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Summary (200w)
Human interactions are organized in sequence, which is a key component of Levinson's "interaction engine." Referring back to the field where it originated, Conversation Analysis, we discuss its relevance within the interaction engine, before moving on to show how sequence organization is actually oriented to not only humans in social interaction, but also to non-human animals. On the basis of video-recorded encounters between baboons (*Papio Anubis)*, we study canonical sequences constituting openings and, within them, greetings. Openings are the *locus* where future interactants adjust to each other to coordinately enter in interaction, thus achieving a common definition of their context, activity, and relations. The analysis shows that the ways individuals spatially approach each other provide systematic interactional affordances for how the first sequences of actions in the opening are formatted, initiated, and responded to. Adopting sequential multimodal analysis, we demonstrate how participants orient to central features of sequence organization—its sequential implicativeness and the expectations it produces—building on them their interpretations of others' actions, their responsivity, and their mutual understanding of the ongoing course of action as it unfolds. This paves the way for further reflections on the pervasiveness of the interactional engine in human and non-human primate communication.

Main text

1. Introduction

The organization of social interaction as a fundamental locus of sociality is the starting point for developing the "interaction engine hypothesis" (Levinson, 2006, 2019), which considers that the interactional infrastructure precedes and makes possible language, rather than the other way around (Levinson, 2019: 189, this issue). This hypothesis has opened several avenues for conceptualizing language universals, language evolution, and the ontogenesis and phylogenesis of language, providing for a unified conceptual framework for explicating key issues in communication and cooperation with and without language, among human and non-human animals (see also Tomasello, 2010, Mélis & Rossano, this issue).

This paper focuses on a crucial dimension of the "interaction engine": sequence organization (Levinson, 2006: 45-46, 50-51). The notion of sequence has been inspired by the tradition of studies in Conversation Analysis, which developed a technical and conceptual approach to sequentiality (Schegloff & Sacks 1973; Schegloff, 2007), which this article relies on. In particular, in this tradition

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of studies, the notion of sequentiality provides a *conceptual* framework to think about crucial issues such as coordination and cooperation, mutual understanding, as well as the interpretation, recognition, and ascription of actions. Moreover, the notion of sequentiality also offers an *analytical* framework for studying in detail how individuals engage in joint actions as a practical moment-by-moment achievement.

The ideas of sequentiality and sequence originated in Sacks' and Schegloff's work on openings of social interactions; in this paper we present these notions, before discussing how they can be operationalized for the study of interactions among baboons. In this way, we show their conceptual relevance to thinking about the continuities between the organization of interaction among human and non-human primates.

2. Background: the sequence organization of openings

The "interaction engine" relies on the idea that social interaction as the "infrastructure for social institutions, the natural ecological niche for language," social order, and culture (Schegloff 2006: 70), is crucial for understanding human evolution (Levinson 2006). Among the properties and the principles of this interactional infrastructure, Levinson mentions the idea—inspired by Schegloff—that "interaction is characterized by action chains and sequences" (2006: 45), highlighting broader consequences of this sequential organization. The fact that a first action is not just followed by another one, but makes the latter expectable, constitutes a fundamental building block of social interaction, and defines an elementary form of sequence: the adjacency pair (Schegloff 1968: 1083; Schegloff & Sacks 1973: 75; Schegloff 2007). The relation between the first and the second action is of *conditional relevance*: the second action is expectable; its format and type is projectable; its production retrospectively shows what the second participant has understood of the previous, and provides an occasion to possibly repair this understanding, and adjust to its consequences. In particular, the doer of the first action creates the next slot that is inspectable for the occurrence of a second action, which may manifest dis/alignment, dis/affiliation, and/or mis/understanding with the first. Moreover, the projectability and expectability of the second action make possible orientation to a *noticeable absence* of response. As stated by Schegloff, "given the first, the second is expectable; upon its occurrence it can be seen to be a second item to the first; upon its nonoccurrence it can be seen to be officially absent—all this provided by the occurrence of the first item" (1968: 1083). A response that is expected, but noticeably absent, is publicly identifiable as such, revealing the normative value of the expectation, as well as the inferences it makes possible (relative to its violation, and interpretable in social, relational, and cultural terms). This can lead to sanctions, as well as to further actions pursuing a response (Stivers & Rossano 2010). In this sense, the organization of the sequence provides for the evidence of mutual orientations—recipient-design, understanding, and the possibility of repairing understanding—that ground the architecture of intersubjectivity in interaction (Schegloff 1992, see Heesen et al., this issue, Fröhlich & van Schaik, this issue).

Sequence organization is fundamental for achieving the possibility of a common engagement in interaction. Its basic characteristics had already been discussed by Sacks and Schegloff at the end of the 60s, initiating what became Conversation Analysis. In his *Lectures*, delivered in the late 60s, Sacks speaks about "the sequential building blocks of conversation" (1992: 99), and offers a first formulation of the *sequencing rules*: by producing an action that requests a response, and creating a new slot for the next action, the participants engage in what can become a conversation. In the same period, Schegloff, while studying telephone conversations, demonstrates the systematic practices through which imminent participants enter into interaction (1968, 1986): Openings are organized in an ordered series of sequences, such as summons/answer, identification, greetings, how-are-you, which leads to the reason of the encounter. Openings are crucially based on the organizational and normative features of the sequence: the summons (e.g., the phone ringing) projects the relevance of an answer (e.g., picking up the phone), and generates inferences in the case of an absence of response (e.g., the interlocutor is not at home, or busy); an answer manifests availability to engage in continuing the interaction—that is, in the next sequence.

Openings in face-to-face encounters (Robinson 2013; Pillet-Shore 2018) have revealed the importance of the progressive approach of the participants within space, based on mutual sighting, and distant and close greetings before a single word is uttered (Kendon & Ferber 1977). This establishes and negotiates a common interactional space (Mondada, 2009) that is based on mutual perception (Goffman 1963). Within the openings, greetings constitute a crucial sequence: By greeting, the individual A makes the individual's B greeting conditionally relevant, and the type and format of this second greeting manifests the alignment, reciprocity, or asymmetry between the participants (Duranti 1997; Firth 1972; Irvine 1974; Pillet-Shore 2012). The absence of greetings can have evil consequences, especially in hostile contexts (Youssuf et al. 1976); exogenous constraints on greetings, for instance during the recent COVID-19 pandemic, are treated as problematic (Mondada et al. 2020). Overall, the order of opening—crucial for the achievement of a shared understanding of the context and the activity to come, as well as for the reciprocity of the perspectives—is fundamentally based on the organization of the sequences constituting it.

Sequence organization has been described among humans not only in relation to verbal exchanges, but also with regard to silent embodied actions (Mondada, 2019), showing the fundamental importance of multimodal resources (Levinson & Holler 2014; Goodwin 2017; Mondada 2018). This has been recognized among infants, prior to the acquisition of language: Children learn the principles of turn-taking before learning to speak (Hilbrink et al. 2015), and they discover very early on the consequentiality of a first action on the next (Keel 2016; Wootton 1997). Moreover, not only turn-taking (Fröhlich 2017; Mondémé 2021; Pika et al. 2018), but also sequence organization has been identified among animals (Fröhlich et al. 2016; Heesen et al. 2021; Rossano, 2013; Rossano & Liebel 2014; Wilkinson et al. 2012). This article contributes to the latter line of research, by demonstrating how engaging in openings and greetings, baboons treat the expectations set up by the action initiating a sequence, and inspect the sequential slot in which a second action is expected and publicly orient to its possible absence. In this way they manifest an orientation toward the other, the production of recipient-designed actions, and the interpretation of another's action, within the interactional architecture of intersubjectivity.

3. Data and methodology

Demonstrating that sequence organization is observable among baboons, the paper focuses on the opening of encounters and greetings. Beyond a systematic detailed analysis of these openings, the paper discusses how sequential organization supposes and reflexively creates interactivity, intersubjectivity, and situated interpretations of others' conduct.

The data analyzed have been video-recorded within a collaborative project between the authors, an interactionist and a primatologist, during 2013 and 2014 at the Rousset CNRS primatology station (South of France), where hundreds of baboons (*Papio anubis et Papio papio)* live in social groups distributed in several parks. The station is accessible only to researchers and follows strict protocols for the well-being of the animals.

The study is based on approximately 8 hours of data recorded with two video cameras (a focused mobile one and a static general one), out of which a sub-set of 100 openings were transcribed and analyzed. The qualitative analyses presented here show the systematic consequences of the way individuals approach and respond to each other. The cases presented in the paper were representative of the sub-set, and were selected because the embodied details unfolding moment-by-moment are particularly visible on the video (vs. in other cases which depend on the movements of the individuals and the positions of the cameras, not always making them continuously visible).

The conversation analytic methodology relies on the building of 'collections' of cases taking into consideration the action done, its sequential environment, and the formats it might take (Stivers & Sidnell 2012). This is an important basis to compare instances that are comparable (e.g. it does not make much sense to compare occurrences of a formal movement in different actions and different sequential environments), to interpret detailed variations (like here: the way the mobile approach is formatted step by step has consequences for the way the sequences of opening actions are shaped) and on this basis to show that the recurrent features and their distribution are 'methodic' that is, are part of systematic practices of individuals (called 'methods' in ethnomethodology) for achieving the

order of what they do. This systematicity is the ground on which quantification could be possible (Schegloff 1993). In this sense, this qualitative analysis is foundational: it reveals systematic recurrent structuring patterns of order and the processes generating it.

This paper explores the sequential organization of openings of encounters between baboons (*Papio anubis*), in which greetings frequently constitute a complete encounter, immediately followed by closings—a possibility considered by Sacks (1992, I: 553–4): "an exchange of greetings is a minimal proper conversation" (cf. De Stefani & Mondada 2018). The study focuses on individuals approaching and mutually adjusting and responding to each other, with one presenting their hindquarters to the other, and the other grasping their hips, mounting them, or touching their genitalia. These movements, accompanied by other displays, such as lipsmacks and mutual gaze, have been identified and described in terms of "greetings" in the literature (Smuts 2002: 301). They have been particularly discussed in the case of baboons: The formats of these greetings are considered to be particularly diversified among baboons (Smuts & Watanabe 1990) in the wild, as well as in captivity (Pelàez 1982). Likewise, these greetings have been identified as having multiple functions, and are considered to express aggressiveness, submission, or affiliation, which have also been correlated with the category and status of the individuals (such as sex, age, status, sexual cycle, etc.), and the type of baboon considered (Dal Pesco & Fischer 2020). These studies have adopted various methodologies, some privileging the observation of large numbers of individuals (e.g., Hausfater & Taraks 1987, relying on 600h of observations), and others that have focused on the longitudinal study of smaller troops (Smuts 1985). Most of the studies rely on the observation and coding of the conducts *in situ*; even when these observations are based on extended coding schemes (see e.g., the lists of parameters proposed by Hausfater & Taraks 1987: 300–301), they treat behavioral features that are recognizable on the fly for expert observers. What escapes these observational protocols is the way the details of conducts are temporally and sequentially coordinated and chained within the very short time these encounters last. By contrast, a video-based analysis enables researchers to precisely document the detailed specific and situated formats of embodied actions unfolding in time, as one individual interacts with, and responds to, another (see Rossano 2013; Smuts 2002; Wilkinson et al. 2012).

In what follows, we present some detailed multimodal transcripts of this conduct, demonstrating how a course of joint action emerges moment-by-moment, how an action projects and is followed in response by another one, and how the contingency of posture in space occasions the next embodied action. In this sense, video analyses and multimodal transcripts based on Conversation Analysis contribute not only methodologically to existing observational studies on baboons and other primates, but also analytically and conceptually to a better understanding of the interactional order and sequence organization among non-human primates, grounding reciprocal adjustments, coordination, mutual intelligibility of actions, and intersubjectivity.

4. Analysis: The organization of openings between baboons (*papio anubis*)

The analysis focuses on the spatial approach between two individuals, projecting the openings of an encounter in a mobile setting characterized by asymmetric initiatives. We will detail how different mobile trajectories project different possible interactions. In particular, we will distinguish different types of initiation of the encounter, establishing different relationships of benefactor/beneficiary, as well as different rights and obligations. These initiatives make relevant different aligned/disaligned responses, as well as observably absent responses. The analysis is organized in relation to these sequential options. In the first configuration, a mobile individual approaches a static individual, and presents their posterior, projecting them to touch it (§ 4.1). By contrast, in the second configuration, when an individual approaches another one, the latter performs a presentation in response (§ 4.2). In these two cases, the asymmetries are inverse: In the first, the approaching individual makes a presentation, and the approached individual accepts/refuses/ignores it; in the second case, the mobile approaching individual chooses to touch, or not, in response to the approached individual making the presentation. The analysis considers cases in which the response is aligned and cases in which there is an observable absence of response—revealing how individuals orient to interactional and social expectations. In a third configuration (§ 4.3), two mobile individuals negotiate the openings and who

will be touching/touched. In this way, the study offers a systematic analysis of the sequential organization of openings of baboons' interactions, on the basis of how the approach and the opening are initiated.

4.1. Openings 1: A approaches and presents their posterior

A recurrent configuration in the video corpus examined concerns one mobile individual moving around in the park, approaching a static individual sitting on the floor/a fountain/near a wall, and presenting them their posterior. In this case, A initiates both the spatial approach and the presentation; B is sequentially expected to respond (or not) to A's action.

Here is a first occurrence: An adult female A walks toward another adult female B, who is sitting on a fountain. The transcript adopts Mondada (2018) conventions: Each numbered line represents the unfolding of time (in seconds), on which depend the subsequent lines, annotating various embodied practices, like in a musical score (each movement is temporally delimited by a symbol, like • or +, which is reproduced in the timeline). The screen shots are also located within the timeline (thanks to the symbol #).

Extract 1 (17)

1

```
1           (0.5)    •  (0.5)  #  •(0.7)+±  (1.0)+  (0.2)  *
   A_body   >>walks twd B-----------+pivots+presents posterior->
   A_head   >>gazes at B------------±
   B_body   >>sitting on fountain-------------------*leans twd A->
   B_head   >>gazes A•on the R•gazes A-------->
   Fig                    #fig.1
2           %(0.3)#ø     (2.3)    ø(0.3)ø%*•+  (0.5)  *•ø(0.7)•+  #(2.2)•+
   B_Lhd    %on A's back----------------%
   B_Rhd            øtouches postAø....øbrings to mouthø
   B_body                              ->*stands up*
   B_head                               ->•gazes R--•gazes L•gazes A•
   A_body                                ->+pivots and steps back+drinks+
   Fig             #fig.2                                fig.3#
```


2

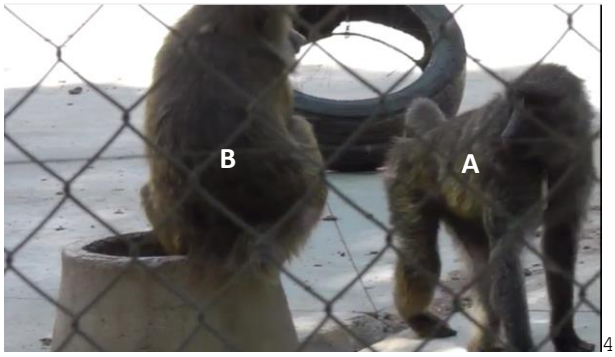

3

A approaches B and both gaze at each other (Fig. 1). B's gaze follows A, although her body stands still. Only after A has pivoted and presented her posterior (1), B leans over A (1), and puts her left hand on her back and her right hand on her posterior, touching her (2, Fig. 2). Thus, B's haptic contact is sequentially configured as a response to A's action, and she reorients her body in such a way as to present her posterior to B, enabling B to touch it. B's response is aligned in relation to the action projected by A.

The haptic contact lasts about two seconds. It is terminated by B briefly bringing her right hand to her mouth/nose, which completes her multisensorial contact with A. When B stands up, A steps back immediately, repositioning herself, and redirects her head toward the fountain, and drinks (Fig. 3).

A similar interactional space is created in the following encounter: The adult female A approaches the adult female B, who is sitting on a tube (Fig. 4):

Extract 2 (61)



4

```
1           (2.5) ± (0.8)•(1.0)+ (0.2)#ø(0.3)ø(0.2)|  (0.4)  +#
   B_body   >>sitting on tube------------>>
   A_body   >>moves closer to B+pivots and presents posterior+
   A_head         ±gazes B->
   A_mouth                                          |lipsmack->
   B_head               •gazes A----->>
   B_Rhd                                øextendsøtouches side->
   Fig                                #fig.4            fig.5#
```

5

```
2            +(0.3) X (1.1) X (0.6)#X (0.2) | (0.2)X(0.1)ø+±
   A_body    +stops----------------------------------------+goes away->>
   A_Rhd            XextendsXtouchesX,,,,,,,,,,,,,X
   A_mouth                                  ->|
   B_Rhd                                                ->ø
   A_head                                                 ->±
   Fig                              #fig.6
```

6

A approaches B, who is sitting. A pivots and presents her posterior (1, Fig. 3). B responds by extending her hand and touching B's side (Fig. 4). A begins to produce a lipsmack, which is both audible and visible on her mouth. Right after, A raises her right hand and touches B's side (Fig. 5). In this way, a reciprocal haptic contact is achieved, and with it a form of symmetry between the participants (Fig. 6). They also gaze at each other during the entire encounter. The intertwined bodies separate when A stops her lipsmack, and lowers her hand, and this is immediately followed by B withdrawing her hand, too. A moves away, dissolving the common interactional space.

In this case, contrary to the previous one, an initial asymmetrical approach evolves into a mutual symmetric engagement mobilizing multiple resources: mutual gaze, reciprocal touch, and audible/visible lipsmack. The contrast between the two extracts shows how, despite a similar initial spatial approach, individuals might mobilize different embodied resources within a specific emerging temporality and sequentiality, thereby establishing different relationships. This is accomplished in the detail of their subsequent responses.

While in the previous case a form of symmetry emerged, the asymmetry of the encounter is enhanced when B does not respond to what A's action projects, as in the following case, also involving two adult females:

Extract 3 (12)

7

```
1            (0.5)  + #(0.9)+ (1.5) +   (0.6) #   (1.2)       +
   A_body    >>walks+pivots-+       +moves post, stepping back+
   A_head    >>gazes B---------------------------->
   B_body    >>sitting---->>
   B_head    >>gazes A----->
   Fig               #fig.7                    #fig.8
2            (0.2)± •(0.2)+(0.1)• (0.5) #
   A_head       ->±gazes elsewhere->>
   A_body               ->+moves away->>
   B_head                     ->•lowers head->>
   Fig                              #fig.9
```


8


9

A is moving across the park and gazes at B, who is sitting near the wall (Fig.7). B gazes back. A approaches, pivots, and presents her posterior to B, who stays immobile. After some time, A steps back, bringing her posterior very close to B's face (Fig.8). B is still not moving. A, turning back, was continuously looking at B (Fig.8); she now averts her gaze (2), and begins to move away. B lowers her head (Fig. 9).

In this excerpt, A's approach is not responded to by B. A constantly monitors B's body, looking back. Moreover, A readjusts her posture, coming closer to B, as a way of insisting, enhancing the visibility of her action, and mobilizing a response (Stivers & Rossano 2010). B still does not move. By going away, A finally dissolves the interactional space she created for a possible encounter.

This extract shows how an individual does *not* respond to another one who has initiated the approach. It also shows how this absence of response is identified and treated by the other. The

insistent modification of A's action displays A's adjustments in treating the absence of response, orienting toward it. These adjustments, as well as a continuous or repeated gaze back, are systematically performed in this sequential context. They can be seen as a way in which intersubjectivity is achieved, even when one individual refuses another's approach, as well as how normative expectations are bound to the sequential organization of initiating actions and their conditional relevance.

The next extract confirms the way an absence of response emerges: A, an adult female, comes closer to B, an adult male, sitting against a column. A passes by B, pivots, and comes back toward him, then presenting her posterior to him (Fig.10):

Extract 4 (5)

```
1           (3.5)•(0.6)+ (1.2)+   (1.2)    + (0.5) ± #(1.0)±
   A_body   >>passes-by+pivots+walks twd B+presents post. twd B's face
   A_head                                          ±gazes B±
   B_body   >>sitting---->>
   B_head        •gazes on his R----->
   Fig                                             #fig.10
2           ∫(0.6)±(0.1)  ∫+ (1.0) ∫  (1.1)    ∫(0.5)± ∫(0.5)#(0.7)∫±
   A_leg    ∫Ll steps back∫       ∫bends knees∫       ∫raises tail∫
   A_body                ->+
   A_head         ±gazes B-------------------------±,,,,,,,,,,,,,,,±
   Fig                                                      #fig.11
3           (0.2) • (3.3)  • (3.0) ±   (3.0) ± (0.3) •  (5.8)  •
   B_head       ->•gz postA•gazes twd his L----------•twd his R•
   A_head                          ±gz B/on R±gz B/on L-->
4           •   (1.9) ± (3.1) • (1.2)  • (0.9) %(3.6)
   B_head   •gz bab passing-by•gz twd R•
   A_head          ->±
   B_hand                                    %masturbates->>
5           ±(1.4) #± (0.1) +
   A_head   ±gazes B±
   A_body                  +goes away->>
   Fig             #fig.12
```

10


11

 12

A comes closer to present her posterior in front of B's face. B does not move and continues to maintain his gaze towards the right (1–2, Fig. 10–11). A orients to this absence of response, by accomplishing various adjusting movements (2): She steps back with her left foot, in a way that delicately touches B's foot; moreover, she bends her knees, thereby coming closer with her posterior towards B's face; she also raises her tail. All these movements constitute an upgrade, thus intensifying her initial posture. B does not move his body and only quickly looks at A's posterior—in a rather minimal response—then gazes away, to his left and right, and toward a passerby. His gaze is monitored by A who turns her head back toward him, looking back on both her sides (3–4). B's absence of expected response is accentuated by his engagement in other centers of attention: not only does he look at other targets, but he also begins to masturbate. This action is seen by A, who has turned back (5, Fig. 12). A goes away.

In this extract, B's absence of response to A's presentation is oriented to by A in a double way: Visually, A repeatedly looks back at him; bodily, A moves various parts of her body, enhancing the visibility, proximity, and carnality of her presentation. In turn, B only minimally glances at her body, rather looking at other targets, and engages in concurrent activities. A brings to a close what is recognizable as her waiting for a response. A does not merely wait for B's response, but treats it as expectable; not only does she interpret his conduct as an absence of response, but she displays the fact that this response is consequential and therefore normatively expected.

In sum, in the cases analyzed so far, an individual approaches another one, initiating a sequence in which they perform a hindquarters' presentation; the co-participant addressed either responds by engaging in haptic contact, or remains immobile, ignoring the presentation. In the latter case, the absence of response is noticed by the initiating party, who actively monitors the addressed individual, and is responded/adjusted to by persistent and insistent upgrades of the initial presentation. These adjustments suggest that individuals orient to the sequential projections and implications of their actions, and expect a response, orienting to the normativity established by the sequence organization of actions they engage in and recognize. Thus, the way individuals respond to the initial approach shows how sequential options are accountably produced and recognized, as well as exploited to engage in encounters, enhancing their symmetric or asymmetric formats.

The asymmetric relations built through sequence organization can be formatted in various ways. We now turn to a similar spatial and embodied configuration, in which, however, the actions are distributed differently among the participants, with different rights and obligations. This further shows the relevance of taking into consideration the sequential details of the emergent interaction, in order to account for their systematic nature and variations.

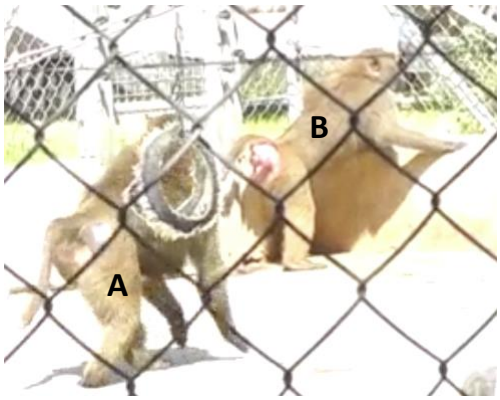
4.2. Openings 2: A approaches and B presents their posterior

An alternative configuration to the one previously discussed is constituted by an individual A approaching another individual B, who is statically positioned. Whereas in the previous cases A was presenting their posterior, projecting B's response, in these cases, B presents theirs, projecting A's haptic response. Thus, here it is A who might either give a response (Extract 5) or ignore B's action (Extract 6).

In the next encounter, A, an adult male, approaches B, a female in estrus:

Extract 5 (63i)

```
1           (1.1)          •*# (0.8)   *(0.4)•(0.2)+(0.2)*  (0.6)+
   A_body   >>moves across the park--------------+reorients to B+
   B_body   >>lying ag wall*turns bck*pivots-----------*pres post->
   B_head                  •gazes A---------•
   Fig                       #fig.13
2           +(0.5) %  (1.5)# %(0.6)+(0.2)*
   A_body   +sits behind B---------+goes away, twd R->>
   A_hand          %touches B%
   B_body                                ->*goes away, twd L->>
   Fig                     #fig.14
```



13


14

A walks quickly across the park and comes closer to one of the walls, where B is lying (Fig. 13). B turns back, sees A, pivots and presents him her posterior (1). A orients toward B's action, and he is observable in his change of trajectory and adoption of a bipedal locomotion. In this way, A approaches B, then squats behind B and touches her genitals (Fig.14). Next, A stands up and walks away in the same direction as his initial trajectory; immediately after, B moves away in the opposite direction.

A's change of trajectory shows that he was initially moving through the park rather than directing toward B, and that his change is a response to B's posterior presentation. Even if the presentation is not yet completed at that point, it has been initiated by B pivoting, and its outcome is projectable. Thus, here B initiates the sequence, and A responds in an aligned way.

By contrast, in this kind of configuration, A can also ignore B's initiating action. This is the case in extract 6, in which a female, A, is engaged in a trajectory that passes by the female, B, who sees her approaching (Fig. 15).

Extract 6 (59a)

```
1           #(0.5)   *  (0.8)*#(0.4)*+(0.3)•  (0.5)  •#(0.6)+(0.7)
   A_body   >>walks----------------+passes B's height---+cont walking->>
   B_body   >>static*pivots*pres--*
   B_head   >>faces A--------------------•turns head•looks at A->>
   Fig      #fig.15         #fig.16              #fig.17
```

15


16


17

A is on the move and B, standing, turns in A's direction, and looks at her (Fig. 15). Projecting the continuation of A's trajectory, B pivots and presents her posterior, timing her action with the progression of A passing at her height (Fig. 16). A does not look at her—despite B monitoring her on her right and then, turning her head, on her left (Fig. 17)—and does not stop.

B's preparatory movements, as well as her monitoring of A's trajectory, make visible her orientation towards A. This projects her action initiating a sequence addressed to A, then treating A not stopping as an absence of response.

Whereas in extracts 1–4 the mobile individual A initiates the presentation, projecting B's touching response, in extracts 5–6 it is the static individual who initiates the presentation, and who projects a reorientation of the mobile individual passing by. In this latter case, the initiation of the encounter is occasioned by the mobility and proximity of the other. The individual producing a response, or an absence of response, is different in both cases. This generates an inverse relation between mobility and initiation of a haptic contact. When the mobile individual does the presentation, their mobile trajectory is part of the initiation of the sequence, whereas in the opposite case, the trajectory is more aleatory, and adjusts locally, relative to the type of response. This grounds the distinction between being on the move versus walking toward somebody where both having different interactional affordances.

4.3. Openings 3: A and B meet and negotiate their engagement

The previous openings were characterized by an asymmetry between mobile versus static individuals. This interactional space defines opportunities and contingencies that affect the next sequential options. In this final section, we consider a more symmetrical body arrangement, in which two mobile individuals meet face to face. This creates a context in which they both negotiate the actions in which they engage, and in particular the greeting sequence: who initiates and who responds.

In the following extract an adult male A crosses the path of B, an adult female in estrus:

Extract 7 (63a)

```
1          (2.0) • (1.0) +*(0.5)±(0.4)#+* (0.5)  +|(0.2)*(0.7)#*
   A_body  >>walks-------+crosses B----+continues+reorients twd B->
   A_mouth                                        |lipsmack->
   B_body  >>walks---------*crosses A----*slows down-----*pivots*
   B_head        •gazes A->>
   A_head                        ±gazes B->>
   Fig                                #fig.18          fig.19#
2          (0.2)¥ (0.6)  ¥(0.4)+X (0.4) #X (0.5) X¥#(0.2)*(0.4)¥
   A_body                    ->+sits->>
   B_body  *stops-----------------------------------------*moves on->>
   A_Lhd        ¥ext Larm¥touches----------------¥touches tail¥
   A_Rhd                     Xext RarmXtouchesX
   Fig                              #fig.20    #fig.21
```

18


19


20


21

A and B cross paths (Fig. 18). A changes trajectory and does a curve that repositions him behind B, while he does a lipsmack; at the same time, B slows down, doing a presentation by a minimal pivoting, and positions herself very precisely on A's new trajectory (Fig.19). A extends his arms on B's sides (Fig.20). Finally, A delicately touches B's tail (Fig.21). B smoothly moves away as soon as her tail is touched.

In this case, two mobile individuals meet and negotiate the next actions, embodied in their respective positions and in the timing of their re-positionings: A comes back, and B slows down. B presents her posterior, and A responds to her presentation in an aligned way. Here the emergent relation is progressively established by mutual adjustments.

4. Discussion and conclusion

The notion of sequence organization is central in Conversation Analysis (Schegloff 2007) and a key element of the "interaction engine hypothesis" (Levinson 2006). It enables us to understand the relationship between two actions as not just one following the other, but one which makes the next relevant as well as displaying an understanding and a dis/alignment with the prior action. The sequential order displays in their emergent details how intelligible actions are produced, how they are progressively identified and recognized, and how they are responded to, establishing and at the same time manifesting the rights and obligations of the participants performing them.

As demonstrated in this paper, this concerns not only humans, but also primates. The analyses showed how baboons' actions emerge in real time, are finely coordinated, and mutually shape each other, both in the projection and sequential implicativeness of recipient-designed initiating actions, and in the responsive actions relying on their close monitoring. Sequence organization includes an intersubjective dimension—related to the intelligibility of actions, locally negotiated—and a normative component—related to expectation management. These results contribute both to an expansion of our understanding concerning fundamental (and perhaps proto-universal, Kendrick et al. 2020) features of sequences in social interaction, and to a recognition of their relevance for the social life of primates.

It is remarkable that in the openings studied, and in particular in the greetings (constituted by the presentation of the hindquarters), baboons manifest a very precise sense of sequence organization. They display it by the way they carefully format their courses of action, and they scrutinize them, expressing whether they conform or not to the social and normative expectations set up by the sequential implicativeness. This is particularly observable in the way they orient to absences of responses.

Video analyses and multimodal transcriptions of opening sequences (and not only single acts or gestures), show that—depending on the trajectories of locomotion and approach, the local ecology, and the emergent interactional space designed by the mobile arrangements of the would-be-participants—some formats of action are afforded rather than others, and some negotiated adjustments are made possible, occasioning/occasioned by initiatives and responses. These are locally achieved (i.e., they are neither deterministic nor probabilistic chains of events), but also are fundamentally related to the principles of sequentiality (e.g., projectability, conditional relevance, expectability), systematically producing sequential options. These options thus account for patterned variations. Smuts (2002: 303-4) refers to the importance of observing them, and searching for possible patterns, suggesting they relate to "intentional communication" à la Tommasello and Call (1997: 10). The analyses presented here suggest that these patterns depend on mutual adjustments that emerge within the spatial approach of the individuals, generating systematic options that configure the coordinated entry (or not) in an activity that may be focused on—and exhausted by—the greetings and more globally the sequence organization of the openings.

While approaching each other, the baboons establish and define their mutual stance (Pillet-Shore 2012) and what their encounter is becoming: an aligned and even affiliative unfolding of actions, or an interaction more or less radically disaligned, an encounter opening in a convergent way but closing in a precipitated way, a trustful encounter or a suspicious one, a reciprocal or an asymmetric one. Symmetry vs. asymmetry, reciprocity vs. indifference, trust vs. suspicion, are local accomplishments produced by the way the sequence emerges, is achieved, and completed.

This emergentist, sequentially interactional perspective contributes more broadly to the way greetings have been discussed in the previous literature. Greetings among baboons have been related to locomotion patterns (Colmenares 1990), as well as to rich repertories of gestures (Hausfater & Takacs 1987). However, they have not been analyzed in relation to complex, sequentially organized multimodal patterns emergent in time—and as such they are mutually adjusted, achieved, and negotiated as they unfold, within the dynamics of initiating and responding actions. Moreover, greetings have been studied by correlating patterns of behavior and status of the individuals (typically, dominant males, or estrus females). In this study, the status of the individuals has not been the basis on which the systematic sequential patterns have been analyzed. Rather, the sequential approach enabled a reflection about how courses of actions locally (re)produce asymmetry vs. bonding and affiliation. The fact we ended up studying many interactions between females (a type of encounter understudied in the literature) emerged out of the search for sequential patterns. Likewise, the literature has frequently disagreed about the function of greetings—as submissive and agonistic (Colmenares 1990), or rather reparatory, consolidating social relations (Whitham & Maestripieri 2003, Smuts 1985, 2002; Smuts & Watanabe 1990). Sequential analysis shows how social relations in interaction are not defined from the onset of the encounter, but are built through the progressively ordered, intelligible, and negotiated arrangement of actions. Social relations are mutually shaped through the multimodal formatting of actions emergently and dynamically designed through time and adjust to the responsive actions of others. This enables us to document both how asymmetric relations are (re)produced, and how more symmetric, mutually negotiated relations that are established are the product of locally situated interactional achievements.

In sum, the study reveals how sequence organization, mainly documented through analyses of human interactions, can be analyzed in detail among non-human primates, thus confirming the conceptual relevance of this central motor of the "interaction engine." The fine-tuned sequential order of baboon encounters reveals their mutual orientations, their public and intersubjective negotiation and interpretation of the meaning of their actions, and the normative character of their sequential expectations.

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Transcript Conventions

Transcripts follow Mondada's conventions (2018, see https://www.lorenzamondada.net/multimodal-transcription).

Annotations

Body part	A	B
Body	+	*
Head	±	•
L-hand	¥	%
R-hand	X	ø
Mouth	|	
Leg	∫	

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Additional information (90w)

Ethics

Videos have been done respecting the well-being of the animals, the local guidelines with the ethical approval and licences of the CNRS. The video's copyright is of both authors.

Authors' Contributions

Both authors participated to video recordings and conception of the project. LM did the transcription of the data, the analyses, the literature review and wrote the article; AM made the recordings possible, participated to initial video screenings, and provided in-depth knowledge of the group studied.

Competing Interests

No competing interests.