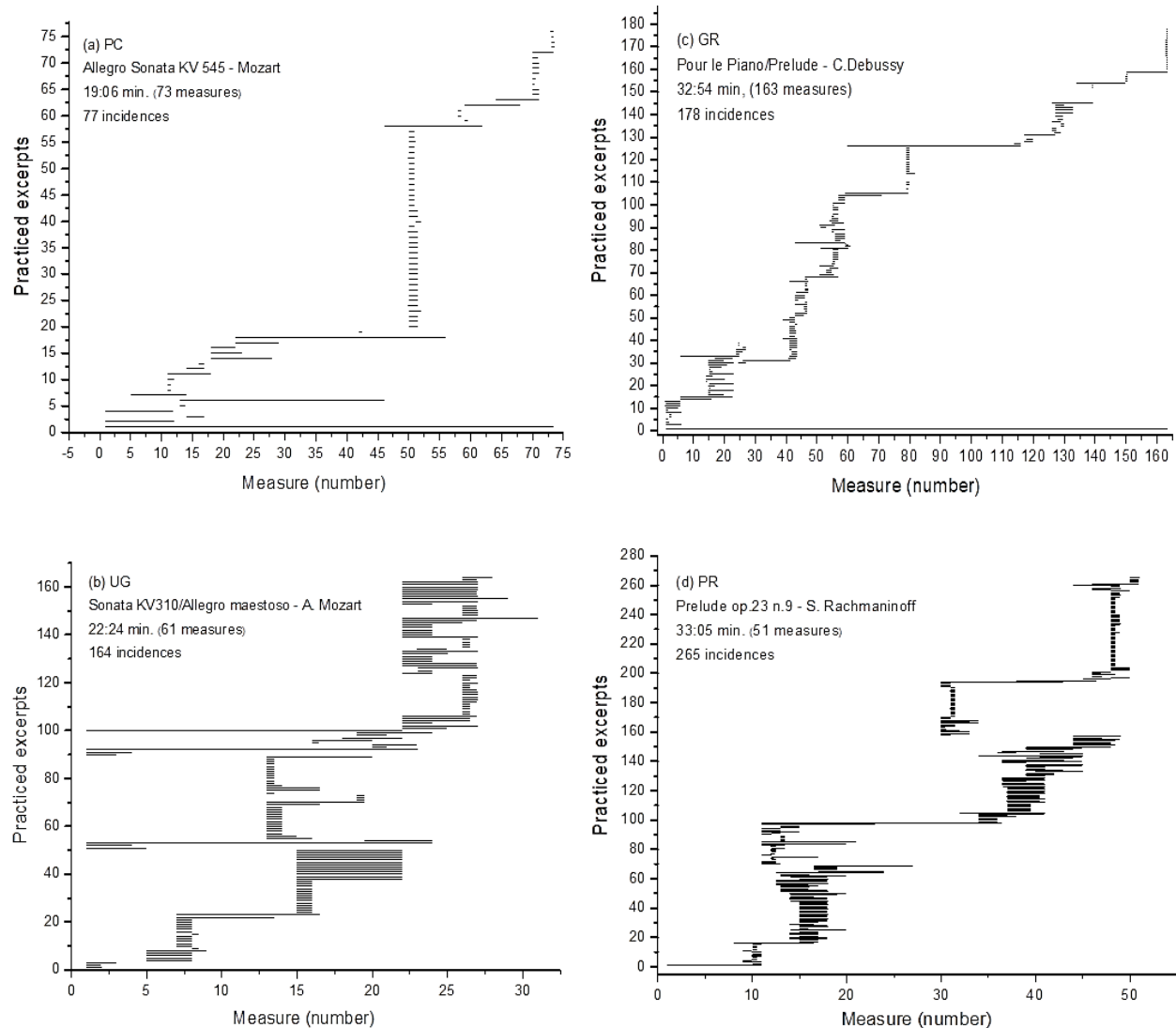


Fig. 1: Details of the excerpts of piece 1 for (a) **PC**, (b) **UG**, (c) **GR**, and (d) **PR**. The x-axis indicates the number of studied measures, and the y-axis indicates the number of segments (or sections) on which the participant specifically focused.

PC (Figure 1a) pointed out, “When I make a mistake, I feel a wish to go back to it [in that part] and keep on playing, playing, playing until I get it right.” Such a testimony exemplifies a kind of error management that has been described in the literature (KRUSE-WEBER; PARNCUTT, 2014: 1-14). A latent purpose was also observed when examining his practice video: his focus seemed to be on achieving an effective fingering for mm. 50–51 possibly to correct potential errors, since he repeated these measures approximately 35 times in 4 min 31 s (almost 25% of his practice session). According to the video observation, participant **UG** seemed to emphasize the upper voice of the chords he played with his left hand in mm. 13–14 (Figure 1b) by first practicing it separately and without a pedal, more slowly, or at a faster tempo, and then with both hands at the final tempo. For **GR** (Figure 1c), the repetitions of mm. 41–43 seemed to achieve accuracy of the sixteenth notes in terms of synchrony between the hands, outlining the

dynamics and accents, as well as conducting an upbeat musical gesture. These aspects seemed better outlined during her practice with the combinations of both hands/separated hands, without pedal, and a gradual increase in tempo, as well as when practicing the upper voice of the right hand separately. In the **PR** practice recording (Figure 1d), repetitions of mm. 14–17 and the surrounding sections were apparently carried out to adjust notes and to outline the voices of the right hand and the phrasing, dynamics, and articulations of the lines of both hands (together or separately), as these aspects were improved in the practice between combinations of tempo changes, without a pedal, and the constant use of rhythmic variations, articulation, and dynamics between the voices, including small breaths/cuts to emphasize the indicated phrasing and constant experimentation of physical gestures for the performance (arm, wrist, and elbow).

These kinds of repetitions also suggested that participants were at different levels of expertise. The following are those discussed by Dreyfus and Dreyfus (1981: 1-56) and Lester (2005: 1-3): **PC** showed characteristics of an advanced beginner, namely, a limited overall understanding of the situation and attention to detail, the ability to treat most aspects of a context separately, a lack of autonomy, and the need for supervision to handle the task, as seen by the fact that he repeated only two measures in a long period, trying to improve them (Figure 1a); participant **UG** demonstrated competency due to his increased autonomy and in the ways he handled some musical aspects separately; **GR** exhibited proficiency in terms of autonomy and confidence in decision-making and paid attention to significant aspects of the musical works, such as the expressive sections when she highlighted dynamics, accents, and musical gestures; finally, **PR** showed expert characteristics, namely, knowledge, autonomy, and responsibility over his practice; a holistic understanding of complex situations that were handled analytically; and the use of problem solving on musical performance as demonstrated through different approaches, such as rhythmic variations, articulations, and dynamics between the voices and physical gestures.

The study found that the repetitions of a given section or fragment were not always literal because the purposes were distinct, for example, insisting on a given excerpt when playing it with separate hands or at a slower or faster tempo and then repeating the action to perform the entire excerpt (now a literal repetition with both hands). These actions are common and even usual in practice situations within the Western classical music tradition (e.g., GRUSON, 2000: 91-112. HALLAM, 1997: 89-107. HALLAM et al., 2012: 652-680) and allow two ways of practicing, here called “isolating” and “alternating”. The isolating category emerged whenever the participant deliberately removed some factor to apprehend the specific musical element/information from the studied excerpt. It is defined as the action of subtraction of a musical element from the performance to bring focused attention to the particular aspect(s) carried out separately in order to simplify the passage under study. For instance, like playing with hands separately, studying without pedal, or combining a reduced number of voices. The alternating category involves the deliberate variation of any musical element, for example, tempo, articulation, and rhythmic pattern, so that it is different from the information noted on the score; the outcome is modified sound and production modes. According to Saville (2011: 72), in the context of teaching strategies, this procedure is called disguised repetition because

“strategies involve the manipulation or alteration of content during the repetition exercise in order to simplify or clarify performance issues.”

Based on the recorded practice situations, the specific need to make changes in the sound results to improve the performance (the “adjusting” category) was also observed. The participants undertook this task to correct a wrong note, fingering or even to emphasize something that they had done correctly, such as highlighting dynamics or an articulation. In these observed situations, adjusting seemed to be the goal, while the practice’s recurring procedures (i.e., repeating, isolating, and alternating) seemed to be the means.

At certain times during the practice, however, the participants presented a different intention when they played the piece from beginning to end or a particular section without interruption, even if they made an error during the execution. This usually occurred before establishing a given focus or after having insisted on or studied the established focus (i.e., a kind of simulation of a performance to test the execution in continuous flow). These procedures are labeled “testing”, which refers to the execution of a given segment of the piece (or work/movement in full) for a single uninterrupted time as a kind of performance rehearsal to verify the result. Testing functions as a kind of supervision of the practice to mark what they had studied and/or what they intended to study.

There were other subtle actions in practice. The participants sometimes practiced a musical element without varying its identity, as noted on the score. This category was labelled “exploring”. Examples of such actions include (i) seeking a gestural movement that might solve a technical difficulty; (ii) trying alternative ways to render the execution easier, such as distributing notes written for one hand to be played between both hands; or (iii) selecting touches to refine the sound after having experienced different types of touch. Exploring took multiple forms in approaching a given aspect in order to refine the sound quality and/or modes of production without necessarily altering the musical information noted on the score. Out of the categories mentioned thus far, exploring was the most complex to define perhaps because it is more subtle to perceive in practice.

Except for the adjusting category, all categories discussed, thus far, were related to the action of “repeating”, either literally or differently. In this sense, these categories were also interconnected because they presented the same procedural nature that was involved in learned actions related to how the participant approached a given piece during musical practice (“How to do it?” or “How to practice?”). Thus, it was realized that “repeating” could be presented in its bare form as repeating the passage literally, as written on the score, as well as in combination with other categories, such as playing only with the left hand (isolating), making a rhythmic variation (alternating), and experiencing a given type of touch (exploring). Therefore, “repeating” was restricted to just the practice of an excerpt, an action associated with the insistent reproduction (literal or diversified) of a given segment that may be a motive, a measure, a phrase, or a section.

All categories discussed thus far are guided by deliberate actions and decisions made by the participants. However, other involuntary actions were also observed, such as misplayed notes, bumping, and fluency loss during performance, demonstrating a kind of “stuttering”, in the metaphorical sense, when

playing something correctly then instantly playing it again. Such undesirable events are known as “slipping”, an action defined as a failure of attention during practice that occurred as an accident at random and/or without the participant’s awareness, causing a return to conscious action. This is similar to “actions slip”, a term employed by Christensen et al. (2016: 10) that is defined as “actions in which not enough attention is given to the task at hand in which the individual performs the wrong action.” In the present research, it was assumed that even if slipping was something unexpected, the participant’s attention, albeit seemingly fragile, would still be focused on practicing.

Another action observed in practice was “stragglings”. This apparent loss of focus and/or dispersion of attention sometimes seemed to be driven by external factors. Stragglings were observed in situations when the participant looked at a cell phone or played random things unrelated to the piece at hand, resulting in a loss of practice quality, such as when notes or dynamics were ignored without the participant realizing it. It is worth noting that such behaviors did not fit in the same parameters of slipping because the attention was dispersed from the study. Thus, stragglings were defined as distractions with external factors during practice or a loss of focus of attention that led to significant changes in the sound results. In the literature, distraction has also been reported and evaluated using self-reporting measures (MADSEN; GERINGER, 1981: 46-52). Finally, there were situations in which the participants stopped playing, either due to something that interrupted their practice, or because the participant was tired and stopped for stretching or writing down something on the score. Hence, the “pausing” category was considered to represent voluntary and involuntary interruptions, either related or unrelated to the practice, during the session.

Table 2 shows a systematized list of the so-called psycho-sensorial categories (testing, repeating, isolating, alternating, exploring, adjusting, pausing, stragglings, and slipping). It is worth noting that the term “psycho-sensorial categories” denotes features of the functional condition of the learning process (TSYHANOVSKA et al., 2017: 91-94), here indicating approaches learned during practice that encompass behaviors, decision-making procedures or even limits and deviations of attention. These categories are propositions in terms of the actions and behaviors of piano practice within the Western classical music context.

Psycho-sensorial categories were illustrated in terms of the number of times they occurred for each practice unit (A, B, C, etc.) of each session and how they presented themselves at the participants’ different levels of expertise: the behaviors and actions common among the participants, the differences in deliberation cues provided by category arrangement in each session of practice seen in terms of recurrent procedures (and their effectiveness), levels of attention, and effort. The data from the four cases are discussed in Table 2.

Psycho-sensorial category	Description	Comments/examples
<i>Repeating</i>	Insistence by reproduction (literal or diversified) of a given segment	"repeating" a motive, a measure, a phrase, a section, etc.
<i>Isolating</i>	Subtraction of any musical element from the performance to focus the attention on the aspect(s) carried out separately, in order to simplify the passage under study	Playing it with separate hands, without pedal, a reduced number of voices from the total;
<i>Alternating</i>	Variation of any musical element differently from that information noted on the score, modifying the resulting sound and the production modes	Varying tempo (slow, gradual increase, to fast), articulation (playing staccato where legato is noted, or vice-versa), different rhythmic patterns, dynamics (playing <i>forte</i> where <i>piano</i> is noted, or vice-versa);
<i>Exploring</i>	One or more way(s) of approaching a given aspect in order to refine the sound quality and/or modes of production without necessarily <i>alternating</i> the musical information noted on the score	Seeking for gestural movement which might solve a technical difficulty; trying alternative ways to render the execution easier; selecting touches to use for refining the sound after having experienced different types of touch;
<i>Testing</i>	Execution of a given segment of the piece for a single uninterrupted time as a form of performance rehearsal to verify the result, functioning as a form of practice supervision to observe/register what they have studied and/or what they intended to study	Playing the piece/movement/section from beginning to end without interruption to test execution in a continuous flow; it may occur before establishing a given focus, or after having insisted on/studied the established focus;
<i>Adjusting</i>	Specific need to seek changes in the sound results in order to improve the performance	Correcting a wrongly played note, a fingering; emphasizing something that was already done correctly, such as highlighting dynamics or articulations;
<i>Slipping</i>	Failure of attention during practice that occurred as an accident that happened at random and/or unconsciously that allows a return to conscious action	Playing wrong notes, bumping, fluency loss during performance, playing something correctly and instantly playing it again (like stuttering, in the metaphorical sense);
<i>Stragglng</i>	Distractions with external factors during practice, or loss of focus of attention that resulted in significant changes in the sound results	Checking their cell phone, playing random things differently from those of the studied piece, losing the quality of practice when notes or dynamics are ignored (without noticing it);
<i>Pausing</i>	Voluntary and involuntary interruptions during the study, whether related to practice or not	Pausing to stretch, to rest, to write on the score, or do something that interrupted the study;

Tab. 2: Psycho-sensorial categories observed during practice

2.1 PC's practice

Figure 2 presents the number of times each psycho-sensorial category was observed at each unit of practice (A, B, C, etc.), while PC practiced the more challenging (Figure 2a) and less challenging (Figure 2b) pieces; the charts detail the participant's focus of attention at each unit and the time invested in it.

Based on Figure 2, some general features were noted: (i) PC spent more time practicing the less challenging piece (piece 2); (ii) there was a broad distribution among the psycho-sensorial categories, mostly characterized by repeating, isolating, and slipping; and (iii) there was one section (in each piece) characterized by many actions (here labeled as unit of more effort [UME]): unit D for piece 1 and unit C for piece 2. These results suggest that in the more challenging piece, PC needed to isolate a few parts (sometimes working on the left or right hand) to direct his focus of attention to manage one specific part of the piece. It is speculated that isolating may help him better understand the selected excerpt.

An analysis of PC's actions during his practice (Figure 2) indicates that the most rudimentary procedure (perhaps the first learned and/or often used in piano practice) was the combination of "repeating" plus "isolating". This occurred, to a similar extent, throughout the study of piece 1 (except in D, whose higher number of isolating events is justified by the concomitant practice of hands separately and without pedal) and in three units (A, D, and F) of piece 2. This procedure consisted of repeating sections that eventually address the structural boundaries of the works and isolating by studying with separate hands and/or without a pedal. The frequent use of these two categories ("repeating" and "isolating") indicates that there is minimal systematization regarding how to study the practice of more elementary levels of expertise, perhaps functioning as cues of incipient deliberation.

Slipping occurred more often than adjusting throughout piece 1 (A–F) and in an opposite manner in three units of piece 2 (C, D, and F). These findings suggest that PC was more successful in the less challenging piece. In both pieces (Figure 2), "alternating" occurred with tempo variations (slow/rushing/fast) in units C, D, and F in piece 1 and A, C, D, E, and F in piece 2 and was combined with consistently and irregularly distributed "repeating" plus "isolating" (in terms of the number of occurrences). There seemed to be an emerging and developing procedure when considering these three categories together: "repeating" plus "isolating" (near) plus "alternating" (less); however, it was not as regular as the previous procedure because alternating was only occasionally employed.

It is worth noting that PC achieved expressivity by "exploring": in A (piece 2), PC explored the legato articulation by means of a *ppp* dynamic for the left hand (mm. 1–31); in C and D, he explored *sumindo* (mm. 51–54) and the *ritardando* and *perdendosi* (mm. 59–61), respectively, varying the timing and dynamics. In E, he also manipulated timing, making it more flexible and sometimes more regular, accelerating it in the figures noted in parentheses in his score, and exaggerating the decrease in tempo in the last sixteenth notes to execute the *smorzando* (m. 56). Although exploring happened sporadically, its expressive purpose observed here (piece 2) by adjustments of notes, timing, and dynamics is different from that of Hallam (1997: 89-107. 2006: 118-141) and Hastings (2011: 369-374). These authors reported that elementary-level musicians practice with the aim to play notes correctly, neglecting the expressive aspects and correction of errors of the studied works.

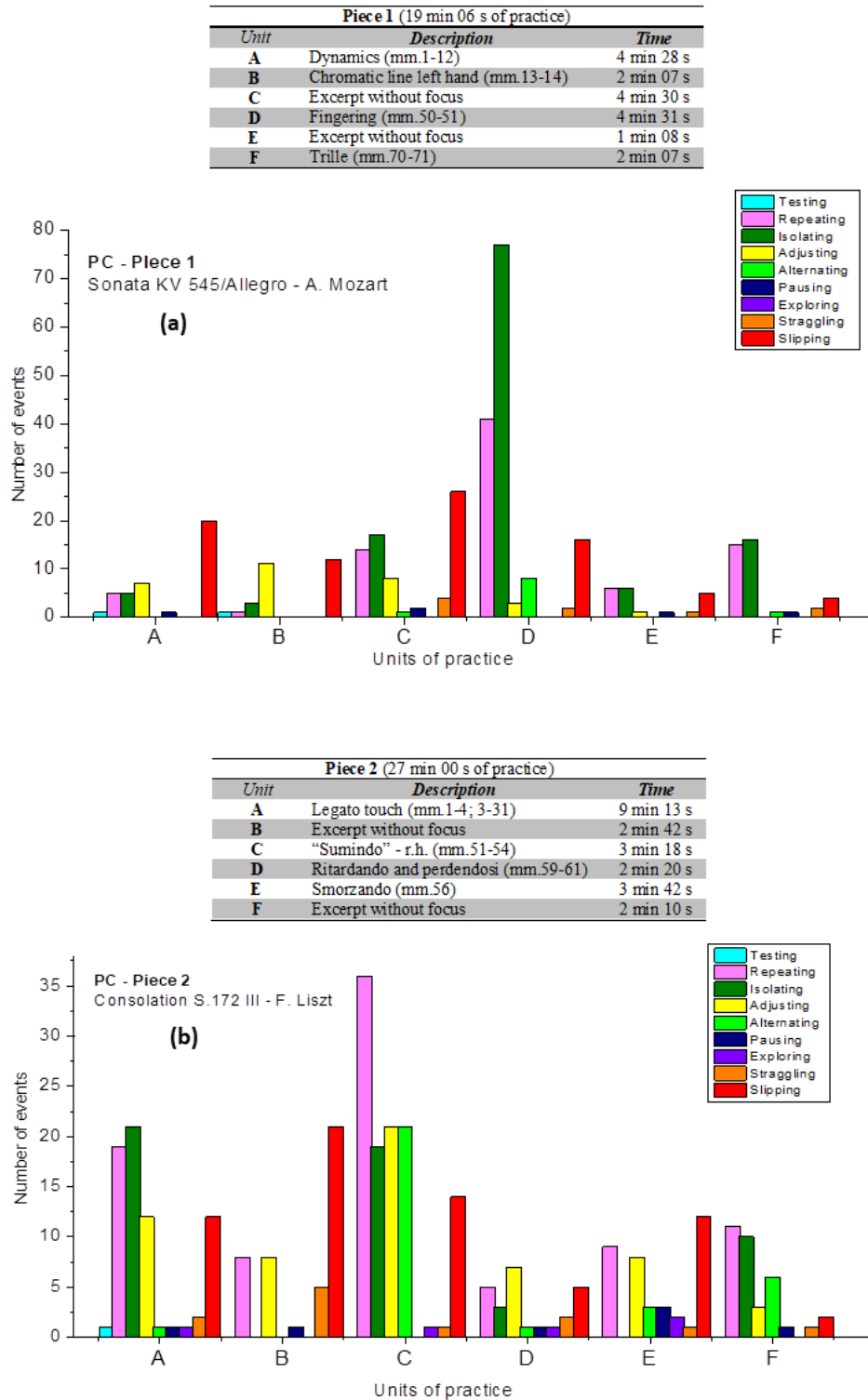


Fig. 2: The number of times each psycho-sensorial category occurred in PC practice: (a) piece 1 – *Sonata* K545/Allegro (A. Mozart) and (b) piece 2 – *Consolation* S.172 III (F. Liszt)

In **PC** practice, testing was the first action carried out on both pieces by the complete execution of the movement (piece 1, A) or musical work (piece 2, A) to check the memorization level and/or select excerpts to be studied, as well as to reintegrate two measures (piece 1, B: mm. 13–14) previously studied separately in a larger section (mm. 13–47). Although this occurred minimally, this category seemed to contribute to the maintenance of **PC**'s attention during the practice of piece 1 because there were no straggling events in the units where it was present (Figure 2). The nature of testing seems to be different from that found for repeating, isolating, alternating, and exploring, all of which bear a more learned action feature, while testing seems to be closer to a kind of supervisory knowledge (CUTIETTA; STAUFFER, 2005: 129).

Another aspect to consider is the limits of attention. According to Sternberg and Sternberg (2012: 137), attention is the means through which a limited amount of information is actively and selectively processed from the amount of information available through the senses, memory, and other cognitive processes. This state of being attentive is not continuous. In the present research, some events deviated and/or redirected **PC**'s attention away from the practice to others, such as pausing and straggling (possibly slipping). Pausing may arise as a response to a perception of difficulty related to the tasks, which may affect the allocation of attention (O'SHEA; MORAN, 2019: 376). In Figure 2, piece 2, **PC** stopped playing with a certain frequency to perform actions related to study, such as organizing and taking notes on the score, or because he was being distracted while playing random parts not related to the musical piece under study. Other diversions included playing too many notes or omitting them without realizing he had done so (straggling). This information suggests that **PC** attention was unstable throughout (piece 2) or during almost the entire session of practice (piece 1). In addition, during qualitative descriptions in practice units (detailed in Fig. 2), there were observed examples with no defined focus of attention in piece 1 (C and E) and piece 2 (B and F), corresponding to 28% and 17% of the total practice time, respectively. It is also worth noting that a minimal increase in straggling incidences (piece 1, C; piece 2, B) occurred in units when **PC** played excerpts without focus, that is, excerpts where his study goals were not clearly demonstrated during the practice video or verbalized during the interview. This suggests that a lack of focus increases the instability of attention during practice, findings that corroborate the results reported by Hallam (1997: 89-107. 2006: 118-141) and Kruse-Weber and Parncutt (2013: 27) regarding the unawareness of errors among those with more elementary levels of expertise.

2.2 UG's practice

Figure 3 presents the number of times each psycho-sensorial category was observed at each unit of practice while the **UG** practiced the more challenging (Figure 3a) and less challenging (Figure 3b) pieces; the charts detail the participant's focus of attention at each unit and the time invested in it.

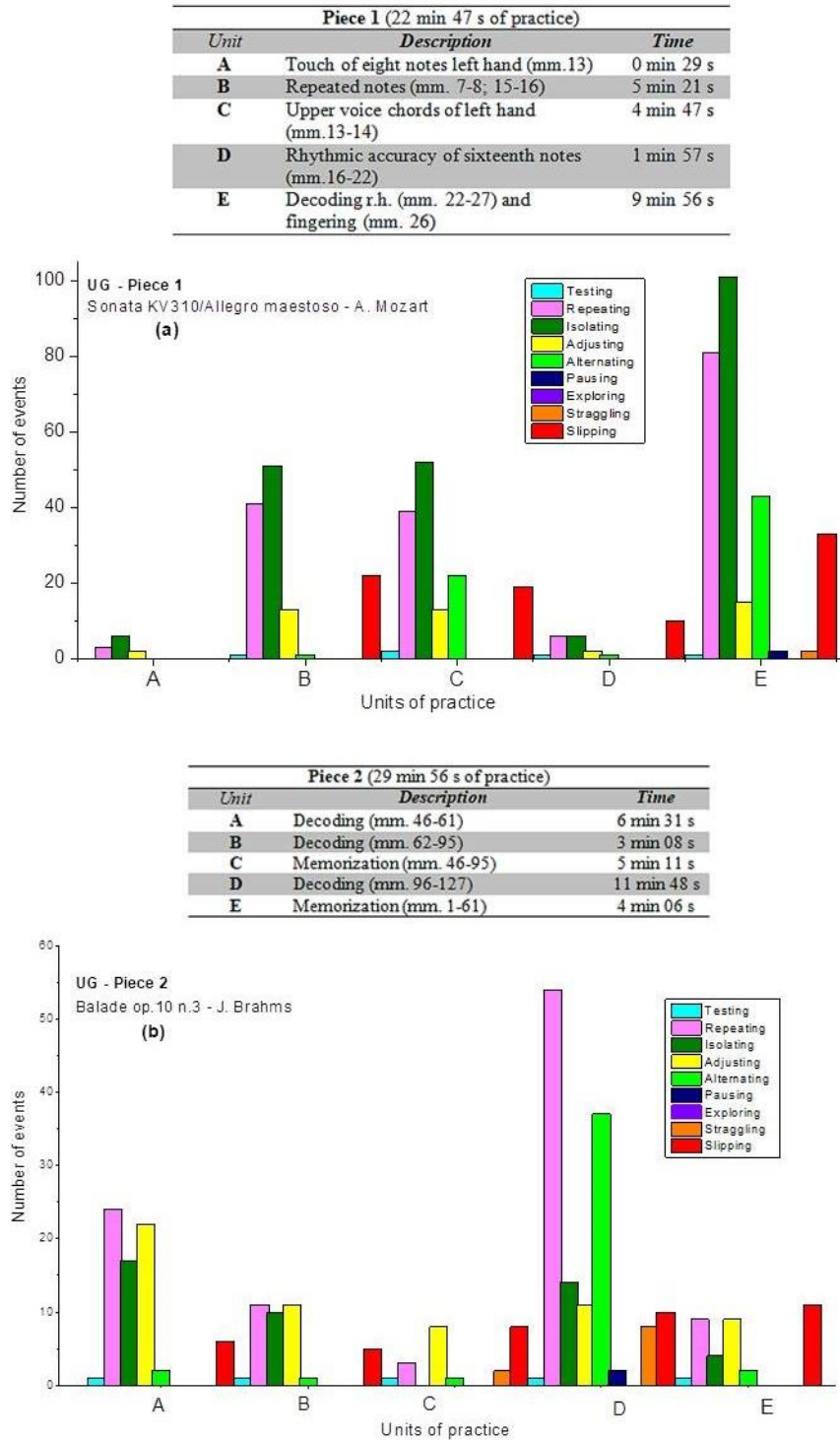


Fig. 3: The number of times each psycho-sensorial category occurred in UG practice: (a) piece 1 – *Sonata K310/Allegro maestoso* (A. Mozart) and (b) piece 2 – *Balade op.10 n.3* (J. Brahms)

Similar to **PC**, **UG** matches “repeating” and “isolating” nearer each other at half units of piece 2 (A, B, E) and throughout the study of piece 1, suggesting that both categories are frequent procedures in piano practice: **UG** repeated short excerpts and whole sections according to the structural boundaries of the works with a focus of attention and other times after adjusting something in order to master and/or improve/automate it; “isolating” occurred by studying voices and hands separately or without pedal. From another point of view, consider developing a procedure with “alternating” added to the previous categories, forming a pattern with them, although with less incidence and not totally proportional (piece 1, B, C, D, E; piece 2, A, B, E): “alternating” occurred by varying rhythm, articulation, tempo (slow/rushing/fast) and the register of the piano, but when its incidences increased (piece 2, D), “repeating” and “isolating” became distant themselves, indicating that these three categories are not always equally grouped for more intermediate levels of expertise. Furthermore, the unit of more effort (UME) occurred when incidences of these three categories and time of practice increased (piece 1, E; piece 2, D).

The slipping category presented itself as mistakes/bumps, loss of fluency, or failures to play correct notes or to do legato touch and as a “stuttering” in execution. There were more incidents of slipping than adjusting throughout most of the piece 1 (except in A), while at piece 2, it occurred only in unit E, since the opposite occurred in three units (units A, B, D) or with equal incidences among them (unit C). This implies that **UG** was more successful in the less challenging piece (like **PC**), in which he also spent more time practicing. However, the effort noted was not necessarily productive since slipping was higher than adjusting (piece 1, E), or almost equal (piece 2, D) in units where it was identified.

Although expressive purpose was observed in adjustments of dynamics, articulation, voicing, and phrasing (notes, fingering, rhythm, and fluency were also addressed), “exploring” was not noted in **UG**'s practice of both pieces: perhaps it is an embryonic category in the practice of more elementary levels of expertise that occurs occasionally for a specific purpose, as it happened for **PC**.

In **UG**'s practice, testing occurred in all units of both pieces (except in unit A, piece 1) and provided a form of supervisory knowledge to select excerpts to be studied and to reintegrate some measures (piece 1, B, mm.7-8 and 15-16) previously studied separately in a larger section (mm. 1-24) or to check the memorization level (piece 2, C, E). Nevertheless, the low number of incidences for this category, in both pieces, indicates that performance simulation (testing the execution in a continuous flow) is an action little accomplished in piano practice, and it does not seem to expand with the increase in expertise.

In Figure 3, “pausing” and “straggling” occurred in only one (piece 1, E) or two units (piece 2, C, D), suggesting that **UG**'s attention was stable during practice sessions and providing a few signs of deliberation, since “it involves engaging with full concentration in a special activity to improve one's performance” (ERICSSON, et al., 1993: 390-391).

2.3 GR's practice

Figure 4 presents the number of times each psycho-sensorial category was observed at each unit of practice while **GR** practiced the more challenging (Figure 4a) and less challenging (Figure 4b) pieces; the charts detail the participant's focus of attention during each unit and the time invested in it.

According to Figure 4, repeating, isolating and alternating categories were often grouped in a more balanced way, either by a certain proximity between them (piece 1, A, B, C) or by a pattern where repeating is more incident than isolating, which in turn is more incident than alternating (piece 2, A, B, C, D). In **GR**'s practice, this latter category seems to be more incident, frequent and relatively balanced (by proximity or patterns) in relation to the others when compared to **PC** and **UG**'s practices. This information suggests a steadier pattern within these three categories, also suggesting clues of deliberation to structure practice procedures, since deliberate practice is a highly structured activity that improves performance (ERICSSON, et al., 1993: 368).

GR repeated after making adjustments to master, improve, and/or automate something and isolating by means of practicing voices and hands separately, or playing without a pedal. However, repeating and alternating categories were slightly more diversified than for **UG**. Comparing the charts in Figures 3 and 4, **GR** repeated short excerpts and whole sections according to the structural boundaries of the works, as did **UG**, but in contrast, **GR** simultaneously addressed many musical aspects, while **UG** kept his focus on one musical aspect at a time. For the alternating category, articulation and tempo variations were also included, but the tempo was deliberately manipulated to emphasize certain textures or dynamics (e.g., Figure 4, piece 1, unit A, when playing the whole piece [see Figure 1] and emphasized the chords in *fortissimo* at mm. 43-57 and mm. 119-127 playing them slower). Tempo was also constantly monitored by feeling the pulse, marking the beat with her feet or snapping her fingers. These results suggest that the procedural categories can be developed as expertise increases, becoming more varied and incident, reinforcing the holistic view and adoption of systematic strategies associated with higher levels of expertise as pointed out by Hallam et al. (2019: 9).

On the other hand (Figure 4), another developing procedure was considered in which "exploring" is added to the trio ("repeating, "isolating and "alternating), either through irregular distribution of incidences in relation to these three categories (piece 1, C and E) or through a harmonious pattern (piece 2, B and C), where repeating is more incident than isolating, which is more frequent than exploring, and, in turn, is slightly more applied than alternating. **GR** explored a fast movement of the left hand over the keyboard in order to get good performance on jumps between the voices written for this hand (piece 1, C, mm.55-57; piece 2, B, mm.74-78) and other alternatives to make the execution easier, such as distributing notes written for one hand to be played between both hands (piece 1, E, mm.163, at the final arpeggio; piece 2, B, mm. 59-60, to keep the phrasing) or trying a different touch to play repeated notes (piece 2, C, avoiding the keys from rising to the keyboard surface completely). It seems that exploring may develop as expertise grows, since the incidences, purposes and frequency of this category increased in the **GR** practice in relation to **PC** and **UG** practices.

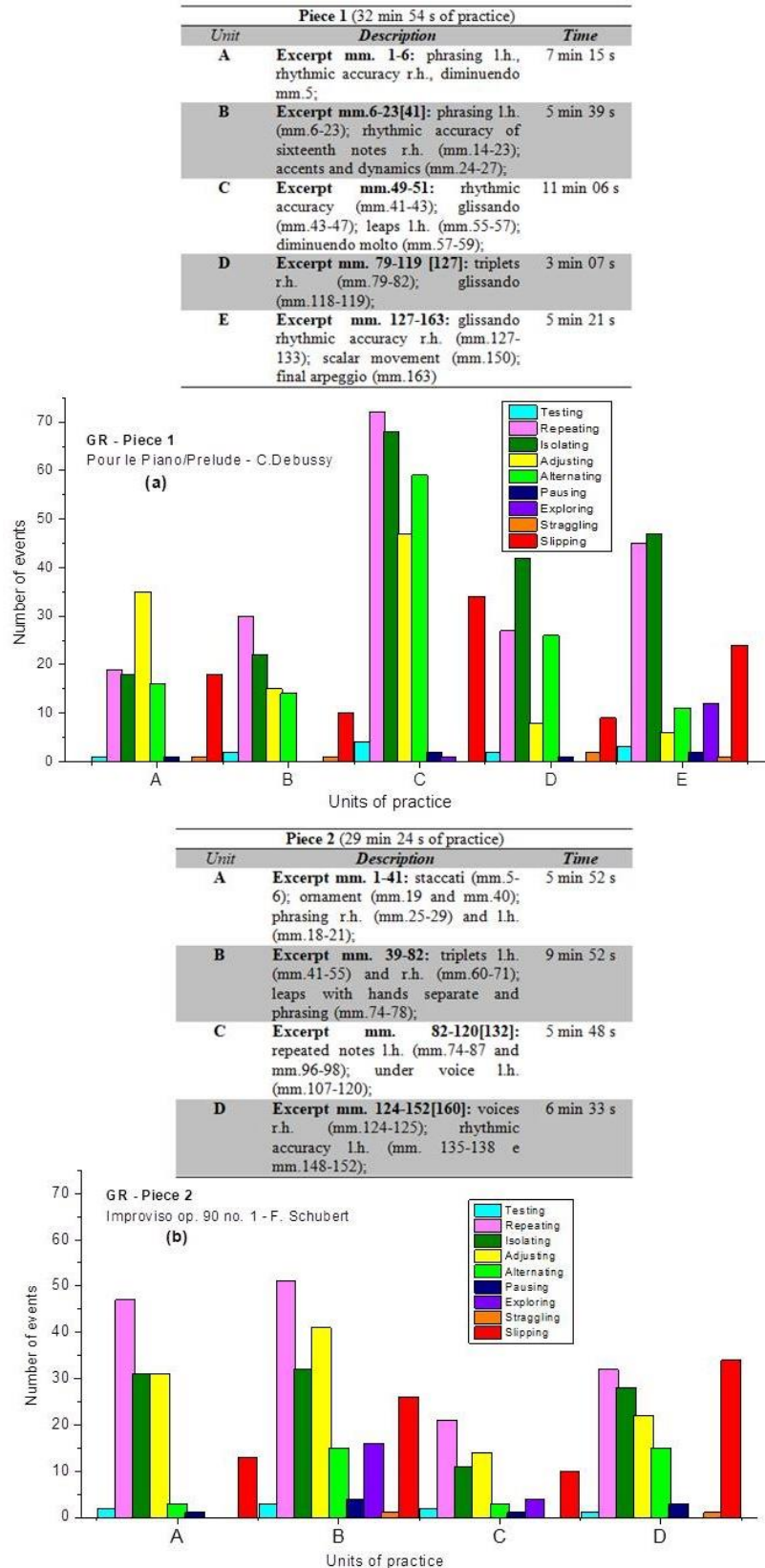


Fig. 4: The number of times each psycho-sensorial category occurred in GR practice: (a) piece 1 – *Pour le piano*/Prélude (C. Debussy) and (b) piece 2 – *Impromptu* Op.90 n.1 (F. Schubert)

Both procedures, considering the grouping of three or four categories, seemed effective since adjusting was more incident than slipping at most units (pieces 1 and 2, A, B, C), but the opposite occurred (piece 1, D and E) in units where repeating, isolating and alternating were distant from each other. This suggests that the balance of these categories was a more efficient procedure for this participant. Units of more effort (UME) were also noted when incidences of these four procedural categories and time of practice increased (piece 1, C; piece 2, B), and the peaks of adjustments provide evidence that the effort was productive. In addition, adjustments of notes, dynamics, accents, articulation, voicing, phrasing, and timing (to emphasize structural boundaries or make them sound more “improvised” at an indication of *tempo di cadenza*, piece 1, A, mm.148-149) were observed, while the slipping category presented itself as mistakes of notes, rhythms, piano register, omission of bars and notes, loss of fluency and “stuttering”.

The supervisory purpose was also noted in **GR**'s practice for the testing category, which occurred in all units of both pieces, but with a small increase (no more than 4 incidences per unit), again reinforcing the previous statement about testing being an action little accomplished in piano practice, which expands minimally with expertise.

In Figure 4, “pausing” occurred as actions related, or not, to the practice, such as organizing the musical score, marking the beats with the feet, conducting, shaking arms and hands in the air to relieve and/or avoid tension, or when **GR** was interrupted by another person; “stragglings” occurred by playing too many notes without realizing that she had done so, or looking at the cell phone. Although both categories occurred throughout most of the study of pieces 1 and 2, **GR**'s attention seemed to weaken when the slipping category had increased (piece 1, C [UME, 11 min 6 s] and E); (piece 2, B [UME, 9 min 52 s], and D, where “stragglings” and “pausing” had increased slightly more), suggesting that attention can be weakened due to lapses in commitment or effort and time of practice spent in a unit or when a person approaches the end of the session.

2.4 PR' practice

Figure 5 presents the number of times each psycho-sensorial category was observed during each unit of practice, while **PR** practiced the more challenging (Figure 5a) and less challenging (Figure 5b) pieces; the charts detail the participant's focus of attention at each unit and time invested in it.

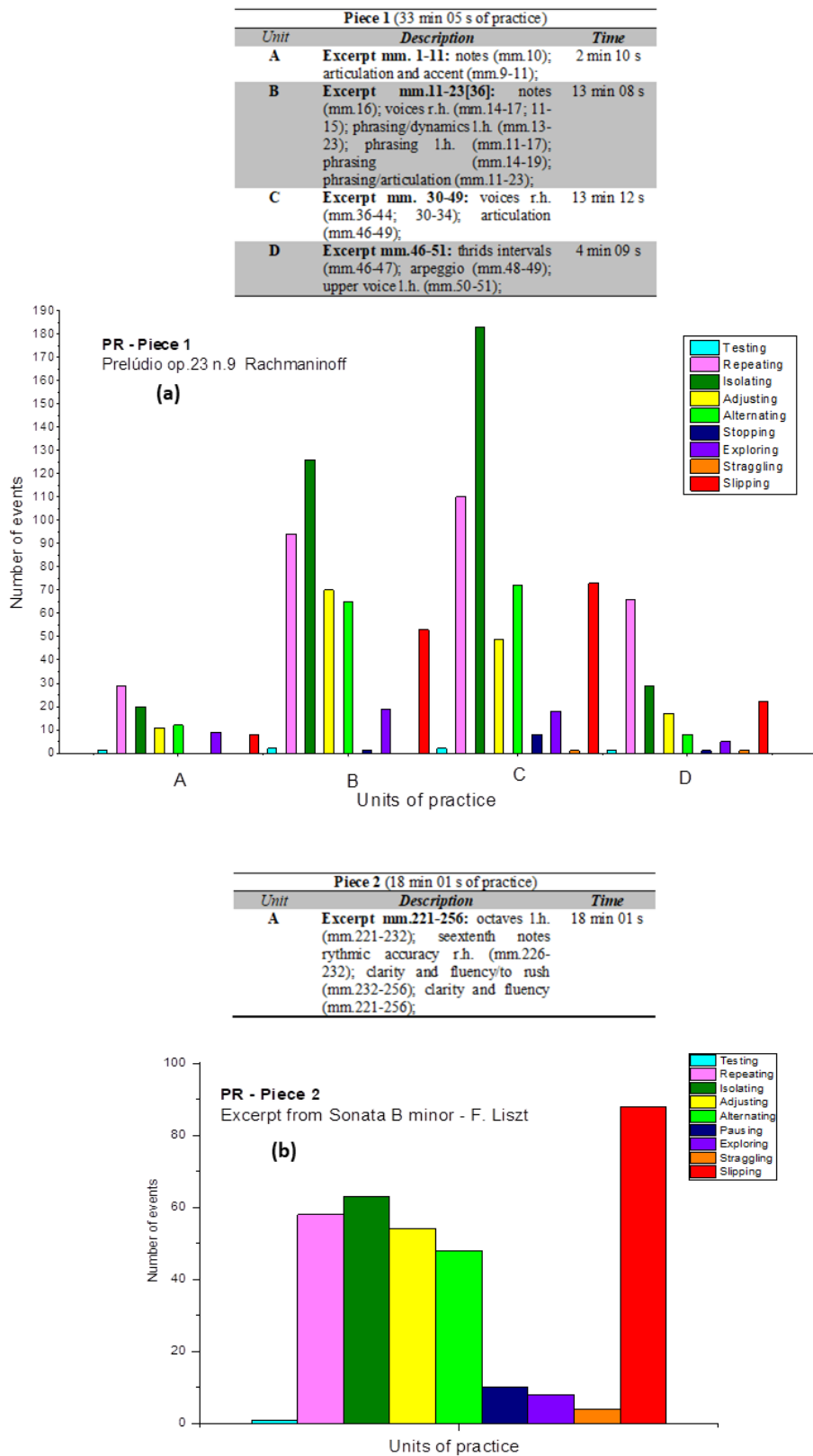


Fig. 5: The number of times each psycho-sensorial category appeared in PR practice: piece 1 – *Prelude* Op. 23 n. 9 (S. Rachmaninoff) and piece 2 – Excerpt from *Sonata* S. 178 (F. Liszt)

During **PR's** practice, we found the clear use of repeating, isolating, alternating, and exploring, all grouped and distributed with some regularity. Two patterns were detected: (i) repeating was more frequent than isolating (A and D, piece 1) with lower incidences of alternating and exploring; or (ii) isolating was more frequent than repeating (B and C, piece 1; whole section, piece 2) followed by incidences of alternating, which were greater than exploring. It is interesting to note that both procedures coincided with the practice time: less time (2 min 10 s and 4 min 09 s in A and D, respectively, piece 1) and more time (13 min 08 s and 13 min 12 s in B and C, respectively, piece 1; 18 min 01 s in piece 2). These results suggest that deliberation takes place, not only in the combination and distribution of these four categories, but also in the choice of which procedures to use depending on the effort and time of practice that **PR** intends to invest on a given excerpt. Similar to the practice of the other participants, there were (Figure 5) some units of more effort (UME), where the four categories were intensified per the high number incidences and/or the increased practice time spent. Such was the case for piece 2 (A) when **PR** focused on only one excerpt, and for B and C of piece 1 (the latter with higher incidences), suggesting that he had greater resistance to invest effort and energy for the sake of his practice goals.

In **PR's** focused practice, there were a variety of examples in which these four categories were presented, such as in "repeating" small motifs, short/long sections that attended to the structural boundaries of the musical works, isolating by means of practicing with hands and voices separately or without pedal, and integrating several aspects of the alternating and exploring categories. For example, **PR** alternated tempo (slow/fast/rushing), rhythm (five different rhythmic variations for each piece), and articulation between the voices or at the ends of each measure and/or rhythmic cells (such as breaths and cuts between the groups of 6, 8, and 10 sixteenth notes of mm. 19–21 in B of piece 1) and the dynamics. Exploring consisted of frequent experimentation with physical movements and gestures aimed at systematizing some procedures and/or avoiding/relieving physical tension in both pieces. For example, **PR** employed actions, such as (i) wide movements of the arm, wrist, thumbs, and elbows to make them more flexible; (ii) exaggeration of finger articulation and moving them like "claws" by scraping the key; (iii) playing with a higher wrist; and (iv) kinesthetic practice to achieve a reflex action of the left hand during a jump. Such examples of exploring also suggest that attention and/or kinesthetic awareness are aspects usually observed during the practice of experts (CANDEAU et al., 2017: 1-8. CHAFFIN, 2011: 689-699). From another perspective, exploring can be associated with creativity in overcoming challenges and achieving aims. This eventuality corroborates the proposition of Ericsson et al. (1993: 368) regarding deliberate practice in which exploring would fit into the development of specific tasks to overcome one's personal limits.

According to Figure 5, the adjusting category was more frequent than the slipping category in only half of the units in piece 1 (A and B); the opposite was true in the other half (C and D) and in the entire study of piece 2 (A). These findings suggest that **PR's** practice contained many mistakes. Such results are different from those reported by Gruson (2000: 100) and Kruse-Weber and Parncutt (2013: 27), who observed that people with higher levels of expertise make fewer errors when practicing. The highest number of adjusting events occurred in piece 1 (B = 70) and piece 2 (A = 54); these numbers were markedly higher than those of the other participants. The adjusting category focused on how dynamics, articulation, fluency,

tempo, agogic/timing, phrasing, sound planes/voicing, accents, and character were approached, while slipping presented itself as mistakes/bumps or failures to play the correct notes and as “stuttering” in execution (playing correct or wrong notes). Such information also provides evidence that an expert's practice is not always deliberate (ERICSSON et al., 1993: 363-406. LEHMANN et al., 2007a: 62).

The testing category (Figure 5) occurred in all units of **PR**'s pieces with low incidences, working as a form of practice supervision to evaluate what had been studied and/or what he had intended to study. There was only a subtle difference when **PR** played at a very fast tempo to reintegrate/evaluate the aspects studied and/or experience the limits of the speed of execution of musical events (mm. 232–256 of piece 2, A). However, the lower incidences of testing suggest that this category does not expand due to expertise; in other words, the performance simulation is an action not frequently present in piano practice even for higher levels of expertise.

According to Figure 5, the pausing category was frequent in both pieces. Examples of actions related to the study comprise shaking hands/arms in the air or making “claw” movements with fingers to relieve and/or avoid tension and resting when leaving the piano or to organize music scores. Stragglings occurred when **PR** was looking at his cell phone or during the execution (playing extra notes, ignoring pauses and dynamics). On the other hand, there was an increase in the number of stragglings and slipping events (higher than the adjusting events) in C of piece 1, a unit to which **PR** also invested more effort according to the longer practice time (13 min 12 s) and the intensification of that unit near the end of the session. In piece 2 (A), stragglings, pausing, and slipping (also higher than adjusting) were present from the beginning of the study, suggesting that **PR**'s attention was unstable for that entire piece. Such results suggest that attention can be markedly weakened due to the time of practice invested in a unit and/or when a person approaches the end of the session, which in turn may represent the effort undertaken (not productive at all).

2.5 The psycho-sensorial categories as evidence of deliberation

For a long time, research on instrumental practice within the scope of the Western classical music tradition has associated deliberation with high levels of expertise, while the practice of elementary and intermediate levels has been described as generalized actions and behaviors (such as repeating the whole piece or ignoring errors or expressive aspects) that convey a careless view about whatever perspective of deliberation could exist. The present research attempted to demonstrate that there are actions and behaviors of piano practice, referred to here as psycho-sensorial categories that do not depend on the level of expertise. These categories were shown to be characteristic actions of the investigated instrumental practice because they can reveal decision-making procedures and limits, as well as deviations of attention. The arrangement of these nine categories (namely, testing, repeating, isolating, alternating, exploring, adjusting, pausing, stragglings, and slipping) can provide evidence of deliberation and show how they can be developed with expertise, exemplified here with **PC**, **UG**, **GR** and **PR** practices.

Regarding decision-making procedures, the repeating, isolating, alternating, and exploring categories revealed common procedural actions and improvements of the piece under study that seem to work as a *modus*

operandi in development: **PC** regularly grouped repeating and isolating; **UG** also added “alternating” to them in an irregular way; **GR** combined these three categories in a balanced manner adding “exploring” (sometimes forming patterns, sometimes irregularly); whereas **PR** also included alternating and exploring, composing specific patterns depending upon the time of practice and effort spent. The relationship between the adjusting and slipping categories is also suggestive of how effective these procedures were, which, roughly speaking, can be associated to how much is wrong, corrected or improved during musical execution. In this sense, **PC** and **UG** were more successful with the practice of piece 2 (the less challenging composition), where they had fewer incidents of slipping and more adjusting, while **GR** and **PR** were more successful with the practice of piece 1 (the more challenging composition). This provides evidence that the way to deal with challenges may be different between levels of expertise or individuals; in addition, **PR**'s practice of piece 2 contained many mistakes, the results that can contribute to demystifying the professional practice as totally deliberate.

Another cue of deliberation that these four procedural categories (repeating, isolating, alternating, and exploring) can reveal relates to one's effort to stay engaged in the task, which functions as an “apex” of practice achieved through the increasing of incidences (of all or some) and practice time. The four participants demonstrated such effort at least in one of the units of their practice of piece 1 and 2, providing evidence that the effort to practice does not depend on the level of expertise, but can become more resistant as expertise grows since **PR** presented two units of more effort in piece 1 (although one of them was not productive at all).

The testing and adjusting categories revealed ways for the participant to supervise the execution to reflect on what they had worked on and/or to guide their intentions for the practice session. The former also suggested that simulating the performance is a rarely addressed aspect in practice and does not expand with expertise. Future research can investigate ways of stimulating this action in piano practice to explore its impact on musical performance.

Although deliberation may require an intentional focus of attention, the pausing, straggling, and slipping categories revealed some human limits (and deviation) with regard to attention since these categories seemed to appear as unwanted and random actions throughout practice regardless of the levels of expertise. However, it seems that the lack of goals in practice (**PC**, pieces 1 and 2), as well as the large amount of time spent on the same goal (**UG** and **GR** - pieces 1 and 2; **PR**, piece 2), can contribute to a loss of attention during practice. Future research can elucidate the causes that foster this instability of attention and recommend strategies to be employed to reverse these undesirable events.

3. Conclusion

In the present paper, nine psycho-sensorial categories were proposed to provide a systematic list of inherited actions and behaviors of piano practice, providing an essential typology that may contribute to elucidating their nature and finality in terms of deliberation and levels of expertise and providing guidelines for assisting instrumental music teaching and practice within the Western classical music tradition. Further research is necessary to utilize or correlate such categories in the design of a potential model for describing practice procedures.

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Michele R. Mantovani holds a doctoral and master's degree in music (subarea: performance practices - piano) from the Federal University of Rio Grande do Sul (UFRGS) and did a postdoctoral fellowship (PNPD/CAPES) at the same institution (Music: Performance Practices - Piano) and a doctoral sandwich internship at the University of Aveiro (Portugal). She also holds a Bachelor of Music in piano from the Sacred Heart University (USC) in São Paulo. Mantovani's professional experience is in the field of music performance practice, researching deliberative perspectives in pianistic practice at different levels of expertise. Her doctoral thesis "Deliberative Perspectives on the Phenomenon of Pianistic Practice" was awarded the ANPPOM Prize for Bibliographic Production - 2019 and was published as a book. She worked as a substitute music lecturer at the Federal Institute of Education, Science, and Technology of Rio Grande do Sul (Porto Alegre campus) in instrumental music technique course and in Prelude Program (outreach music course). She is currently piano teacher at Sinodal School (São Leopoldo-RS). She is a member of the EDEPI research group (Expertise Development Studies in Performance Practices), coordinated by Regina Antunes Teixeira dos Santos (UFRGS Graduate Program in Music). mantovani.michele@gmail.com

Regina Antunes Teixeira dos Santos, received a Bachelor of Music (Piano) in 1986 at the Federal University of Rio Grande do Sul (UFRGS). In 1991, she obtained the title *Maître* in music education at the Université Toulouse Le Mirail (France) with a dissertation entitled: "The Piano Works by Villa-Lobos" under the auspices of Dr. Robert Fajon and Dr. Jésus Aguila. During the period 1990-1993, she was matriculated at the Toulouse Conservatory studying harmony, musical analysis, and history of music receiving three honorable mentions in harmony and musical analysis. During the 1999/2000 academic year she studied instrumental practice (piano) with Prof. Minako Fujita at Ueno Gakkuen University (Tokyo). In 2001, she conducted music research at McGill University's Department of Music (Montreal) under the guidance of Dr. Eugênia Costa-Giomi. In 2003, she received a master's degree in music education at UFRGS (Porto Alegre) under the supervision of Prof. Liane Hentschke and Cristina Capparelli Gerling with a dissertation entitled "Proposal for the Development of Music Reading According to Davidson & Scripp: A Theoretical and Performance Analysis". In 2007, she received her doctorate degree in music education from UFRGS under the supervision of Dr. Liane Hentschke with a thesis entitled "Mobilization of Musical Knowledge in Preparing Piano Repertoire during an Academic Education: Three Case Studies". Her current research focuses on music psychology and the interconnection between instrumental practice and performance and musical knowledge. She has been a member of the editorial board of the *International Journal of Music Education* and has been working in developing manuscripts submitted to journals such as *Psychology of Music* and *Frontiers in Psychology* (music psychology). Presently, she is an associate professor at the Department of Music of UFRGS Institute of Arts in Porto Alegre. regina.teixeira@ufrgs.br