## A model for the individual decision process in collective free improvisations

### MODALIDADE: COMUNICAÇÃO

SUBÁREA: Composição e Sonologia

Arthur Faraco Universidade de São Paulo arthurfaraco67@gmail.com

Abstract. We propose here a theoretical model for the individual decision process that happens during collective free improvisations (CFI for short), informed by cognitive theories of human judgment, decision and choice, and from empirical research in CFI. This model searches to represent a cognitive process specific to CFI, based in three different phases: first, the judgment, musicians' perception and interpretation of the sound environment; second, two different decisions that have to be made by the improviser, the directional intention of the gesture (to change or maintain the sound environment) and the degree of interaction (with whom one interact and the level of influence exerted by other improvisers in one's own gestures); third, the decision regarding the musical material, a consequence from the previous decisions. Such a process results in a choice (the observed behavior), aggregated to the collective sound result, that is further evaluated, in an iterative process. We also argue that each decision process is intertwined, and the improviser assigns a weight to each decision dependending on the context. Finally, our model assumes the influence of external factors such as familiarity between musicians and group size. We argue that our model of individual decision is complementary to current CFI models, and can be an interesting framework to understand how musicians coordinate in a referent-free, non-idiomatic practice such as CFI.

Keywords. Collective free improvisation, decision, choice, cognitive models

#### Título. Modelo do Processo de Decisão Individual em Improvisações Livres Coletivas

Resumo. Propomos neste trabalho um modelo teórico para o processo de decisão individual que ocorre durante as improvisações livres coletivas (ILC), informado pelas teorias cognitivas do julgamento, decisão e escolha humana, e pela investigação empírica em ILC. Tal modelo busca representar um processo cognitivo específico da ILC, e baseiase em três fases diferentes: primeiro, o *julgamento*, a perceção e interpretação do ambiente sonoro por parte dos músicos; segundo, duas decisões diferentes, a intenção direcional do gesto (para mudar ou manter o ambiente sonoro) e o grau de interação (com quem se interage e o nível de influência exercido por outros improvisadores nos seus próprios gestos); terceiro, a decisão do material musical, uma consequência das decisões anteriores. Este processo de decisão resulta em uma escolha (o comportamento observado), que é agregado ao resultado sonoro coletivo, posteriormente avaliado, em um processo iterativo. Argumentamos também que cada processo de decisão está interligado e que o improvisador atribui um peso a cada escolha, dependendo do contexto. Finalmente, tal modelo também assume a influência de fatores externos, como a familiaridade entre os músicos e a dimensão do grupo. Argumentamos que o nosso modelo de decisão individual é complementar aos modelos atuais de ILC, e pode ser interessante para compreender como os músicos se coordenam em uma prática não idiomática e sem referentes como a ILC.

Palavras-chave. Improvisação livre coletiva, decisão, escolha, modelos cognitivos

### Introduction

Collective free improvisation (CFI for short) is usually defined as a referent free and non-idiomatic type of improvisation (Pressing, 1988; Bailey, 1993; Saint-Germier and Canonne, 2020), as its construction relies mostly on the sonic propositions made on the spot by improvisers and their interaction. According to Jeff Pressing (1988, p. 346), the referent is an "underlying formal scheme or guiding image specific to a given piece, used by the improviser to facilitate the generation and editing of improvised behavior on an intermediate time scale". In CFI, musicians do not agree beforehand on a plan or a structure for the improvisation; also, there are no harmonic, melodic, rhythmic or formal constructs that are used as base to improvise. Musicians rely primarily on their musical gestures that are created in the course of the improvisation, usually distancing themselves from idiosyncratic elements from established musical genres.

In a recent study, as we'll further describe, Canonne and Aucouturier (2016) demonstrated that there are shared mental models among experienced CFI musicians, which are considered task-specific rather than piece-specific. That is, improvisers have a higher-level knowledge about what it is to freely improvise rather than sharing a common knowledge about specific elements of a piece (in a jazz standard, for example). Thus, in view of the specifics of this practice, one can assume that the decisions made by an improviser during CFI performances differ from those in idiomatic improvisations. Our objective in this paper is to propose a model for the decision process in CFI, departing from known improvisation models such as the ones of Jeff Pressing (1988) and Canonne and Garnier (2011). We define our model based on Howard Rachlin's (1989) vision on judgment, decision and choice and cognitive decision theory. In summary, our model consists first of a judgment-the perception and analysis of the musician of the sound environment-, and three different decisions: directional intentions, degree of interaction and musical material. The first relates to the decision in maintaining or changing the current sound environment; the second relates to whom and to which degree an improviser wants to interact; finally, these two decisions inform the last: the musical material used in order to express the previous decisions. We also account for external factors that can influence these decisions, such as familiarity and group size.

We first analyze the two aforementioned improvisation models and their specifics; second, we describe the concepts of judgment, decision and choice, based on Howard Rachlin's

(1989) theory, and the three decisions in our model, presenting recent theoretical and empirical research that grounds our model. We also analyze the possible influences of the external factors and why they are important to understand the decision process in CFI. Lastly, we search to demonstrate how our model can be complementary to other CFI models, discussing possibilities for empirical research.

### **Improvisation models**

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As we'll further describe, our model is specific to CFI practices, and regards the individual decision processes. However, theoretical models of both improvisation in general and CFI have already been made. Jeff Pressing's (1988) model regards individual improvisations that have a defined referent (although it can be generalized to referent-free improvisations such as CFI), and starts from an understanding of improvisation as a sequence of non-overlapping sections. Each section contains musical events (a cluster of events - "a group of notes, one or more gestures or phrases, etc." [Pressing, 1988, p. 153]), and each new section is generated from certain elements: previous events, long-term memory, current goals and referent. To accomplish this division into sections of event clusters, Pressing assumes that there are triggers at specific time points that "instigate the movement patterns appropriate to effect intended musical actions" (1998, p. 153). These time points refer to the improviser's decision-making moments (which in turn marks a change in the improvisatory flow).

The moment of "change", according to Pressing's model, occurs when the musician reaches a tolerance for repetition (which is individual). In that moment, the improviser searches to change to a different cluster of events in two ways: an *association* or an *interrupt* generation. The main difference between these two ways relies on the cognitive strength of certain musical elements (which will not be detailed for the sake of length; see Pressing [1988, p. 154-156]). If the musician keeps certain elements (for example, a rhythmic pattern, but changing the pitches used), it is called an *association* generation given that the new cluster of events is somehow related to the previous one. Thus, it is usually perceived as a continuation rather than a change, since the musician chooses to keep some aspects from the past cluster of events. Consequently, an *interrupt* generation happens when the improviser abandons all elements of the current cluster of events, and starts a new musical gesture with no association with the previous one.

Canonne and Garnier's (2011) CFI model is inspired by Pressing's model, and searches to "[...] determine if, and within which conditions, a collective structure can emerge from CFI" (Canonne; Garnier, 2011, p. 2). A collective structure is defined as moments in

which musicians are coordinated, that is, they achieve a sense of *flow* (Sawyer, 2003). Achieving coordination in CFI can also mean that musicians achieve a stable sonic identity during a certain period of time, by mechanisms of *emergent coordination* (which occurs when individuals have no specific plan in realizing joint actions) and *planified coordination* (when individuals' behaviors are guided by desired results of the joint actions) (Knoblich; Butterfill; Sebanz, 2011; Saint-Germier; Canonne, 2020).

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The authors' model relies on two main variables: *intention* and *objective* of a musician. Intention is defined as the "[...] ideal signal that the musician would like to deliver" (Canonne; Garnier, 2011, p. 4). The signal, in this case, is not related to acoustical information but rather to the relative complexity of a musical gesture (a cluster in the piano would be more complex than a triad, in the authors' example). Therefore, improvisers' intentions are always more complex than the acoustic signal, given the information loss that happens from the pretended signal (the intention) and its acoustic realization. The dynamics of this intention depend on the signals of the other musicians (and not on the intentions of the other improvisers, since this is not known by the musician under analysis). The objective, according to the authors, defines the value towards which the intention tends on a longer time scale than that of the cluster of events (Canonne; Garnier, 2011, p. 6), i.e., it is a representation of the intention on a long time scale (in a sequence, for example). It functions as a control mechanism for the model, influencing the direction and evolution of musicians intentions.

Individual sequences are then understood as moments in which the musician has a defined objective which guides their intention. When individual sequences from multiple improvisers have constant intentions, it can be said that a collective structure emerges and coordination happens. Finally, the authors raise two elements that are influential for a individual sequence change: *cognitive load*, the attentional limit of an improviser, and *boredom*, when a sequence is no longer interesting for a musician,

Overall, both models rely on the notion that improvisation, even CFI, can be understood by a *segmental form*, in which there are individual and collective structures that are characterized by a stable sonic identity. In the case of CFI, these collective structures are achieved when musicians coordinate their actions, with a stable intention. Evidence of a segmental form in CFI was found in recent empirical research, such as Canonne and Garnier (2012; 2015). Now, we turn to our model of the individual decision process and show how it can integrate both models here analyzed.

### A model for the individual decision process in CFI

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Our proposed model can be considered as a decision-making process, and it describes cognitive processes of the musician in order to generate their intention (that is, the ideal signal that they would like to execute, as described by Canonne and Garnier [2011]). It is based on Howard Rachlin's (1989) theory of human decision, and comprises a moment of judgment (perception and analysis of the sound environment), and three different decisions. We'll now approach Rachlin's theory and specify each of the parts of our model.

#### Judgment, choice and decision: Howard Rachlin's theory

Howard Rachlin's (1989) objective in his book "Judgment, Decision and Choice: A cognitive/behavioral synthesis" was to demonstrate that cognitive decision-making theories and the behaviorist choice theory are not incompatible. Although this debate is beyond the scope of this paper, it is important to understand that the author's perspective is closely related to these psychological theories and adheres to their underlying assumptions. Our model is mostly based on cognitive decision theory, as we aim to study internal processes (decisions) that lead to a choice (observable behavior).

According to cognitive decision theory, every decision-making process involves a judgment, which is an inherently internal process that "[...] you might not verbally express the output or even be conscious of it" (Rachlin, 1989, p. 44). Also, according to the author, "[...] a judgment is always a stage in a wider decision process in which a choice is eventually made and an outcome is experienced" (Rachlin, 1989, p. 44). We can then assume that judgment is a guide to behavior, and involves assessing the values, probabilities, and potential results of different options. It's a cognitive process that precedes making a decision, and is a critical step where the value of different outcomes is compared and considered. Also, according to Rachlin, individuals make, more often than not, judgment errors caused by heuristics (biases, errors of perception, etc.), which can lead to decisions and choices that are not satisfactory. After the judgment, there is the act of making a decision between the alternatives presented. Usually, a decision is defined based on subjective probabilities and on assigned values on each alternative by the person making the decision. When the decision is made it is translated to behavior, and further evaluated (if it was a good or bad choice). Finally, the expression of this decision is considered a choice: the observable behavior.

Rachlin summarizes the decision making process in cognitive theory: first, a complex situation is presented with multiple choices and associated outcomes, framed within a context;

second, a person perceives and internally represents the situation, translating objective properties into subjective ones; third, the person compares the alternatives; and finally, the internal decision is converted into an observable choice or behavior (Rachlin, 1989).

In CFI, improvisers constantly face complex situations in which they need to evaluate the sound environment in order to decide what they will play next. Objective properties of the performance (the overall sound result, improvisers' movements, etc.) are internally represented and judged by the improviser. We propose here that, after this judgment and the creation of an internal representation of the situation, they are faced with three different decisions, which will result in the *intention* of the improviser (Canonne and Garnier, 2011). That is, these decisions are cognitive processes which will result in a choice, the behavior of the improviser. In our model, these decisions are: *directional intention* of the musical gesture; the *degree of interaction* aimed; the *musical material*. We'll approach each decision in the following subsections.

#### **Directional Intentions**

Directional intentions are defined as whether the improviser wants to change or maintain the current sound environment of the improvisation. As CFI is a highly interactive practice, in which the music is created by the proposition of musical gestures and the interaction between musicians without a specific referent, improvisers have to decide whether they would like to keep the collective group sound or if they would like to change it. In Canonne and Garnier's (2011) CFI model, these moments of change in the directional intention would happen when either the cognitive load or the boredom of the musician achieves high levels, resulting in an individual sequence change. However, it is important to notice that a change in an individual sequence does not necessarily result or intends to change the collective sequence: it could happen, for example, that an association generation (as in Pressing's model) could be used in order to further develop a certain group idea.

The use of the name *directional intentions* in order to address the extent to which the improviser wants to maintain or change the group sound was first made by Goupil *et al.* (2020), in a paper in which the authors analyzed the influence of group size in a CFI ensemble, using directional intentions as a variable in order to measure certain aspects of coordination. However, the concept of the decision between maintaining the sound environment or changing it as a decisive aspect for the improviser in CFI is not new. For example, Wilson and MacDonald (2015, p. 7) provided a "model for the process of individual choice during group musical improvisation", derived from interviews with CFI musicians after they performed (in a

controlled environment). Their model resembles ours as it starts with an evaluation and a choice between maintaining the sound environment or changing it. The change, according to their model, can be done by initiating a new gesture or by responding to a gesture from another musician. This response can be made by adoption, augmentation or contrast, in relation to the other improviser's musical gesture.

We follow Wilson and MacDonald (2015) in saying that directional intentions are a crucial part of freely improvising. However, it is not the sole decision present in a performance. Also, directional intentions refers to the willingness to maintain or change the group sound, that is, keeping an identity or trying to change it and establish a new collective structure. We need also to account for individual changes, especially those made by association generations, which are not made with the objective to change the collective structure, but rather to adapt a musical gesture to the current sound environment and avoid repetition.

### **Degree of Interaction**

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Degree of interaction is defined in two ways: first, with whom the improviser wants to interact and to which degree; second, the degree to which the musical gesture of other musicians influences one's own gesture. Of course, there is a natural tendency in CFI performers to interact mostly with the collective sound result instead of with individual musicians. However, there are moments where improvisers tend to "divide" their attention between individuals for multiple reasons (interest, coordinating a new sequence, imitation, etc.). For example, XXX<sup>1</sup>, demonstrated that although there is a preference for a global listening behavior, there are moments (articulations of a new sequence or salient events) in which musicians direct their listening towards themselves or to a specific musician. This shows how there are moments in CFI performances that musicians choose to focus on a specific musician (or a group of musicians) in order to interact. A specific study in interaction was conducted by Golvet et al. (2023) with duos performing free improvisations, and investigated what the authors' considered as *relational intents*: to play with, against or without the other improviser. The first represents a cooperative interaction, while the second and the former represent an uncooperative interaction (to play against is when a "[...] given musician does not intend to cooperate with the other", while playing without is when a "given musician does not intend to interact with the other" [Golvet et al., 2021, p. 2]). Results of this study indicated that, at an individual level, musicians tended to play with their co-improviser (in a cooperative way), although in a group

1 Omitted for anonymity.

level "musicians tended to combine their relational intents in such a way as to create interactional dissensus" (Golvet *et al*, 2021, p. 1), with familiarity between musicians and copresence (if they were in the same room or not) acted as "interaction smoothers", influencing "relational plasticity"–greater movement between the different relational intents–and a greater exploration of non-cooperative behavior (Golvet *et al.*, 2021).

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A subsequent study from Wolf, Goupil and Canonne (2023), based on excerpts of the improvisations recorded for the experiment in Golvet *et al.* (2021), addressed whether the attested interactional dissensus at the group level behavior affected the perception of creativity and tension by third-party listeners. Results from this study showed that "musical snippets exhibiting interactional dissensus were rated as more creative by expert third-party listeners than consensual snippets, and that the degree of interactional dissensus between the performers predicts the tension perceived within the music by expert third-party listeners" (Wolf; Goupil; Canonne, 2023, p. 1).

The aforementioned studies show how there is a decision process that happens in CFI performances in which the musicians decide whether they will interact with a specific musician (or group of) or with the collective sound result, and to which degree they will interact. We believe that, in order to understand this degree of interaction, we have also to understand to which degree the improviser is influenced by other musicians' gestures. That is, and using Canonne and Garnier (2011) concepts, how much does the signal of another improviser influences one's intentions. The degree of interaction thus dictates whether the musician will maintain their own gesture or if they will make association generations in order to interact differently with the sound environment.

#### **Musical Material**

The last decision in our model refers to which musical material the improviser will use in order to express their intention, informed by the last two decisions. In our visualization of the model (see Figure 1 below), this last decision comes after the directional intentions and the degree of interaction since it has to be informed by these. Following Canonne and Garnier's (2011) model, the musical material is the expression of the signal that is derived from the intention (of which our model is a part) and the objective. Therefore, it contains the information from the decisions made by the improviser.

However, as shown before, both directional intentions and the degree of interaction are general concepts that can be experimentally measured, as they depend on the context but can be generalized (that is, they can be measured in similar ways in different improvisations). Musical material, however, is completely dependent on the context of the improvisation and from both decisions made beforehand. Therefore, it cannot be generalized: a similar musical material used in an improvisation can assume another intention when used in another improvisation. However, we searched for ways to analyze musical material, such as in an experiment conducted in our PhD where musicians performed virtual improvisations in which an "addresser" sent real-time directions to a performer. These directions consisted exclusively of musical materials. After the performance, the performers analyzed their directional intentions in a similar manner as in Goupil *et al.* (2020), with a slider bar indicating the degree to which they thought that the directions made, we were able to analyze the types of musical material chosen by addressers in order to express their intentions, as the interaction between the musical material chosen by multiple addressers.

Following Rachlin's terms, these three decisions result in a choice, which is the perceivable action of the musician. This choice is, as aforementioned, the expression of the signal of the musician and their intentions, consisting of the decision in directional intentions and degree of interaction. This choice is then perceived by other improvisers, who then perform a judgment and the three decisions, in an iterative process. We believe that this decision process occurs constantly during the improvisation, given that the musician needs to have a constant state of attention both to their own production (self-monitoring process) and to the production of their co-improvisers.

#### **External Factors**

Finally, there are external factors that influence the decisions which constitute our model. The first to be discussed is *familiarity*. According to Saint-Germier and Canonne (2020), familiarity between musicians in a CFI group can act as a *coordination smoother*, that is, an aiding factor that benefits coordination between musicians. One hypothesis raised by Canonne and Aucouturier (2016) is that experienced CFI musicians have *shared mental models*, which are defined as "organized knowledge structures that allow individuals to organize and remember relationships among components of their environment and to construct expectations for what is likely to occur next" (Rouse; Morris, 1986). In Canonne and Aucouturier's (2016) hypothesis, musicians in CFI would have shared mental models that are not piece-specific (that is, a common representation of structural aspects of a piece, or the idiomatic forms of improvising in such genre, for example), but task-specific (what it is to freely improvise together). In the authors' experiment, they found that "[...] the degree of similarity in



Second, as shown by Goupil *et al.* (2020), even though coordination can be achieved in large CFI ensembles, there is a tendency of forming sub-groups, with a more localized coordination. It is common for CFI musicians to comment that group size alters their way of playing, given the increase of information that is proportional to the increase in group size. Therefore, it can affect the way that musicians perform the decisions described in our model. For example, one could decide that they would like a complete change of the group sound. In a duo or trio setting, a complete change is highly noticeable, while in a large group this change can be masked by other elements happening. Also, this change can be localized in a sub-group of improvisers, not changing the whole collective sound. Furthermore, the degree of interaction is more important in large ensembles, especially due to this tendency of forming sub-groups. Future research could then use different group sizes as a variable in order to study the decisions here proposed.

Finally, we provide a visual conceptualization of the model, with the three main decision processes (Figure 1). Note that there are no direct pathways from the judgment to the musical material. We believe that even in the most simple cases, such as maintaining a constant gesture, decisions on directional intentions and degree of interaction have to be made and inform the decision on the musical material. Also, the decision on musical material comes after directional intentions and degree of interaction, since it is informed by them.

Figure 1 – Visual conceptualization of the model





### **Final Considerations**

We believe that our model for the individual decision-making process in CFI integrates Canonne and Garnier's (2011) CFI model. The authors' model is a macroscopic view of the dynamics of individual sequences (and, consequently, emergent collective structures) that are based on musicians' intentions that are controlled by objectives. The decisions on our model are closely related, or are a part of, the *intentions* of the improviser. By realizing a judgment of the overall sound result of the improvisation, musicians create an intention, which can be decomposed into three decisions: the directional intention (do I want to maintain my individual sequence or change it?) and the degree of interaction (with whom do I want to interact and to which extent?); these two decisions are then summarized in the decision of the musical material intended to express the improviser's intention, and is then executed.

As mentioned by Canonne and Garnier (2011), the expressed signal always suffers from loss of information, and that is why the individual decision process is iterative: besides analyzing the collective sound result, the improviser also realizes judgments on their own musical gesture, in order to compare its result to their intention. The decisions in our model can also be integrated to the notions of *interrupt* and *association* generation in Pressing's (1988) model: while keeping a constant intention (thus maintaining a similar directional intention and degree of interaction), an individual sequence is established. When there is a change in one or both of the choices, it constitutes a change in said individual sequence, which can be by *association* (keeping certain aspects of the previous intention and signal) or by *interruption* (a completely new gesture). Finally, external factors such as familiarity and group size influences the way that musicians develop their intentions and, in consequence, how they deal with their decision-making process. Overall, we believe that our model for individual decision in CFI can further contribute to the understanding of the cognitive processes of improvisers invested in such practice, and can be an interesting framework for empirical research in coordination in CFI.

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