The Role of Eye Gaze and Body Movements in Turn-Taking during a Contemporary Dance Improvisation

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Abstract

This paper intends to contribute to the multimodal turn-taking literature by presenting data collected in an improvisation session in the context of the performing arts and its quali-quantitative analysis, where the focus is on how gaze and the full body participate in the interaction. Five expert performers joined Portuguese contemporary choreographer, João Fiadeiro, in practicing his Real Time Composition Method during an improvisation session, which was recorded and annotated for this study. A micro-analysis of portions of the session was conducted using ELAN. We found that intersubjectivity was avoided during this performance, both in the performers' bodily movements and mutual gaze; we extrapolate that peripheral vision was chiefly deployed as a regulating strategy by these experts to coordinate turn-taking. A macro-analysis comparing the data with an analogous one obtained from Non-Performers provides the context for a discussion on multimodality and decision-making.

Index Terms: gaze, non-verbal behavior, silent turn-taking, gesture function, decision-making, performing arts, inter-rater agreement

1. Introduction

Humans regulate their contributions in social interactions using practices, norms, and rules depending on the nature of their exchanges (inter alia [1]), whether it be by using prosody to solicit a reply to a question or realizing who goes next around the table during a hand of poker. The present study intends to contribute to the multimodal turn-taking literature by presenting data collected in a group contemporary dance improvisation where speech is absent. The quali-quantitative analysis presents preliminary results of how body movements alone (i.e. without the support of language) have the onerous of communicating and coordinating in the interaction.

For the purpose of this study, five expert performers joined internationally renown Portuguese contemporary choreographer, João Fiadeiro, in practicing his Real Time Composition (RTC) Method (or *Composição em Tempo Real*; [2]). Fiadeiro, one of the founders of the *Nova Dança Portuguesa* in the 1980s, created the so-called "RTC Game" in 1995 as an improvisation exercise in order to provide choreographers and performers a methodological tool for composing artistic works.

Applying the method, the artists take turns performing in a delimited space in the studio, following a process of creating relations with previous actions in the piece. Although Fiadero's method invites performers to use their bodies on a stage floor, he also uses a variation using props on a table. As the performers sit around the table, and through means of self-selection, they perform a single action at a time on the Game Table with props taken from the Objects Table to develop compositions. This improvisational performance is called a "Game". Creative and innovative ideas and material for stage compositions and other types of performances are generated collaboratively through what emerges throughout the Game.

Unlike other research done on "expressive gestures" in the domain of dance (inter alia [3]), which focuses on those non-verbal behaviors having an affective content (concerning the performer's persona's mood, feelings, emotions, etc.) which performers have rehearsed and act out on stage, we are more interested in the behavior which is less monitored and not explicitly intended for an audience. The focus of this study is more on the "behind the scenes" behavior, concentrating on those moments where expert performers are not performing per se, but have to make decisions of what, how, and if to perform next and at which moment during an improvisation, and all in coordination with their fellow performers' behavior.

In contrast to previous studies on turn-taking in social interactions, the context of this inquiry is linguistically independent, and there are no regulated turns in the traditional sense. Performers do not talk to each other during the improvisation unless their speech is being used as artistic material. They are also free to choose to perform in the improvisation or not, but only a single action at a time, and not twice in a row. Nonetheless, there is social communication: turns are coordinated by the information "given" (e.g. moving towards the table to perform) and information "given off" (e.g. via gaze or other body movements) [4].

Various studies investigating the co-occurrence of speech and gestures in the turn-taking scenario confirm that interlocutors systematically use their non-verbal behavior to coordinate the conversational flow. The gesture involvements in the regulative process of turn-taking mechanism was sufficiently examined in previous research in multi-party conversations [5, 6], but mainly in dyadic situations [7, 8], suggesting that people deploy a broad scope of body movements to yield or grab the floor (e.g. pointing gestures [9], head movements [10, 11], eye gaze [12, 13, 14], and body posture [15, 16]).

To our knowledge, ours is the first study to address the issue of turn-taking where speech is accessible but not used. This study intends to describe and analyze what non-verbal strate-

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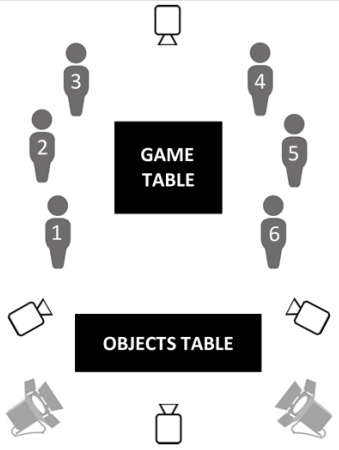

Figure 1: Schematic representation of the setup.

gies are deployed in coordinating complex turn-taking actions in a creative multiparty social interaction where speech is not involved, and whether or not these strategies are analogous to other social interactions where speech is co-present. We will compare what has been described in the literature with the analysis of empirical data to address the question of how performers coordinate their bodies differently by looking at the cues they "give" and "give off" when the speech channel is not used as a communicative tool. We will also describe qualitatively the role of decision-making in the improvisational performance.

2. Methods

2.1. Participants

Five Expert performers who were also practitioners of RTC participated in the study alongside the choreographer Fiadeiro for a group total of six. All participants had at least eight years of professional dance/performance formal training and experience, and on average three years of formal training and experience in Fiadeiro's method. The group was balanced for gender (3 females and 3 males) and culturally mixed (Portuguese and non-Portuguese). Participants were between the ages of 26-41 and proficient in English, which was the common working language, although the Game performances were silent.

2.2. Materials and Procedure

The study was conducted at the RE.AL Atelier, Fiadeiro's studio in Lisbon. The six participants were seated about 1.5m away from and around the Game Table, the focal point of the Game performance. Props to be used during the improvisation exercise were readily available on the Objects Table (Fig. 1).

The study was conducted in a 3.5-hour session, which included briefing, debriefing and breaks between improvisation exercises. After having been informed and given their consent, participants were briefed and had 2.5 hours to perform various Games.

2.3. Data and annotation

The collected video data of the Game performance, excluding briefing, debriefing and breaks, totals 51 minutes. Given the lack of resources to annotate the entire data, a sampling destined for micro-analysis of at least the first 10% of the Game performance was decided a priori. This data subset of the first six minutes of Expert Game performance was processed, annotating the movements of each of the six participants.

An annotation scheme was created in-house for the purpose of this study. In order to investigate how the performers interpret their co-performers' bodily signals, and thus anticipate the communicative flow in their current social environment, the focus of the annotation scheme was on the their visible behavior, as it was perceived and interpreted by those sharing that particular context. This including all movements, gross or fine, that other participants potentially noticed and as they were captured by the four HD cameras.

The annotation scheme codes for information related to:

1. directedness behavior (spatial location and orientation of the body, gaze points, object interaction);
2. a formal description of each movement unit, or MU (i.e. a gestural complex marked by the distinct change of the articulator's configuration or position in space) of the head/face, upper body, and lower body articulators. Each annotation was comprised of the temporal segmentation (defined by each MU's onset and offset) and a label indicating the articulator(s) formally and actively involved;
3. a hermeneutic tier categorizing the functional-semiotic interpretation of the MUs. Each MU temporal segmentation was labeled according to one of the three functions below. This functional taxonomy is a semiotic classification, based on Peircean relations of firstness, secondness, and thirdness [17]. This follows a hierarchical taxonomy where the higher order builds on (and includes) the lower one(s):
   (a) self-focused MUs (purely physical movements meant for the self; e.g. fidgeting, stretching);
   (b) context-focused MUs (relational movements establishing a physical or cognitive relation of orientation, attention, volition, etc.; e.g. orientational head-turns, action-oriented movements, deliberate attention-gaining actions, etc.);
   (c) communication-focused MUs (representational movements, having a symbolic or social nature; e.g. polite smiles, symbolic-communicative gazes, etc.).

Semiotically speaking, any body movement could be inferred and construed as communicating something, even when the person does not have the intention of communicating that. For example, we may infer that a person fidgeting is nervous, but that would not necessarily make that action communication-focused (unless it was done deliberately to convey that sense). Our analysis is obviously not from the production perspective: we do not have access to what the participants were thinking while they were performing these body movements. We can, however, speculate that from an interpretative perspective a certain movement was intended to be communicative (in a strict sense) or not, notwithstanding what information can be inferred.

The first two levels of annotation have a more objective quality (for example, the participant is seated or is moving to a new location; there was movement or not in the left hand, right leg, head, etc.), whereas the last level, based on the previous formal MU segmentations, describes raters' subjective interpretation of the performers' movements before, during and after

Table 1: The global results of the inter-rater agreement obtained from the modified Cohen's kappa [18] calculated in ELAN. The measurement was conducted using data from three participants of the 6-minute subset.

	Global results		
Participant	*kappa*	*kappa_max*	*raw_agreement*
P4	0.6352	0.7590	0.6500
P5	0.9041	0.9281	0.9111
P6	0.9516	0.9516	0.9541

Table 2: Distribution of the functions of all movement units, all participants.

		Function		
	n	self-focused	context-focused	comm.-focused
head/face	141	76	65	0
upper body	122	109	13	0
lower body	58	57	1	0
∑	321	242	79	0

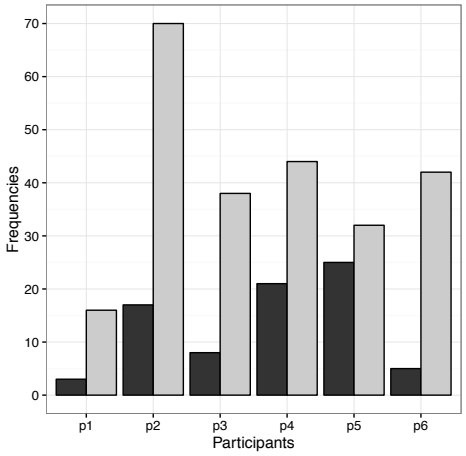

Figure 2: The relative frequencies of functions detected in the head/face, lower and upper body regions of the six Expert participants. Only context-focused (dark gray) and self-focused (light gray) movements were present in the data (zero instances of communication-focused MUs).

their actions. According to high inter-rater agreement (see below), we extrapolate that co-participants who attended to these same movements interpreted each other's behavior in a similar way.

2.4. Inter-rater agreement and data reliability

Because of the importance of data validity and reliability in any research endeavor, working with a reliable annotation scheme was crucial for this study. For this, the scheme was gradually improved upon and eventually tested on the data collected from pilot studies. Two annotators processed a sample from the first pilot study using the annotation scheme, which was critically discussed and reviewed.

The revised version of the scheme was then applied to a sample from the second pilot data for validation. The result of the modified Cohen's kappa [18], calculated in ELAN, produced a global agreement of κ= 0.8685, considered an "almost perfect agreement" [19]. This value confirmed the validity of the annotation scheme, which was then used on the final data.

Two raters annotated three of the six participants, 50% of the data, using the final version of the annotation scheme. Based on the kappa obtained from this sample (Tab. 1), one annotator proceeded confidently with the coding of the remaining 50% of the data.

3. Results

3.1. Quantitative results

The data from the Expert Game performance yielded a total of 1186 annotations. The comparison of all movement unit (MU) functions across participants indicates variety across individuals (Fig. 2); nonetheless, trends in the data do emerge, and some generalizations can be made with regards to both the body movement data and the gaze data. In particular, unlike in more common, everyday social interactions, we found that intersubjectivity was avoided during this performance of contemporary dance improvisation. These results will be discussed below.

3.1.1. Gesture and body-movement function data

The data indicates that the participants performed three times as many self-focused movements (*n*= 242) than context-focused movements (*n*= 79; see Tab. 2). About half of these self-focused movements were produced in the upper body; in fact all but 13 MUs performed with the upper body were self-focused. One out of every three self-focused MUs were produced with fingers and one or both hands (*n*= 58; 33.5%).

Context-focused movements were a third fewer, present mainly in the head/face region, clearly because of changes in head orientation between the two tables, which were the two main focal points throughout the exercise.

Zero (*n*= 0) communication-focused movements were found in the data.

3.1.2. Gaze data

The usage of the term "gaze" in this study may be better described as gaze direction or the end-point of the gaze (to other participants, to the table, etc.). The method of gaze analysis adopted is purely based on what the annotators perceptually coded in a frame-by-frame video analysis and does not include saccades and other minor movements, which may require eye-tracking devices to collect fine-grain information. This technique has been successfully adopted in previous gesture and gaze research (inter alia [7, 20]).

The data exhibits few and fleeting moments of gaze contact among participants. Considering the group as a whole and the time all participants spent looking at another participant versus looking elsewhere, each participant spent on average slightly over 10 seconds each minute glancing and looking to any other participant. Mutual eye contact, where any two participants look at each other reciprocally, amounts to 1.1 seconds in the entire 6 minutes distributed over three distinct occurrences, two of these mutual glances taking place within the first 30 seconds of the data when the Game was just underway.

3.2. Qualitative analysis

We present a preliminary qualitative macro-analysis comparing the 3.5 hour session of the Expert performers' Game interactions with analogous data collected from a parallel study involving a group of Non-Performers. This synoptic analysis focuses on features directly related to the decision-making process throughout the improvisation exercises, such as the management of turns and hesitations versus determination movements in both groups (when participants are moving from their chairs to the Objects Table). We were closely looking at torso and arm movements: determinedly leaning forward just once before standing up and/or backwards in the chairs when there is any hesitation. The differences between the two groups have been analyzed under the light of recent literature focusing on social cognition and decision-making [21]. Constraints such as common knowledge [22], alignment [23, 24] and trust [25] have been taken into account to contrast the results between groups.

Regarding how turns were managed, the Experts took much more time in between turns as opposed to the other group of Non-Performers. Turn management was much more fluid compared to the Non-Performers group, which was not as confident with the method. Experts have been trained to concentrate, taking their time before acting, and to focus only on the Game Table as they are quite used to performing the Game with Fiadeiro: there is somehow a similarity to meditation practices, where silence and control over body movements seem to rule.

As expected, Non-Performers rely much more on those strategies common in verbal social communication, such as gaze exchange. We observed many more gazes to each other and to Fiadeiro, probably looking for confirmation before acting. Moreover, their posture sitting in the chairs seems to be quite stiff.

Concerning determination versus hesitation differences between both groups, the Experts did hesitate much less before taking action than the Non-Performers, which was not surprising either, due to their very different levels of acquaintance with the Game. The Non-Performers' higher hesitation rate can also be related to the fact that they perceive the choreographers' presence as an "authority", whom they are implicitly hoping to please by following his example. They seem to need his approval and reassurance by looking at him before taking action. Another possible reason for their hesitations (either by moving on their chairs uneasily or by looking at the other participants or Fiadeiro before deciding to stand up) can be their tendency to compete with each other by trying to be the "best pupil" in the eyes of the choreographer who does not know them yet [26, 27, 28].

The Expert performers seem to be very relaxed and focused, almost as if they were meditating and reading each other's minds (mentalizing). It seems that they have developed higher-level control processes which modulate low-level reactions such as emotional impulses. Moreover, because they have been playing the Game with Fiadeiro for many years, they perceive him as one of them, not there to judge but to collaborate with (to simply play with the collective intention of creating "common ground", in Fiadeiro's words). According to [22], when acting collaboratively, each subject may automatically represent the task requirements and goals of the other subjects as well as their own.

These results suggest that prior knowledge and awareness about the potential actions of one's partners (as is the case in the Experts group) increases the awareness of the self and also increases the need to monitor one's actions.

4. Discussion

4.1. Gaze and other body-movement functions: collaborative coordination and Performance Studies

Following the details in the Results section, the data indicates differences between what is described in studies on turn-taking in more traditional social interactions where speech is present and the results found within this particular social interaction of dance improvisation. The most surprising finding is the lack of mutual gaze, fundamental for joint-attention [29], which would be expected in a silent, collaborative decision-making context where turns need to be managed and coordinated.

Although a low number of communication-focused movements (i.e. body movements performed with representational intentions and having a symbolic or social nature) were initially predicted, given the participants' background and expertise in performance, it was not expected that there be absolutely none. Zero (n= 0) communication-focused movements, were found in the data. Data from a parallel study involving non-performers indicate a greater number of communication-focused MUs in this group [30]. One explanation for this is that non-performers will fall back on those non-verbal turn-taking strategies commonly used in conversation when they know they cannot use speech (mutual gaze, facial expressions, etc.), whereas these performers have embodied other strategies that non-performers do not have available.

One out of every three self-focused MUs were produced with fingers and one or both hands (n= 58; 33.5%) and are comparable to what are described in the literature as self-adaptors. Self-adaptors are body movements, such as scratching or fidgeting, typically produced under more "stressful" conditions because their production has a self-regulating and soothing function (inter alia [31, 32, 33]). Although these performers are experts in their domain, there is nonetheless a cognitive load as they must determine what, how, when, and if to improvise next. This may explain the high number of self-focused movement units across participants.

So how is it possible that these performers collaborated and coordinated without communication-focused gestures or even gaze exchanges, let alone made an improvised composition in real time? We posit that the greatest amount of information came via peripheral vision (e.g. [34]). This idea is based on our observations (such as participants' blinking patterns), but also from self-reporting from the choreographer Fiadeiro himself. In the context of this improvisation exercise, the types of visual inputs are quite limited, and to avoid "stealing the stage", performers monitor their body movements. With regards to turn-taking, using parafoveal and peripheral vision is sufficient to detect movements, such as if someone suddenly gets out of her chair to perform.

Covert attention [35] is most likely activated by the Expert performers as a strategy while they are fixating on the Game Table without ostensibly and unnecessarily moving their heads. In other words, the Expert performers intentionally allocate their attention following the goal or task they have at hand. This endogenous orienting [36] requires broadening the scope of perceptual attention, which in turn, may affect creativity by generating more original and extra-categorical uses for the Game objects in this improvisation [37].

Gaze is sometimes treated as if it were an autonomous behavior, where the eyes just move depending on what attracts them. We would like to highlight a fact which often goes unnoticed: gaze in fact is often controlled and monitored by the person according to their context. Thus, gaze becomes an im-

portant part of the social interaction context, and much like metaphors and gestures, it is a "structuring structure" which becomes part of the speaker-gesturer's conceptual system [38, 39]. We would like to suggest gaze's relationship to the concept of Bourdieu's "habitus" [40] and practice theory, a discussion which will be addressed in another venue. The data indicates that the performers did not use mutual gaze as a primary strategy in this collaborative process or in the turn-taking. It seems that performers use gaze as a habitus and an embodied practice, in the more sociological term. This avoidance of intersubjectivity in the traditional sense is paradoxical. It is not motivated only by the desire to be focused on the creative and collaborative task of the improvisation (cognitively akin to what is described in [41]). It also serves a social function of showing the others that they are participating in that very practice of performance, and that they are adhering to what is expected of an expert performer in that context. By avoiding intersubjectivity, they are being connected with their dance partners, who expect that type of behavior, hence forming a coordinated communicative behavior [42].

One of the more interesting findings for performance studies concerns shared attention and collaborative coordination during a creative sequence. The data displays few and brief moments where everyone's gazes converge onto the same focal point simultaneously, an indication that the individuals were commonly attending to different things. There is only one longer significant moment which lasts some twenty-seven seconds where all gazes meet on the Game table. Before this stretch of time, a number of improvised actions had already been enacted by various artists. When the last action was performed, there is almost no noticeable movement activity in any of the participants' bodies and all performers are attending to what has just happened for almost half a minute, a considerable amount of time. The other performers not only may be thinking of the future (what next action could be improvised), but they are also appreciating the present moment, as evidenced by a smile which emerges on the fourth performer's face.

Fiadeiro describes a phenomenon of "real time suspension" in his method, where dancers "accept that the creative flow is suspended and that they are together suspended in the flow" (personal communication). This may well be one of these moments, as everyone is looking at their joint creation, hardly moving, until one of the dancers decides to build on the creation. What seemingly is a moment of sacred silence in the creative process, with minimal movements and the group's fixated gaze, may well be an indication of collaborative coordination. Analyses like these may allow us to use group behavioral data to better identify moments of creativity and collaboration in other research.

4.2. Decision-making and precursory gestures

A phenomenon which emerged during the analysis of this decision-making exercise of the Game, and which is not entirely described in the literature (cf. [43]), is what we have dubbed the *precursory gesture*, in that it is a tell-tale movement of the gesture that is (or was) to come.

On various occasions, before participants were going to perform an action, they made a rapid and small body movement having the qualities of a preparation phase [44], followed by an immediate retraction or a hold. For example, before moving the hand and the arm to perform an action, there would be a small movement in the same hand, moving along the same path and direction, and with the same hand shape as the subsequent gestural movement. This type of body movement could be inferred as a hesitation in the decision-making process, including the decision of whether to self-select oneself in turn-taking.

We speculatively define the precursory gesture as a gesture, or more precisely a body movement, which is imagistically and functionally related to its more complete, immediate *successor gesture*. Here we tentatively describe its anatomy, function and timing, based on the observations from our data.

The anatomy of a precursory gesture is partial and not "well-formed" [45]. It is an incomplete and reduced image of the more complex successor gesture, sharing certain formal parameters. It typically includes a retraction phase characterized by the relaxation of the muscles involved in the gesture's production and a return to its initial rest position.

In terms of function, the successor gesture executes an intentional, or directed and purposeful, action; the precursor embodies the initial hesitation to perform that action.

As for the timing, our data indicates that the duration of the precursory gesture is speculatively and generally on the order of hundreds of milliseconds, and the successor occurs after a time on the order of seconds; however, these times are relative to the size of the articulator, by virtue of the physics of larger masses (for example in precursory gestures produced by the torso versus a hand).

As opposed to other types of communication-focused human gestures, which are referential and/or representative [46], we posit that the precursory gesture is not at all symbolic; rather, it is a self-focused, neuro-physiological bodily response to an uncompleted intentional action. These gestures may very well be universal if the function is tied to the biology of the gesturer and not to a symbolic system, and analogies are present in non-human primate data (Hélène Cochet, personal communication). Precursory gestures, which we will describe more in depth in future publications, were recurrent in our data and might prove useful in other research on multimodality and decision-making. Further research is recommended to better define and clarify this phenomenon.

4.3. A note on Cohen's kappa, contingency tables, and detecting gross errors

In Gesture research, observations of non-verbal behavior are typically conducted by a close inspection of video-recordings and displayed as spatio-temporal segments on a timeline in one of the available annotation tools. The segmentation and annotation work are conducted by independent human raters, who determine the beginning and the end of the gesture movements, as well as assign labels from an annotation scheme to the segments. Exactly this decision-making process of segmentation and annotation work creates problems in calculating the value of inter-rater agreement (IRA), and thus in estimating the validity and reliability of the collected material. Although various statistical coefficients are currently used in the measurement of IRA (e.g. Fleiss' kappa [47], Krippendorff's alpha [48]), Cohen's kappa [49] still remains the mostly widely used statistical measurement in the field, mainly because the kappa value informs the researchers on raters' agreement, disagreement and their agreement by chance.

To reach IRA, we calculated a modified Cohen's kappa using a function in the ELAN software. The determination of the inter-rater reliability in the tool is based on an algorithm by [18], which has the advantage of considering not only the raters' annotation agreement but also their segmentation agreement. The IRA output presents tabular results of cross-matched annota-

Table 3: Extract of the contingency table for gaze. The dark gray cell marks the gross errors committed because of "annotator fatigue", the gray cell displays correctly matched labels between two annotators. The diagonal in light gray highlights positive crossing between raters.

	gaze_to_home	gaze_to_gameT	gaze_to_objectT	gaze_to_p1	gaze_to_p2	gaze_to_p3	Unmatched
gaze_to_home	0	0	0	0	0	0	0
gaze_to_gameT	0	22	18	0	0	0	5
gaze_to_objectT	0	0	10	0	0	0	0
gaze_to_p1	0	0	0	2	0	0	0
gaze_to_p2	0	0	0	0	14	0	3
gaze_to_p3	0	0	0	0	2	4	1
Unmatched	1	4	5	0	3	2	0

tions between two annotators (contingency tables), as well as values of agreement by chance (modified Cohen's kappa), pure raw agreement, and the Kappa maximum (see Tab. 1).

The contingency tables were used in this study as a methodological tool in the annotation process to detect gross errors committed because of "annotator fatigue". The matrix table for gaze (Tab. 3) exemplifies how a gross error was made evident after a brief examination of the table. Because of this unusual value outside of the diagonal, both raters consulted the data and noticed that one of the raters had wrongly assigned the label "gaze to objects table" (dark gray cell) 18 times as "gaze to game table" (gray). Since the two tables were placed distant from one another, this mistake cannot be considered as an interpretational misjudgment and counts simply as a gross error, rectifiable without affecting the data. We advocate the use of this procedure to eliminate any similar mistakes resulting from annotator fatigue. In our case this supported us in reaching high IRA and in confirming the reliability of our data and subsequent analyses.

5. Conclusions

This study intends to contribute to the existing literature on turn-taking, presenting a novel context, that of a contemporary dance improvisation, which is multi-party and absent of any verbal communication. Unlike in more common, everyday social interactions, we found that intersubjectivity was actively avoided during this performance of the contemporary dance improvisation of João Fiadeiro's Real Time Composition Game, both in the performers' bodily movements and mutual gaze. We extrapolate that peripheral vision was chiefly deployed as a regulating strategy by these experts during the performance to coordinate turn-taking, but social practice and habitus also played a heavy role. The data provides zero cases of communication-focused movements. Although context- and communication-focused movements were monitored by the performers, self-focused movements seemed less monitored and were in fact overwhelmingly present, a further indication that these bodily movements are produced as neurophysiological responses to a cognitive load (self-adaptors).

In the qualitative analysis, we compared the data from the Expert performers with analogous data from Non-Performers introduced to the Game. A macro-analysis of the data frames the observations under the light of recent social cognition and decision-making literature.

Furthermore, we identified a class of body movements occurring in decision-making contexts that we have dubbed "precursory gestures", and we describe the anatomy, function and timing of these bodily movements.

From a methodological perspective, we argue for using the modified Cohen's kappa (notwithstanding its shortcomings) to validate researchers' annotation schemes and to achieve inter-rater agreement between two annotators. We also advocate using contingency tables as a tool to correct for "annotator fatigue" by highlighting gross errors.

6. Future research

The current paper reports preliminary results of the data collected in a contemporary dance improvisation. Future research will compare and contrast the data from the Experts group with a Non-Performers group, focusing on gaze and body movement units and their functions, in particular self-focused ones. These data will be further analyzed within the context of sociological practice. We also intend to investigate in greater detail the phenomenon of the precursory gesture in decision-making contexts, such as turn-taking.

A broader qualitative analysis of the collected data, with a special focus on participants' individual differences, is planned. We would like to closely examine how the body "reacts" and which non-verbal signals are observable across the groups at different stages of collaborative decision-making processes such as the one presented here.

Furthermore, we aim to detail a computational model tool for the visualization of eye gaze and MU data [50] in order to better evaluate annotated data.

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