The Processes and Relationships in Composers Scale: Construction and Psychometric Analysis of a New Self-assessment Inventory

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We introduce a new inventory labeled the Processes and Relationships in Composers Scale (PRCS). This is a novel inventory developed to self-assess creative and social factors inherent in music composition. The PRCS consists of two separate scales of 12 items each, namely the Composing Processes Scale (CPS) and the Social Relationship Scale (SRS). An exploratory factor analysis revealed that the CPS scale has a single factor structure, while the SRS scale relies on three main factors: loneliness, support, and friendship. The total score of the CPS was found to be highly reliable, whereas the SRS obtained a lower score. The PRCS can contribute new insights into how creative and social processes can be self-assessed by music composers with different backgrounds and levels of musical expertise. Our work aims to deepen understanding of the relationship between musical creativity and social life, contributing to existing scholarship that has explored this connection in musical activities specifically.

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The relationship between social life and creativity has sparked a lively scholarly debate in recent years. Whereas traditional approaches to creative cognition have tended to focus on intrapersonal dispositions and individual traits (see Boden, 2006; Hodgson, 2007), a growing number of psychological perspectives hold that the nature of creative processes and the quality of their outcomes may be better understood when considering in detail the social and cultural environment in which creators are situated (see Elisondo, 2016; Montuori & Purser, 1995; Sawyer & DeZutter, 2009; Paulus & Nijstad, 2003). The former individual-focused position is known—among other things—to offer insight into one's creative abilities by distinguishing between two aspects of creativity: divergent and convergent thinking (see Razumnikova, 2013). While divergent thinking is understood as the capacity to generate a range of potentially valid answers to open problems, convergent thinking can be conceived of as a problem-solving capacity—one in which a specific solution is offered.

Conversely, research on human creativity from a more social perspective trades the sole focus on individual cognitive abilities to embrace a more open approach that accounts for both individual creators and their sociocultural niche (see Glăveanu, 2014). Among other sources of inspiration (such as social constructivism), this view builds on, and expands, classic work by Rhodes (1961), who examined creative cognition by looking at four "Ps," standing for Person, Process, Product, and Press. Notably, the latter term ("Press") refers to the external influences, circumstances, and conditions that individuals need to establish and navigate within their cultural and social environment to foster their creative potential. It signifies the various interactions, challenges, opportunities, and stimuli that individuals encounter in their surroundings, which play a crucial role in shaping and facilitating their creativity. In essence, Press highlights the importance of the dynamic relationship between individuals and their environment, as external factors can profoundly impact and enable their creative development and expression.

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In a similar vein, the "five-A" model more recently put forward by Glăveanu (2013) intends to investigate what creative thought and action entail by studying the role of Actors, Actions, Artifacts, Affordances, and Audiences, all seen as deeply interconnected aspects of creativity. This latter work points to a fluid integration of individuality and collectivity, offering a particularly useful avenue for the study of creative cognition and its defining features. With this in mind, we suggest that music represents an ideal context where such a *desideratum* can be achieved. On the one hand, there is a consensus in modern musicological research in considering all musical practices as profoundly socially and culturally constituted (Cross, 2003; Reybrouck, 2021; Small, 1999; Tomlinson, 2015); on the other hand, the multiple forms of creativity at the heart of musical experience are given nowadays more attention than ever, spanning domains such as performance, pedagogy, perception, as well as composition (Burnard, 2012; Collins, 2005; Hargreaves, 2012; van der Schyff & Schiavio, 2022).

This unique variety of manifestations makes music particularly well suited to offer a way forward for the study of creative cognition, facilitating a deeper exploration of the inherent interplay between individual creators and their social environment within a distinct context characterized by its unique history, norms, and traditions. This broad focus can also include an analysis of aspects such as gender, the type of music usually listened to and played by an individual, as well as their teaching habits and experiences. And while several publications have explored these factors in detail from a range of perspectives, a direct link to creative cognition from a psychometric point of view continues to be lacking (see Bennett et al., 2019; Burnard & Younker, 2004; Halstead, 2017). The aim of using psychometrics in this context is to establish a direct and comprehensive connection between the explored factors and the process of creative cognition. This involves quantifying and measuring psychological traits, behaviors, and attributes to gain insights into how they contribute to creative thinking. By employing psychometric tools, we could potentially uncover the underlying psychological mechanisms that drive creative endeavors and understand their impact on the overall creative process.

In general, the connection between music, creativity, and sociality may be best understood when considering how "creativity is the interaction among aptitude, process, and environment by which an individual or group produces a perceptible product that is both novel and useful as defined within a social context" (Plucker et al., 2010). Such a dynamical, meaningful interplay of individuality and collectivity has been recently highlighted by a range of music scholars, when examining what creative properties may be individuated in musical settings (Hill, 2018; Schiavio & Benedek, 2020). This provides an apt counterpoint to more traditional accounts of creativity in music, where its social aspects were arguably dismissed in favor of stereotypical narratives centred on the mythological figure of the "lone genius" (see Burkus, 2013, Luo, 2016; Montuori & Purser, 1995).

Instead, important questions to be asked include: how exactly does interpersonal experience take part in, and shape, one's creative processes when composing music? Can composers be aware of such an influence? Is there a way to measure how social life affects musical creativity? To address these general questions, in the present article we propose a new preliminary construct based on two scales. The first one, named "Composing Processes Scale" (CPS) aims to offer a self-assessment tool to examine one's creative activity when composing music; the second scale, labelled "Social Relationship Scale" (SRS), provides instead a more general tool to report on one's social life and experiences. Taken together, these two scales might form a coherent analytical resource to help appraise in greater detail the social aspects that permeate music composition. We named the total inventory PRCS (i.e., "The *Processes and Relationships in Composers* Scale").

In what follows, we first provide an overview of other existing tools that aim to investigate various artistic and everyday activities from a range of perspectives which variously encompass individual, social, emotional, and creative experiences. After this, we return to our psychometric instrument and justify how each item has been developed. We then present our findings by reporting on two quantitative studies, with music composers as participants, where the instruments are validated and correlations between the two scales examined. Finally, we conclude by discussing the major implications that our construct might have for future research, theory, and practice.

Existing Instruments

To our knowledge, no comprehensive scale has been explicitly constructed to scrutinize the influence of social factors on artistic creativity. However, there are existing instruments that examine some of the domains and notions relevant to our research focus. In this section, we will briefly review these related instruments., and the design and validation studies associated with them. In so doing, we aim to make more apparent the manner in which we built our own instrument, and what elements of it we refashioned from elsewhere.

A first approach examines how the creative process affects and is dependent upon cognitive and emotional support functions. For instance, the *Emotion Regulation Strategies for Artistic Creative Activities Scale* (ERS-ACA; Fancourt et al., 2019) is an 18-item instrument measuring types of emotional regulation strategies (ERSs) used when engaging in artistic creative activities. The instrument specifically assesses which mental processes ("strategies") are used to regulate our emotional responses. The authors suggest that artistic creative activities affect emotions via a number of ERSs that can be broadly classified into three categories: avoidance (such as distraction, suppression, and detachment), approach (such as acceptance, reappraisal and problem solving), and self-development (such as enhanced self-identity, improved self-esteem, and increased agency).

A second approach is to assess and quantify the outcome of creative acts, in artistic and everyday contexts. We give the example of four specific instruments. First, the *Creative Achievement Questionnaire* (CAQ; Carson et al., 2005) is a self-report measure of creative achievement that assesses accomplishments across 10 domains of creativity: Visual Arts, Music, Dance, Architectural Design, Creative Writing, Humour, Inventions, Scientific Discovery, Theatre and Film, and Culinary Art. The CAQ produces a two-factor solution, identified as an Arts and a Science factor. Second, the *Biographical Inventory of Creative Behaviours* (BICB; Batey, 2007) is a 34-item scale that assesses everyday creativity across a broad range of domains, by noting the respondent's partaking in each of a wide set of behaviors. While the CAQ focuses on public creative accomplishments, the BICB focuses on everyday creative behaviors covering many domains including individual (e.g., arts and crafts) as well as social acts of creativity (e.g., leadership and mentorship), but without providing domain-specific scores. Third, the *Inventory of Creative Activities and Achievements* (ICAA; Diedrich et al., 2018) assesses creative activities and achievements across eight domains including music. While the creative achievement subscale asks for specific creative accomplishments (like in the CAQ), the creative activities subscale asks for engagement in actual creative behaviors (like the BICB). Together, these scales offer an assessment of individual differences in domain-specific creativity ranging across professional and non-professional levels. Finally, the *Creativity Scale for Different Domains* (CSDD; Kaufman & Baer, 2004) assesses creative self-concept by asking people how creative they see themselves in different domains. It arrives at factors termed "hands-on creativity" and "math/science," with an additional "empathy/communication" factor. The CSDD has been used in several studies of creativity as a complement to measures of creative abilities and achievements (e.g., Silvia & Kimbrel, 2010).

A third approach is to quantify individual differences in creativity and its related trait or state dimensions.[1] We note here, first, the *Emotional Creativity Inventory* (ECI; Averill, 1999), which specifies three facets of emotional creativity: preparedness (understanding and learning from one's own and others' emotions), novelty (the ability to experience unusual emotions), and effectiveness/authenticity (the skill to express emotions honestly and competently). Female participants score higher than males on two of those facets: emotional preparedness and effectiveness/authenticity, and those can be mapped approximately to a variety of other personality variables, including the Big Five personality traits. One recent study (Alzoubi et al., 2021) shows that these three facets predict performance creativity, while another study argues they predict intrinsic motivation and academic engagement in university students (Oriol et al., 2016). Second, unrelated to creativity per se, but indirectly relevant, the *Empathy Components Questionnaire* (ECQ; Batchelder et al., 2017) measures cognitive and affective components of empathy, including ability and drive components within each.

We end by noting the link between creativity as an individual trait and the situations that appear to enable it in the moment, and during which it may manifest. In personality theory, a basic distinction is drawn between traits (of character) and (mental) states. These are both patterns of thinking, feeling, and behaving that differ systematically between individuals and between situations. However, while traits remain rather stable for an individual across time, states apply to concrete situations that one encounters at specific moments in time (Schmitt & Blum, 2020). While the different measures of creativity described above may describe a person's trait, a related and rather more state-like notion is *flow*. Put simply, flow might be seen as a specific state in which a person performing some activity is fully immersed, displaying concentrated but effortless focus (Csikszentmihályi, 1990; see also Doyle, 2017, Schutte & Malouff, 2020; Wrigley & Emmerson, 2013). The cognitive processes associated with flow, such as intense concentration and a sense of control, align well with the conditions that foster creativity. In a state of flow,

[1] "Emotional creativity stands to emotional intelligence in roughly the same relation as cognitive creativity stands to cognitive intelligence. A certain degree of intelligence or talent is required for performance to be creative within a particular domain. Intelligence, however, is no guarantee of creativity" (Averill, 1999 p. 2).

individuals often experience a merging of action and awareness, which can lead to novel insights and unique connections between ideas. This heightened cognitive fluidity facilitates the generation of original and imaginative solutions, revealing the association between flow and creativity. Flow exists in any domain and is characterised by the complete absorption in the task at hand and a resulting subjective transformation of one's sense of time. Intuitively, thus, the flow state could be seen as a momentary (i.e., state-like) instantiation of a longer-term creative endeavor; it, too, can be quantified empirically (see e.g., Byrne et al., 2003; MacDonald et al., 2006).

One of the most popular tools to measure the flow experience is the *Dispositional Flow-Scale-2* (DFS-2; Jackson & Eklund, 2002). Although originating from the field of exercise and sport research, this tool is commonly used in flow research across domains. The DFS-2 includes 36 items, equally distributed into nine scales that evaluate the following dimensions: Challenge-Skill Balance, Action-Awareness Merging, Clear Goals, Unambiguous Feedback, Concentration on Task, Sense of Control, Loss of Self-Consciousness, Time Transformation and Autotelic[2] Experience. Together, these provide a quantitative measure described either as a *state* flow-scale or a *dispositional* (i.e., trait) flow-scale, with the implied differences explained above. The former scale has been used in music research on several occasions. For instance, Gaggioli and colleagues (2016) measured group collaboration and the relationship between flow, social presence, and performance in 15 music bands during rehearsals. They found that perceived emotional contagion was positively correlated with the autotelic experience dimension, which the authors suggested indicates a "flow contagion" among players. Another instrument to assess flow is the *Flow Short Scale* (FSS; Engeser & Rheinberg, 2008; Rheinberg et al., 2003). The FSS tries to cover all six main components of the flow experience (Csikszentmihályi, 1975) within 10 items, featuring two factors: *fluency of performance* and *absorption by activity*. This scale has already been administered in a musical context by Stupacher (2019), showing that fluency of performance correlates with tapping accuracy and stability in a sensorimotor synchronisation task.

To sum up, existing psychometric instruments allow quantifying individual differences both in creativity per se as well as in the affective and cognitive functions upon which it depends. They also allow quantifying the direct effects (in terms of achieved creative act) enabled by their in-the-moment and long-term combination, for a given individual. This applies across a wide range of domains including music, but with a gap surrounding the process of composition, and specifically with regards to the interaction of composition-specific mental processes and composers' social relationships. We have taken inspiration from some of those instruments in producing an item pool that is specifically designed to address the study aims. We next outline how this item pool has been developed.

Item Development

As we saw, to our knowledge, there is no validated instrument that is specifically designed to measure the relationship between creative and social processes in musical composition. Therefore, we created PRCS (involving two separate scales) inspired by current literature as well as existing similar constructs. It should be noted that, as a baseline, musical creativity research has given rise to fewer psychometric tools when compared to a broader domain such as social cognition, as the latter area also involves more clinical applications (e.g., relational and general social disorders). Because of this, we have not been able to use items from other scales that examine one's creative composing processes as a coherent whole. Instead, we developed from scratch a total of 12 questionnaire items, reflecting key features of what creativity in the realm of composition is likely to entail (CPS; see Table 1). Conversely, the 12 items of the scale on social life (SRS; see Table 2), have been taken (and slightly adapted) from an existing instrument (Cyranowski et al., 2013). The item pool of both scales is examined in detail below:

Composing Processes Scale (CPS): This scale looks at six core features of creativity, forming a unique construct. These features are ideational *fluency*, *flexibility*, and *originality* (three established central indicators of creative ideation performance; see Guilford, 1967, Renzulli et al., 1974; Shaw & DeMers, 1986; Weiss & Wilhelm, 2022), as well as *flow*, *creative quality*, and *imagination*. As we were interested in letting our participants reflect vividly on their own creative musical experiences, all questions refer to activities done *in the past week* (two items per feature). According to Kasirer and Mashal (2018), fluency can be defined as a "spontaneous flow of ideas and images," defining one of the main dimensions of the creative mind individuated by Guilford (1967). Because this is usually measured by

[2] "Autotelic" is a term that describes something as having an inherent or self-contained purpose. It is often used to refer to activities or experiences that are intrinsically rewarding and satisfying in and of themselves, rather than being pursued for external rewards or goals.

TABLE 1. *Mean (M), Standard Deviation (SD), and Factor Loadings (Factor) of the Rotated Factor Matrix (Exploratory Factor Analysis) for the CPS*

Items This past week, how often	*M (SD)*	*Factor*
1a. did you think about new musical ideas?	3.58 (.99)	.659
2a. did you compose music?	2.64 (1.21)	.697
3a. did you consider multiple solutions to a particular composing need/problem?	3.02 (1.91)	.677
4a. did you compose music that crossed boundaries between styles/procedures/techniques?	2.76 (1.37)	.668
5a. have you experienced a sense of deep immersion while thinking about new music?	3.42 (1.22)	.729
6a. did you feel yourself bursting with energy while composing?	3.09 (1.34)	.763
7a. were you surprised by your own musical ideas?	3.01 (1.12)	.731
8a. did you find your music innovative?	2.71 (1.11)	.733
9a. did you consider your musical ideas valuable?	3.10 (1.12)	.714
10a. were you satisfied with the music you have composed?	2.91 (1.14)	.704
11a. did you imagine other people (e.g., performers, clients, audience) when composing?	2.95 (1.35)	.525
12a. did you feel you were communicating with others when composing?	2.69 (1.32)	.562

TABLE 2. *Mean (M), Standard Deviation (SD), and Rotated Factor Matrix (Exploratory Factor Analysis) for the SRS*

Items	*M (SD)*	Factors *		
This past week, how often		*1.*	*2.*	*3.*
1b. did you feel that someone truly understands your problems?	2.69 (1.14)		**.638**	
2b. did you feel that there are people who can listen when you need to talk?	3.35 (1.16)		**.753**	
3b. did you have someone to drive you places if you needed to?	2.88 (1.40)		**.549**	
4b. did you have someone around to help you if you needed to?	3.47 (1.23)		**.726**	
5b. did you get invited to go out and do things with other people?	3.21 (1.18)		.373	**.679**
6b. did you feel like you were part of a group of friends?	3.34 (1.22)		.303	**.773**
7b. did you feel alone?	2.76 (1.18)	**.635**		
8b. did you feel left out socially?	2.41 (1.23)	**.658**		−.416
9b. did you feel that people act like your problems are not that important?	2.38 (1.16)	**.705**		
10b. did you feel that people avoid talking to you?	1.90 (1.02)	**.720**		
11b. did you feel that people get mad at you?	2.05 (1.00)	**.651**		
12b. did you feel that people act nasty to you?	1.83 (.91)	**.712**		

Note: Only factor loadings > .30 are shown.

looking at the number of ideas generated or solutions provided to solve an issue, the first two items of our scale referring to fluency focus on how much the respondent thought about new musical ideas (item 1a) and how much music was composed (item 2a). This dialectic between musical thought and action is also present in the following two questions, which aim to capture ideational flexibility. The latter term refers to "the ability to create and use new mental categories and concepts to reorganise our experiences" (Kenett et al., 2018), which we addressed via two items respectively dedicated to understanding how often multiple solutions were considered to solve a particular composition problem (item 3a), and whether music that crossed boundaries between genres, style, or techniques, was composed (item 4a). Another important dimension at the heart of creativity is flow, a concept we introduced above (see Cseh, 2016; Csikszentmihalyi, 1996). Because this concept is usually associated with a positive feeling potentially boosting one own's creative ideas, we have developed two items looking at how often a sense of deep immersion has been experienced when thinking about new music (item 5a), and at how often the respondent could felt bursting with energy while composing music (item 6a). The next two items were developed with the concept of originality in mind, one of the most important dimensions defining creativity (Runco & Jaeger, 2012). As such, we asked whether participants would feel surprised by their own musical ideas (item 7a) and find them innovative (item 8a). These items were followed by an examination of self-reported quality of the composers' own musical material. It should be noted that the intrinsic value of creativity self-assessments has been questioned, though they may still "serve as a limited proxy for performance-based measures" (Kaufmann, 2019, p. 190). Consequently, the next

two items (item 9a and 10a) focused respectively on the perceived value of the composers' musical ideas and on the satisfaction of the music they composed. The quality aspect could also be justified by the fact that originality of ideas only captures one dimension of the quality of ideas (Runco & Jaeger, 2012), but not its value or effectiveness, beyond its novelty. The final two items were inspired by recent work that looks at solo creative performance as an inherently social activity (see again, Cook, 2018; Høffding & Satne, 2019; Schiavio, Moran, et al., 2022). This may involve imagining (item 11a) or feeling like communicating (item 12a) with other people when composing music.

Social Relationships Scale (SRS): Differently from CPS, for SRS we did not create our pool *ex novo*. Instead, we derived each item directly from the *Adult Toolbox Social Relationships Scales* (Cyranowski et al., 2013). The latter is a construct composed of six different scales looking at the following dimensions: *emotional support*, *instrumental support*, *friendship, exclusion*. In its original version, all dimensions contained eight items with the sole exception of "loneliness," which only had five items. For our scale, however, we selected two core items for each dimension, as outlined below. This process gave rise to a total of 12 items. Moreover, whereas all items originally referred to activities (and experiences) carried out (and felt) in *the past month*, all items in our SRS focus on what occurred *in the past week* (as in the CPS). With regard to emotional support, we chose two items meant to capture directly the "non-verbal and verbal processes by which one communicates care and concern for another, offering reassurance, empathy, comfort, and acceptance" (VandenBos, 2015). Accordingly, we opted for questions focusing on the feeling of somebody truly understanding the respondent's problem (item 1b), and the feeling that there are people who can listen when needed (item 2b). Instrumental support refers instead to "the perceived availability of people who can provide functional aid in completing daily tasks (such as making meals or providing transportation) if needed" (Cyranowski et al., 2013). As such, two items were chosen from the original instrument (*Adult Toolbox Social Relationships Scales*), which referred to the availability of someone to drive to places (item 3b) and to help (item 4b) the respondents when needed. Because of their inherent connection to the need of someone else, the first four items can thus be considered as one specific factor, as confirmed by the data reported below. With regard to friendship, we selected two items which in our view best underlie its distinctive social dimension, both in terms of activity and feeling. We thus opted for the following: "did you get invited to go out and do things with other people?" (item 5b) and "did you feel like you were part of a group of friends?" (item 6b). Given its specificity, we considered friendship as a dimension separated from the others. This also emerges from the exploratory factor analysis we illustrate in the following section. The two items selected from the original instrument referring to loneliness, asked whether respondents felt alone (item 7b), and left out socially (item 8b). We chose these two items as we considered them the most relevant to our investigation when compared to the other three (recall that in the original scale, the factor loneliness only involved five items). The last four items refer to perceived rejection (items 9b and 10b) and perceived hostility (items 11b and 12b). Somewhat similar to the items selected for loneliness, the questions for these last two categories involve a focus on the (negative) feelings that people close to our respondents could contribute to generate. Hence our items refer to whether people would act like the respondents' problems are not vital (item 9b), avoid talking (10b), get mad (11b) and act in a nasty way (12b). As the analysis below shows, exclusion could be understood as one of the main dimensions of the SRS.

Study 1 – General Test Analysis

RATIONALE

There is a scarcity of quantitative tools that look at creativity self-assessments in a population of music composers. Furthermore, only a few scales consider the social contexts that frame their composing activity. Our first study intends to fill these gaps by reporting on the validation of two specific, related scales. To do so, the following driving research questions are considered: 1) What are the main dimensions of the two scales? 2) Are the two scales reliable?

PARTICIPANTS

Three hundred and forty-three participants took part in the study (134 females; 198 males; 9 preferred not to say, 2 reported other; age: M = 30.75 years, SD = 11.82). They were recruited in spring 2022 via various announcements in social media, followed by emails sent to schools of music and departments of music theory and composition throughout the EU, the US, and Asia, as well as to composers known to the research team. Inclusion criteria were: 1) being more than 18 years old, 2) being an active composer or songwriter, and 3) being fluent in English. All participants gave their informed consent and were offered the opportunity to participate in a lottery to win a financial reward of 100, 50, or 25 €. The participants' median experience in regularly

TABLE 3. *Distribution of Participants' Years of Musical and Compositional Practice*

Musical practice in years	0	1	2	3	4-5	6-9	10 or more
n	3	3	3	11	14	35	274
Compositional practice in years	0	0.5	1	2	3	4-6	7 or more
n	28	13	43	38	34	57	130

practicing an instrument was found to be "10 or more years" with an IQR = ["10 or more years," "10 or more years"] as rated on an interval scale (Levels in years: 0 < 1 < 2 < 3 < 4-5 < 6-9 < 10 or more). The median experience in writing original music was "4-6 years" with an IQR = ["2 years," "7 or more years"] as rated on an interval scale (Levels in years: 0 < 0.5 < 1 < 2 < 3 < 4-6 < 7 or more) (see Table 3 for the distribution of years of musical and compositional practice for all participants). Some participants ($n = 3$) had never practiced a musical instrument or reported that they have never composed music on a regular basis ($n = 28$), meaning they are either beginners, amateurs, or have only been composing music sporadically. We intentionally included these participants because we wanted to have a sample displaying a large variety of musical expertise, ensuring validity of the construct across different levels. All procedures were approved by the Ethical Committee associated with research of the University of Graz and were in accordance with the statements of the Declaration of Helsinki.

DATA COLLECTION

The questionnaires were administered via Google Forms and completing them took participants around 15 minutes in total.

DATA ANALYSIS

Data were analyzed with IBM SPSS Statistics (Version 23.0.) to test the psychometric properties of the *Composing Processes Scale*. In a first step, an exploratory factor analysis was computed to determine the factorial structure of the measure. For the resulting factors (i.e., subscales), we then examine their distribution by means of descriptive statistics, and their internal consistency as reliability evidence by means of Cronbach's alpha.

RESULTS

Exploratory factor analysis for the CPS: The first research question concerns the factorial structure of the *Composing Processes Scale*. Accordingly, KMO and Bartlett tests were the first statistical analyses performed to verify suitability of the data for an exploratory factor analysis. A KMO value over .90 suggests a high probability that underlying factors explain the data, and a significant Bartlett test rejects the notion that the items are essentially unrelated. The KMO = .911 and Bartlett test $\chi 2 = 2082.485$, $df = 66$ ($p < .001$) clearly indicated that the data is suitable for a factor analysis. Hence, we performed an exploratory, unconstrained factor analysis that used a Varimax rotation method to determine the links between observed variables and underlying factors. The Kaiser criterion and the Scree test were used to determine the number of factors, and only the factors with eigenvalues equal or superior to one were considered. A single factor structure was found. The factor loadings[3] ranged between .525 and .763, as reported in Table 1. The factor explained 51.08% of the total variance, as indicated in Table 4. The results of the item loadings per factor, the eigenvalues and the high explained variance support the mono-factorial structure. Descriptive statistics, eigenvalue, percentage of variance and Cronbach's α of the total CPS are reported in Table 4.

Exploratory factor analysis for the SRS: The same analyses performed for the CPS were conducted for the Social Relationships Scale. The results were: KMO = .814; Bartlett test: $\chi 2 = 1672.914$, df = 66 ($p < .001$), which indicated that it is suitable to conduct a factor analysis on this scale as well. The second step was to perform an exploratory factor analysis with the Varimax rotation method. A rotated factor matrix adds value by simplifying and clarifying the interpretation of underlying factors, making them more meaningful and aligned with the observed data. It enhances the understanding of relationships among variables, improving the accuracy of model representation and aiding in actionable insights. The Kaiser criterion and the Scree test were used to determine the number of factors, and

[3] Factor loadings are essentially the correlations between observed variables (or items) and the underlying latent factors in factor analysis. They represent the strength and direction of the relationship between each observed variable and the underlying factors. In other words, factor loadings indicate how much of the variation in an observed variable can be attributed to a particular latent factor. A high positive loading suggests a strong positive relationship, while a high negative loading suggests a strong negative relationship. Loadings close to zero indicate a weak or negligible relationship. Eigenvalues, on the other hand, are a mathematical concept which in factor analysis represent the amount of variance explained by each factor.

TABLE 4. *Mean (M) and Standard Deviation (SD), Eigenvalue, Percentage of Variance, Cronbach's α, for the CPS and the SRS*

Factors	*M (SD)*	*Eigenvalue*	*% Variance*	*Cronbach's α*
1. CPS Total	2.99 (.86)	6.130	51.084	.910
2.1. SRS_*exclusion*	2.22 (.81)	4.214	35.116	.841
2.2. SRS_*support*	3.10 (0.96)	2.422	20.179	.780
2.3. SRS_*friendship*	3.27 (1.09)	1.117	9.311	.791
2.4. SRS Total	2.69 (.51)		64.607	.615

Note: CPS = Composing Processes Scale; SRS = Social Relationship Scale.

the factors with eigenvalues equal or superior to one were considered. A structure of three factors was found. Based on the defining items in each factor, these factors can be named as follows:

- *factor 1*: exclusion (6 items: from 7b to 12b)
- *factor 2*: support (4 items: from 1b to 4b)
- *factor 3*: friendship (2 items: 5b and 6b)

The rotated factor values ranged between .549 and .773, as reported in Table 2. The rotation was unconstrained and items with factor loadings lower than .30 are not reported. In the factors where one item loaded in other factors, the higher value was considered. The factors explained 64.61% of the total variance, as indicated in Table 4. The results of the item loadings per factor, the eigenvalues and the variance that explains the percentages of the factors confirm the three-factor structure. Descriptive statistics, eigenvalues, percentages of variance, and Cronbach's α values are reported in Table 4.

Reliability of the scales: The second research question regarded the reliability of the construct. To determine its internal consistency, a Cronbach's α coefficient was calculated for each factor of the two scales. For the total score of SRS, as items of factor 1 can be expected to be negatively correlated with the items of the other two factors (reflecting negative vs positive social aspects), they have been reverse-coded[4] before computing the total score and reliability analysis to guarantee the logically coherence of the internal reliability. Cronbach's α was .910 for the CPS, and .615 for the total score of the SRS, while it ranged between .780 and .841 for the SRS factors. The results are shown in Table 4. The α values indicate a good internal consistency according to the cut-off value of 0.70 found in the benchmark of Nunally (1978). It should be noted that (sub)scales reflect the average of relevant items rather than factors scores.

[4] This refers to a process in which the values of certain items or variables within a dataset are systematically changed or flipped so that high item values consistently correspond to higher expressions of the scale.

Study 2 – Validation of the Scales

RATIONALE

The purpose of the second study was to apply and validate the newly developed scales within a research context. The following leading question was considered: are variables such as gender, listening to classical music, performing classical music, and teaching music correlated with CPS and SRS?

PARTICIPANTS

We based this study on a subset of participants from the previous experiment, excluding those who did not compose music in the week prior to completing our questionnaire. The total number of participants was thus reduced to 265 (107 females; 150 males; 6 preferred not to say, 2 reported other; M = 30.44 years, SD = 11.65).

DATA ANALYSIS

The data were analyzed using the software IBM SPSS Statistics for Windows (Version 23.0.). The analysis involved three steps. First, descriptive statistics for all scale items were calculated (mean and standard deviation). Second, we selected several variables: gender (male/female/other), listening to classical music (yes/no), performing classical music (yes/no), and teaching music (yes/no) and tested for differences between the means of their levels using a one-way ANOVA. Third, intercorrelations (Pearson's r and point-biserial correlation coefficients) were computed between the previously mentioned variables and aspects of the CPS and SRS.

RESULTS

Descriptive statistics and mean comparisons (one-way ANOVAs): Mean scores and standard deviations were calculated for the factors of the two scales. The results of the descriptive statistics are reported in Table 5. To understand the differences in the mean scores reported by male and female participants, a one-way ANOVA was performed to compare the mean scores of factors of all of the questionnaires, and Cohen's d and the

TABLE 5. *Descriptive Statistics of Group Comparison (Gender, Listening to Classical Music, Playing Classical Music, Skills, Teaching Music)*

			CPS	SRS		
		N		*M (SD)*		
Variables	*Levels*		*Composing process*	*Social support*	*friendship*	*Social exclusion*
Gender	Male	150	**3.37 (.60)**	3.04 (.94)	3.24 (1.11)	2.21 (.85)
	Female	107	**3.17 (.64)**	3.14 (.98)	3.38 (1.05)	2.38 (.75)
	Other[5]	2	-	-	-	-
Listening to classical music	No	194	3.28 (.59)	**3.15 (.93)**	**3.39 (1.10)**	2.32 (.81)
	Yes	71	3.35 (.68)	**2.90 (.97)**	**3.08 (1.01)**	2.22 (.80)
Playing classical music	No	155	3.31 (.61)	**3.23 (.89)**	3.36 (1.10)	2.27 (.81)
	Yes	110	3.28 (.63)	**2.87 (.98)**	3.23 (1.07)	2.33 (.81)
Skill level	Beginner	98	**2.99 (.53)**	3.15 (.97)	3.44 (1.10)	2.29 (.76)
	Intermediate	101	**3.35 (.61)**	3.00 (.94)	3.20 (1.03)	2.27 (.81)
	Expert	66	**3.68 (.52)**	3.10 (.88)	3.26 (1.16)	2.34 (.90)
Teaching music	No	108	**3.17 (.62)**	2.98 (.91)	3.33 (1.09)	2.32 (.79)
	Yes	157	**3.39 (.60)**	3.15 (.96)	3.29 (1.09)	2.28 (.82)
	Total	265	3.30 (.62)	3.08 (.94)	3.31 (1.09)	2.29 (.81)

Note: In bold the significant differences, at alpha = .05. CPS = Composing Processes Scale; SRS = Social Relationship Scale.

partial eta squared (ηp 2) were computed. These two measures of effect size are standardly used in statistics based on the general linear model, respectively assessing the standardized mean differences between experimental conditions, and the proportion of variance in the dependent variable accounted for by the independent variable while controlling for covariates. Bonferroni post hoc corrections were applied for multiple variables to account for multiple testing. Significant gender differences were found only for the CPS, where participants who identified as male showed a higher level than those who identified as female, $t(1, 255) = 2.59$; $p < .05$. However, it should be noted that d was .32, which indicates a small effect size (Cohen, 1988). Regarding the variable "listening to classical music," participants who listen to classical music, reported lower support, $t(1, 263) = 1.930$, $p < .05$, and friendship, $t(1, 263) = 2.076$, $p < .05$, factors respectively. However, it should be noted that d was .27 and .29 respectively, indicating again a small effect size (Biasutti & Concina, 2018; Cohen, 1988). Participants who prefer playing classical music displayed a lower mean in the factor of support, $t(1, 263) = 3.087$; $p < .05$, with a small effect size of $d = .38$. Regarding the influence of the level of composing skills, the results show that expert composers have a higher CPS score when compared to intermediate and beginner composers. In a similar vein, composers with an intermediate expertise have a higher CPS score than beginners, $F(2, 263) = 31.392$, $p < .05$ ($\eta p\ 2 = 0.19$). According to Cohen's (1988) criteria, the effect size can be considered medium since the value of $\eta p\ 2$ was .06. In addition, the comparison between those who teach music and those who do not was computed. The results have shown that teachers have a higher mean in the CPS than those who do not teach, $t(1, 263) = -2.826$, $p < .05$, with a small effect size $d = -0.35$.

Intercorrelations: To verify the hypothesis, intercorrelation coefficients were computed. Person's r coefficients were used for the correlations between gender, skill level, and the SRS factors scores, teaching, possession of degree and listening and playing classic music. All correlations are reported in Table 6. CPS correlates positively with skill level ($r = .46$), SRS Support ($r = .22$), SRS friendship ($r = .14$), possession of a degree ($r = .12$), and teaching ($r = .19$) and negatively with the gender ($r = -.16$). The assessment of skill level showed a significant positive correlation with possession of a degree ($r = .36$) and teaching ($r = .22$), and negative correlation with the gender ($r = -.20$). Regarding the SRS support score, it is positively correlated to SRS friendship ($r = .50$) and negatively correlated with SRS exclusion ($r = -.29$), play genre classic ($r = -.19$), and listen genre classic ($r = -.12$). For SRS friendship score only two significant negative correlations appear with SRS exclusion ($r = -.31$, $p < .05$) and listen genre classic ($r = -.12$). Conversely, the SRS exclusion score is positively correlated also with gender ($r = .10$). Playing classical music has positive correlations with listening to classical music ($r = .47$), possession of a degree ($r = .12$), and gender ($r = .11$). For listening to classical music, a positive correlation appears with teaching music ($r = .13$). Correlations also appear between the score of possession of degree with gender ($r = .13$) and teaching ($r = .44$).

[5] Because of the large difference in sample size, we did not compute comparisons for this level.

TABLE 6. *Intercorrelations Among CPS, Expertise Level, SRS (Support, Friendship, Exclusion), Play Genre Classic Music, Listen Genre Classical, Possession of Degree, Teaching, and Gender*

Measures	1	2	3	4	5	6	7	8	9
1. CPS	—								
2. Skill level	.46**	—							
3. SRS_Support	.22**	−.27	—						
4. SRS_Friendship	.14*	−.07	.50**	—					
5. SRS _exclusion	.02	.04	−.29**	−.31**	—				
6. Playing_genre_classical	−.04	−.10	−.19**	−.07	.03	—			
7. Listen_genre classical	.06	.09	−.12*	−.12*	−.05	.47**	—		
8. Possession of a degree	.12*	.36**	.04	−.07	−.02	.12*	.09	—	
9. Teaching	.19**	.22**	.09	−.02	−.01	.04	.13*	.44*	—
10. Gender	−.16**	−.20**	.05	.06	.10*	.11*	.01	.13*	-.01

Note: CPS = Composing Processes Scale; SRS = Social Relationship Scale. As gender is taken here as a dichotomous variable (0=male, 1=female), inter-correlation between this, CPS, expertise level, SRS support, SRS friendship, SRS exclusion, play genre classic music, listen genre classical possession of degree, and teaching, are computed using point biserial correlation coefficient.
*$p < .05$; **$p < .01$

Regression analysis: A step-wise regression analysis was performed with the CPS considered as the dependent variable, whereas gender, skill level, and the SRS factors teaching, possession of degree, listening, and playing classic music scores were considered possible predictors due to their significant zero-order correlations with the criterion. The final model revealed two predictors that explained unique variance in CPS: The first variable that appeared as a predictor is skill level, adjR^2 = .21, $F(1, 255) = 68.68$, $p < .01$, indicating that a high level of expertise supports composing processes. The second predictor of the model is the factor of support in SRS, adjR^2= .26, $F(2, 254)= 46.09$ $p < .01$, suggesting that such a dimension has a higher impact on composing processes. In the above statistics, adjR^2 refers to the adjusted coefficient of determination (adjusted *R*-squared).

General Discussion and Conclusions

The present article reports on the construction and psychometric analysis of PRCS, the *Processes and Relationships in Composers Scale*. This is a novel measure for the self-assessment of those creative and social factors that arguably inhere in the process of composing music. To analytically distinguish between the two, and better examine their reciprocal interactions, the PRCS was designed to involve two separate scales of 12 items each: CPS (*Composing Processes Scale*) and SRS (*Social Relationship Scale*). Based on our analysis, the factor solutions display satisfactory fit in our sample and both scales exhibit sufficient reliability.

An exploratory factor analysis found no relationship between observed variables for the CPS scale, giving rise to a single factor structure; the SRS scale was found instead to rely on the three main factors of loneliness, support, and friendship. A Cronbach's Alpha test showed the total score of the CPS to be highly reliable, whereas the SRS obtained a lower score (0.62), which was accepted given the preliminary nature of our study. Taken together, these findings highlight the capacity of our construct to contribute new insights into how creative and social processes can be self-assessed by music composers with different backgrounds and levels of musical expertise. In general terms, this provides an important resource for research interested in exploring the intersection between creativity and social relationships in daily life from a quantitative perspective. Such a broad theme has been addressed in several contributions and has a long history in creativity research and theory (Amabile, 1982a, 1983; Arieti, 1976; Glăveanu, 2013; Mead, 1938; Stein, 1953).

With this in mind, our study takes a more focused approach by using music composition as a domain-specific test-case. By examining the relationship between musical creativity and sociality, we aim to contribute to a deeper understanding of how musical activity and its creative manifestations relate to the social dynamics that permeate our lives. Accordingly, our research contributes to existing scholarship that explored the connection between creativity and sociality in musical activities specifically. This work posits that creative musical thought and action might be best understood as co-constituted by individuals and groups at different levels (Bishop, 2018; Borgo, 2005; van der Schyff et al., 2018), and includes situations where musical "others" (e.g., co-performers, teachers, audience members) are not physically present (Høffding & Satne, 2019; Schiavio, Moran, et al., 2022). Indeed, recent scholarship has put forward the view

that a range of musical creativities can be conceived of as intrinsically social even when musicians or composers are alone, calling into question views of creativity that remain too focused on the individual agent in their solitary activity.

This last point reveals music as a phenomenon in which traces of intersubjectivity may be found in ostensibly solo creative work (see Cook, 2018, Moran, 2014). Such a realization warrants further investigation into the intricate relationship between creativity and social life. Qualitative data recently reported by Schiavio, Ryan, et al. (2022) suggest that playing music alone often involves experiencing a sense of the presence of others. This feeling stems from a creative re-enactment of shared practices or an anticipated experience of music-making in a social context, where musicians may mentally construct or imagine "virtual others" during their solitary musical activity. It might therefore be argued that, in a sense, individual musical choices are never fully independent from broader social dynamics. It is well known that creativity involves interacting with those around us (see e.g., Sawyer, 2003; Simonton, 2019), suggesting that seemingly isolated musical practices are complexly intertwined with social factors that permeate creative and expressive musical outcomes of individuals and groups.

Among others, one particular element that may play an important role in shaping self-assessed composing processes might be that of gender. Indeed, we note that participants who identified as females reported a lower level in the CPS than those who identified as males. This indicates a worrying trend where female composers appear to self-assess themselves as less creative than those who identified as males. This trend is consistent with previous research on gender bias in music, particularly in Western classical music, which has historically been dominated by male musicians (see Colley et al., 2003; O'Neill, 1997). The lack of female representation in music has been attributed to various factors, including gender stereotypes and social norms that shape individuals' perceptions of music and music-making. For instance, as reported by Werner and colleagues (2020), a number of contributions have shown how gender bias impacts orchestras selection procedures (Goldin & Rouse, 2000). Addressing similar biases requires a concerted effort from all stakeholders, including educators, performers, and industry leaders, to promote gender diversity and inclusivity in music. We thus hope that future indices concerned with musical creativity will consider more deeply the factor of gender and explore concrete ways to support a more balanced music industry.

Among the Pearson's correlations reported in Table 6 (in Study 2), probably the most interesting are those between CPS and the factors of skill level and teaching. Additionally, our findings show that two factors of the SRS have a predictive impact on the CPS score: skill level and support. It is perhaps not surprising that a high level of expertise would influence the individual's composing process. However, it is noteworthy to see that the social support that composers experience in their broader environment can affect their creative output and that teaching is positively related to self-assessment of creative processes. The former finding is particularly interesting when considering the existing literature on creative cognition and its links with a supportive social environment. As reported by Tan and colleagues (2022), for example, the positive relationship between creativity and social support can be considered solid from both theoretical and empirical perspectives. From a conceptual standpoint, the link appears to be supported by so-called *self-determination theory* (Ryan & Deci, 2000), which assumes that three main psychological needs (autonomy, competence, and relatedness) can be enhanced by a supportive social environment and in turn become fundamental to boost creativity. Empirically, well known research by Amabile (1979; 1982b) showed that participants who were told their artistic work would be evaluated and those who competed to win a reward for their artistic endeavors produced fewer creative outputs than participants who were not being evaluated or competing for a reward. As reported by Cropley (2006), an extensive analysis of 20th-century British novelists conducted by Crozier (1999) revealed that social support factors played a significant role in their creative productivity. And similarly, Csikszentmihalyi (1988) asserted that social support networks are crucial determinants of creativity in the lives of individual creators.

Before we conclude, we should note that our study involves some limitations that should be addressed in future research. One important limitation is the need for independent validation of the CPS scale. While our results provide promising initial evidence for the validity of the CPS scale, further validation studies are needed to establish its psychometric properties and assess its usefulness in different populations and contexts. Yet, our reliable and valid tool can already help to provide a more comprehensive and nuanced understanding of how musical creativity and sociality are related. This knowledge can be useful for a wide range of fields and can help individuals and communities to foster creativity and social connectedness through musical activities. Additionally, variables pertaining to the distribution of composition activities based on respondents' music domains—such as classical music, popular

music, or other genres—were not included in this analysis. Future work could examine whether inclusion of these categories corroborates further our findings.

One potential application of our tool is in the context of music education: aspiring composers often receive feedback on their work from their teachers, peers, and other musical experts, but these evaluations may not consider the social and creative processes that underlie their compositions. By using our tool to self-assess their own work, composers can gain a deeper understanding of their own strengths and weaknesses, and how these relate to their creative and social processes. This self-assessment process can pave the way to open forms of communication with others, leading to more comprehensive evaluation methods. This goal resonates with recent research in music and social justice which highlights how assessment criteria need to be negotiated so that identification of what is important and amenable to intervention (i.e., for formative assessment) can be facilitated (see Fautley, 2015). Another potential application is in the context of music therapy. Music therapists may often work with clients who are struggling with social isolation, anxiety, and other mental health challenges that may exert a considerable influence on their creative potential (see e.g., Erkkilä et al., 2012; Wilson & MacDonald, 2019). By using our tool to assess the social and creative processes that underlie their clients' musical expressions, therapists can gain insights into the ways in which music can be used to promote social connection, emotional expression, and other positive outcomes. As these examples illustrate, our psychometric tool may offer a structured and generalizable resource to understand the relationship between musical creativity and social connections in a range of different domains. We thus look forward to seeing concrete applications of our inventory in these areas and beyond.

Author Note

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Data and instruments used in this study is available at: https://osf.io/dcngk/?view_only=0d2d86383af94baabe3390ac701b63f7

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