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Beyond Neutrality: the Human–Primate Interface During the Habituation Process

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Abstract Ethnoprimatology explores the ecological, social, and cultural interconnections between humans and other primates. Since the field's emergence, researchers have examined overlapping human–primate resource use and conflict, human–primate disease transmission, primate folklore and its influence on conservation status, and primate tourism. One facet of the human–primate interface that remains underexplored from an ethnoprimatological perspective is habituation. Habituation—defined as when wild animals accept a human observer as a neutral element of their environment—has long been considered a critical first step for successful primate fieldwork. Although primatologists have explored how to accomplish habituation, little attention has been paid to habituation as a mutually modifying process that occurs between human observers and their primate study subjects. By drawing on the ethnoprimatological approach and engaging with perspectives from human–animal studies, this manuscript examines habituation as a scientific and intersubjective process. Over seven months, we documented behavioral changes in moor macaques (*Macaca maura*) and human participants that occur during habituation. We also conducted interviews with researchers and local field assistants to track perceptions of habituation progress. Integrating ethological measures with ethnographic material enabled us to explore how and why quantitative markers of habituation "success" differ from subjective impressions, observe habituation—and primate fieldwork in general—as a bidirectional, intersubjective experience, and come to understand habituation as a dynamic spectrum of tolerance rather than a state to be "achieved." Collectively, these findings have important implications for future work in ethnoprimatology and habituation methodology, as well as the practice of primate fieldwork.

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Introduction

The field of ethnoprimatology is fundamentally concerned with the multifaceted ways human and nonhuman primate (hereafter primate) lives and livelihoods intersect. Though several scholars had recognized and examined the intertwined biological, sociocultural, and ecological realms of humans and other primates (Asquith 1995; Else 1991; Fa 1992; Strum 1994; Wheatley and Harya Purta 1994), it was not until the late 1990s that the term "ethnoprimatology" was coined (Sponsel 1997). Since the field's proliferation, researchers have investigated a diverse array of topics including, human–primate disease transmission (Jones-Engel *et al.* 2005; Loudon *et al.* 2006; Muehlenbein 2017), human–primate overlapping resource use and conflict (Hill 2000; Hockings *et al.* 2009; McLennan and Hill 2012; Paterson and Wallis 2005; Riley 2007a; Strum 2010), primate tourism (Fuentes *et al.* 2007; McKinney 2014), and the ways primates figure into human folklore and mythology (Cormier 2003; Fuentes 2012; Nekaris *et al.* 2010; Riley and Priston 2010; Alves *et al.* 2017). However, one facet of the human–primate interface that remains largely unexplored from an ethnoprimatological perspective is habituation.

Defined as the process by which wild animals accept human observers as a neutral element in their environment (Tutin and Fernandez 1991), habituation is one of the hallmarks of field primatology. It is widely accepted as the first step toward conducting most types of field research, enabling the researcher to systematically document complex behavior that may not otherwise be attained through observation of unhabituated primates (Cheney *et al.* 1987). Although early pioneers of field primatology recognized its importance (e.g., Carpenter 1934; Emlen and Schaller 1960), historically, little was written about habituation because it was the outcome, the state of "being habituated," that was deemed important, not the process. In more recent years, increasing concern about the risks associated with close proximity of humans to primates has resulted in more attention to the topic (Williamson and Feistner 2011). For example, scholars have explored how to best achieve habituation (Johns 1996; Tutin and Fernandez 1991; van Krunkelsven *et al.* 1999; Williamson and Feistner 2011), the effects of observers on primate behavior and ecology (Crofoot *et al.* 2010; Isbell and Young 1993; Jack *et al.* 2008; McDougall 2012; McLennan and Hill 2010), and the ethical dimensions of habituation (Goldsmith 2005; Strier 2010). However, few primatologists have systematically explored habituation as an intersubjective process, that is, a process during which humans and primates learn to understand one another. Instead, as Rees (2006, 2007) notes, recognition of the intersubjective nature of primate fieldwork is confined to popularized accounts. Primatologist Barbara Smuts (2001, p. 297), for instance, describes how her experiences did not always match the guidance she was given: "…although ignoring the approach of a baboon may at first sound like a good strategy, those who advised me to do so did not take into account the baboons' insistence on regarding me as a social being."

In contrast to primatologists, scholars in human–animal relations and science studies have examined the intersubjectivity of habituation (e.g., Candea 2010; Knight 2009; Rees

2006, 2007). Intersubjectivity refers to an unspoken process of awareness, attunement, transformation, and unity between humans and other beings (Dutton 2012; Hurn 2012; Siegel 2015). This interest in intersubjectivity is largely situated in the recent shift in anthropological and sociological studies of humans and animals from seeing animals as symbolic resources toward viewing them as active agents in scientific inquiry (Hurn 2012) and emphasizing the relational nature of the human–animal interface (Candea 2010; Kirksey and Helmreich 2010; Knight 2005). This shift toward viewing "animals as parts of human society" (Knight 2005, p. 1) is, in turn, linked with a shared dissatisfication across many fields with seeing the world in terms of dualisms (e.g., human and animal; nature and culture; objectivity and subjectivity). For example, in his study of field biologists and habituated meerkats, Matei Candea (2010) invokes the terms "engagement" and "detachment" to critique how interspecies relations are often viewed in dichotomous terms, arguing instead for explorations of the space in between.

In this manuscript, we draw on theoretical and methodological insights from ethnoprimatology and human–animal studies to address the elements of habituation and its process that are largely absent in the primatology literature: the co-shaping of humans and primates as the process of habituation unfolds. The human subjects/participants included ourselves, our research assistants, and other field researchers working at a research site. The primate subjects/participants comprised one habituated group and one unhabituated group of moor macaques (*Macaca maura*), an Endangered primate species endemic to the Indonesian island of Sulawesi. We used a mixed-methods approach, integrating techniques in ethology and sociocultural anthropology, to address the following research objectives and questions.

First, we seek to reexamine understandings of what constitutes "successful" habituation. We asked how observer impressions of the habituation process contribute to established, quantitative understandings of habituation. Research tracking habituation progress has involved the collection of data on several behavioral parameters (Table I). Using the already habituated moor macaque group as the baseline, we assessed the following parameters to measure changes in habituation progress in the unhabituated group over time: encounter duration and types, location efficiency (i.e., the number of minutes required to locate each group after each new forest entry), minimum distance tolerated, and rates of human-directed behaviors. Following previous habituation studies (Table I), we predicted that search times, minimum tolerated distances, and rates of human-directed behavior would decrease while encounter duration and "ignore" encounter types would increase. We also assessed observer perceptions of habituation progress via interviews and participant observation to determine how they link with and help explain quantitative behavioral indicators.

Second, we asked how varying levels of habituation shape observer–macaque relations. In other words, how does observer–macaque intersubjectivity differ for habituated and unhabituated groups? Although few scientific examinations of habituation consider the ways in which observers themselves "habituate" to study groups (Narat *et al.* 2015, p. 347), observer transformation during habituation and observer–study group intersubjectivity are prevalent themes in post hoc fieldwork narratives. These popular accounts often describe habituation as a process of "acceptance" into the primate social group, during which researchers achieve "quasi-group member" status (Rees 2007, p. 887). With this in mind, our objective was to explore habituation as a *mutually* transformative process, whereby the researcher is also fully engaged in

Table I Habituation criteria used to quantitatively track habituation progress in previous studies

Habituation parameter	References
Response to observers	Tutin and Fernandez (1991) Johns (1996) van Krunkelsven *et al.* (1999) Blom *et al.* (2004) Bertolani and Boesch (2007) Souza-Alves and Ferrari (2010) Westin (2017)
Encounter duration	van Krunkelsven *et al.* (1999) Blom *et al.* (2004) Doran-Sheehy *et al.* (2007) McLennan and Hill (2010) Souza-Alves and Ferrari (2010) Narat *et al.* (2015)
Time spent in contact to time spent in forest ratio	Blom *et al.* (2004) Doran-Sheehy *et al.* (2007) Narat *et al.* (2015)
Tracking/location efficiency	Doran-Sheehy *et al.* (2007) Narat *et al.* (2015)
Minimum distance	Narat *et al.* (2015)

"becoming habituated" to the study group, and adjusts his or her own behavioral responses to those of the other primates undergoing habituation.

Methods

Study Site

We conducted this research in the Karaenta area of Bantimurung–Bulusaraung National Park (TNBABUL) in South Sulawesi, Indonesia. In 2004, the Indonesian Ministry of Forestry established TNBABUL, which protects ca. 43,000 ha of the region's karst (limestone) ecosystem and biodiverse flora and fauna, including the Endangered moor macaque (Supriatna et al. 2008; Waluyo *et al.* 2005; Fig. 1).

Research Participants

Karaenta is a 1000-ha section of karst forest that is home to a population of moor macaques, including one well-habituated moor macaque group (group B), and other unhabituated groups, one of which (group G) we selected as a focal group for habituation. The moor macaque is one of seven endemic macaque species that inhabit the island of Sulawesi, Indonesia (Fooden 1969). All seven species are considered to be high conservation priorities, with habitat loss and hunting being the most critical threats (Riley 2010). Moor macaques inhabit a relatively small portion of Sulawesi's south peninsula, and have been studied at Karaenta since 1981 (Okamoto *et al.* 2000; Wanatabe and Matsumura 1996). The population density of moor macaques in Karaenta is relatively high (3.5 groups/km^2), and estimated home range sizes are between 20 and 30 ha (Matsumura 1998; Okamoto *et al.* 2000). The species is characterized by cohesive multimale–

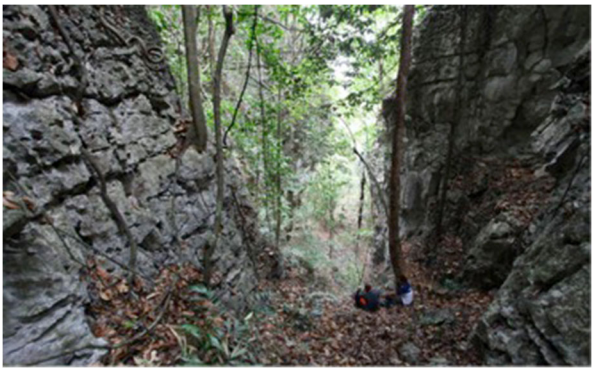

Fig. 1 Tower karst in the home range of an unhabituated group of moor macaques, Bantimurung–Bulusaraung National Park, South Sulawesi, Indonesia. (Photo: Indra Pradana).

multifemale groups comprising 15–40 individuals, social tolerance, female philopatry, moderate birth seasonality, and a frugivorous diet (Albani 2017; Okamoto *et al.* 2000; Riley *et al.* 2014; Sagnotti 2013; Wanatabe and Matsumura 1996).

Group B consisted of 27 individuals (3 adult males, 8 adult females, 15 juveniles) at the beginning of our study and has been intermittently observed on the basis of individual identification since 1988 (Okamoto *et al.* 2000; Fig. 2). In early stages of research, researchers heavily provisioned group B at a designated feeding site (one or two times per day) in an effort to accelerate habituation, obtain group counts, and identify individuals (Okamoto *et al.* 2000; Wanatabe and Matsumura 1996). Research at Karaenta ceased in the late 1990s, but resumed again in 2010. During this 10-yr. gap, group B went unfollowed by researchers, but park staff continued to provision the group for tourism purposes (one or two times per month). In 2010, when researchers returned to Karaenta to study group B, regular provisioning for research purposes resumed (three or four times per week) (Sagnotti 2013). Since 2012, however, researchers have strongly discouraged park

Fig. 2 Park ranger sitting near a habituated study group (group B) of moor macaques in Bantimurung–Bulusaraung National Park, South Sulawesi, Indonesia. (Photo: Kate Jameson).

staff from provisioning the group in order to avoid influencing data collection. No provisioning occurred during observations for this study.

The previously unhabituated group selected (group G) comprised at least 23 individuals (2 adult males, 7 adult females, and 14 juveniles) and has an overlapping home range with group B. The human participants included the habituation research team (ourselves and two TNBABUL park rangers who served as field assistants) and members of another research team who were simultaneously collecting behavioral and ecological data on group B.

Ethological Data Collection

Data collection began on July 14, 2014 and ended on January 25, 2015. Habituation attempts with group G also began on July 14, 2014. We chose this timeframe based on previous research documenting a 5- to 7-mo habituation period for another Sulawesi macaque, the Tonkean macaque (*Macaca tonkeana*) (Riley 2007b). We spent ca. 5 days per week locating and following group G, and 1 day per week following group B. On most "group G" days, we were accompanied by one field assistant, while on "group B" days, the team expanded to include another field assistant and two members from the other research team.

On both "group G" and "group B" days, we entered the forest at 06:00 h and attempted to locate and follow the group until 12:00 h. On most days, the habituation team reentered the forest between 14:00 h and dusk to collect additional data and, if possible, follow group G to their sleeping trees. We located groups either visually or via vocalization, either from birds (the black drongo and yellow-billed malkoha, *Dicrurus macrocercus* and *Phaenicophaeus calyorhynchus*, respectively) that associate with macaques (Matsumura 2001) or vocalizations from the macaques themselves. During the study, we spent 130 days in the forest attempting to locate and follow group G. We collected observational data on 87 of these days, and spent the remaining 43 days either searching for group G or with intermittent contact that was not long enough to begin a group scan. We spent 27 days following and collecting data from group B (Table II).

We defined a group encounter, the key unit of investigation, as direct or indirect (obscured by dense canopy) observation of two or more macaques. At the start of a new encounter, we calmly announced our presence by a throat-clearing noise if it was unclear whether the group had already detected us. Then we conducted a group scan at 30-min intervals, during which we recorded activity data and other habituation data not reported here (see Hanson 2017). After the group scan, we began a 5-min human focal follow on the accompanying field assistant or researcher. During this time, we recorded all

Table II Sampling effort during a study of *Macaca maura* at Bantimurung–Bulusaraung National Park, July 14, 2014–January 25, 2015

Group	Number of days attempting to observe	Number of days observing	Number of encounters	Total hours in contact	Total no. of scan samples	Total no. of all-occurrence samples
G	130	87	107	138	223	102
B	27	27	34	97	165	123
Total	157	114	141	235	388	225

primate-directed behavior (defined as pointing, staring, approaching, talking to, laughing at, imitating behavior, coughing or throat clearing to draw primate attention, and sitting down, redirecting gaze, or backing up when individuals threatened or approached us), comments regarding the macaques, and other activities, such as smoking, that could elicit a reaction from the macaques. Following this focal sample, we began a 15-min "all occurrence sample" on humans and macaques, recording all occurrences of human-directed and primate-directed behaviors (Table III). We chose these sample lengths based on previous experience following group B, and to ensure we adequately captured behaviors from both primates and the human observers during encounters.

During encounters, observers spoke and moved quietly, limiting their movements to a 3- m radius, unless following the group to another location. At the end of each encounter, we recorded the closest observer distance tolerated by the macaques and the encounter type (i.e., the predominant group response to us over the course of the encounter, Table IV). We considered the encounter to end when the group had moved far enough away or obscured themselves high enough in the karst such that visual and audio detection was no longer possible, and there was no way to be certain the group was still there.

Ethnographic Data Collection

The ethnographic fieldwork component of this project involved participant observation, including observation (as described earlier), unstructured interviews with field assistants, semistructured group interviews with two Western primatology graduate students

Table III Ethogram of human-directed macaque behavior and primate-directed human behavior

Activity	Definition
Human-directed behaviors:	
Monitor	Surveillance of the observer; includes at least one of the following elements: staring, moving to obtain a clearer view of observer, peering at observer from behind a tree trunk.
Threaten	Human-directed aggression; includes bark, open mouth threat, yawn threat, protruded lip, lunge, and support shake.
Approach	Individual deliberately directs movement toward observer, advances within 5 m.
Avoid	On detecting the observer, individual moves away at a normal pace.
Flee	On detecting the observer, individual moves rapidly with or without alarm vocalization.
Primate-directed behaviors:	
Submission-conveying	Human behavior directed at the macaques that closely resembles submissive primate behaviors and/or expresses submission (e.g., redirecting gaze, sitting down or backing up when macaques threaten and/or approach observer).
Dominance-conveying	Human behavior directed at the macaques that does not communicate submission and are more closely aligned with common primate behaviors that express dominance (e.g., staring, pointing, approaching, talking to, laughing at, imitating behavior, and coughing or throat-clearing to draw macaque attention).

Human-directed behavior definitions adapted from McLennan and Hill (2010) and Thierry *et al.* (2000)

Table IV Encounter types, defined as the majority group response to observers and coded at the end of each encounter, between observers and moor macaques in Bantimurung–Bulusaraung National Park, July 14, 2014–January 25, 2015

Encounter type	Definition
Ignore	After noticing observer presence, individuals resume previous activity.
Monitor	Surveillance of the observer; includes at least one of the following elements: staring, moving to obtain a clearer view of observer, peering at observer from behind a tree trunk.
Avoid	On detecting the observer, individual moves away at a normal pace.
Flee	On detecting the observer, individual moves rapidly with or without alarm vocalization.
Threaten	Human-directed aggression; includes bark, open mouth threat, yawn threat, protruded lip, lunge, and support shake.
Collective arousal	Many individuals excited; they emit and exchange numerous affiliative behaviors, including clasp, silent bared teeth display, lip smacking, affiliation call, etc. For group B, occurs in proximity to provisioning site.

Adapted from McLennan and Hill (2010); Thierry *et al.* (2000); Tutin and Fernandez (1991)

conducting research on group B, and our own reflexive field notes. We conducted interviews with field assistants in Bahasa Indonesia and interviews with researchers in English. Field assistant interviews were often opportunistic, occurring before and after group encounters ($N = 67$). Interviews with researchers took place outside of the forest, usually in a group setting. These semistructured interviews ($N = 8$) occurred throughout the study period, varied in length from 20 min to >2.5 h, and involved questions related to research backgrounds, study groups' reactions to us and our engagements with them, impressions of habituation progress, what behaviors count as "natural," understandings of "wild" and "habituated," behavioral differences between groups G and B, and the process of searching for and following group G.

Data Analysis

We analyzed primate behavioral data in Stata 12. Following several previous habituation studies (Table I), we focused on the following parameters to measure changes in habituation progress over time: encounter duration, location efficiency (i.e., the number of minutes required to locate each group after each new forest entry), minimum distance tolerated, and rates of human-directed behaviors. We divided data sets for these criteria into six equal periods based on the total time spent in contact with each group (Table V), so that tests would be more sensitive to changes over time. For each parameter evaluated, we used nonparametric statistical tests to determine patterns of change over time and compare groups B and G, when applicable. All tests were two-tailed, and we considered results significant at $P < 0.05$. To shed light on patterns of observer–primate interaction during the habituation process, we also analyzed rates of primate-directed behavior. Specifically, we used Mann–Whitney and Kruskal–Wallis tests to compare group B and G data sets, Spearman's rank correlation coefficient and the Wilcoxon rank-sum test for trend to examine trends in quantitative parameters over time, and Pearson chi-square and logistic regressions to explore patterns in primate-directed behaviors between groups B and G, and field assistants and researchers. We coded qualitative data from field notes and

Table V Data set divided into six equal periods, based on the total hours spent in contact with each moor macaque group, Bantimurung–Bulusaraung National Park, July 14, 2014–January 25, 2015

	Period 1		Period 2	
Group	Dates	Encounter no.	Dates	Encounter no.
G	7/14–7/31	1–19	8/7–8/27	20–39
B	7/22–8/15	1–6	8/30–9/19	7–10
	Period 3		Period 4	
Group	Dates	Encounter no.	Dates	Encounter no.
G	8/29–10/3	40–57	10/3–10/21	58–72
B	9/26–10/17	11–14	10/24–11/12	15–21
	Period 5		Period 6	
Group	Dates	Encounter no.	Dates	Encounter no.
G	10/22–11/20	73–87	11/20–1/25	88–107
B	11/13–12/26	22–28	12/31–1/22	29–34

interviews using maxQDA 12 to identify major themes that emerged over the course of the study, and to facilitate connections with patterns in quantitative data.

Data Availability The datasets analyzed during the current study are available from the corresponding author on reasonable request.

Ethical Note

The research complied with protocols approved by the SDSU Institutional Animal Care and Use Committee, IACUC (APF #14–03-006R) and Institutional Review Board for Human Subjects (vIRB approval #1715093), and adhered to the legal requirements for foreigners conducting research in Indonesia. We obtained verbal informed consent from all human participants, and allowed them to withdraw if they wished. The authors declare they have no conflict of interest.

Results and Discussion

Quantitative and Qualitative Understandings of Habituation

Encounter Duration and Type Encounters were significantly shorter with group G than with group B, the habituated group (Mann–Whitney test: $Z = 6.13$, $P < 0.001$) (Table VI). However, we found no significant trends in encounter duration for group G over the study period ($N = 107$, Wilcoxon rank-sum test for trend: $Z = 0.19$, $P = 0.85$). During the habituation process, encounter types coded as "ignore" significantly increased (Spearman's rank correlation coefficient: $N = 107$, $r_s = 0.47$, $P < 0.001$), while "monitor" encounter types significantly decreased ($N = 107$, $r_s = -0.445$, $P < 0.001$) and "avoidance" encounter types remained stable ($N = 107$, $r_s = -0.154$, $P = 0.114$) (Fig. 3). "Flee" ($N = 1$) and "threaten" ($N = 2$) encounter types were infrequent and therefore not included in analysis.

Table VI Summary statistics for quantitative behavioral indicators of habituation in two groups of *Macaca maura*, Bantimurung–Bulusaraung National Park, July 14, 2014–January 25, 2015

Habituation indicator	Group G				Group B			
	N[a]	Mean	SD	Range	*N*	Mean	SD	Range
Encounter duration	107	70 min	±64.51 min	2–306 min	34	180 min	±87.0 min	10–336 min
Location efficiency	94	141 min	±101.72 min	<1–328 min	27	26 min	±34.91 min	<1–162 min
Minimum distance tolerated	107	5.24 m	±1.26 m	1.5–7 m	34	1.50 m	±1.44 m	0.88–6 m
Rate of human-directed behavior	102	6.54/h	±6.26/h	0–28/h	123	3.29/h	±4.98/h	0–24/h
Rate of primate-directed behavior	102	3.52/h	±4.96/h	0–20/h	123	4.19/h	±6.03/h	0–28/h

[a] *N* = encounters (except for human-directed and primate-directed behaviors which are the number of "all-occurrence" samples >10 min). We excluded "chance" encounters in location efficiency analyses

While encounter type results supported our prediction that ignore responses would increase over the course of the habituation process, encounter duration results contrasted with hypotheses associated with a degree of tolerance; as study groups become more accustomed to human presence, encounter durations are predicted to increase (Williamson and Feistner 2011). Results in the habituation literature, however, remain equivocal; encounter durations significantly increased in some study groups (Bertolani and Boesch 2007; Blom *et al.* 2004; Doran-Sheehy *et al.* 2007), but not in others (McLennan and Hill 2010; Narat *et al.* 2015; van Krunkelsven *et al.* 1999).

Our qualitative data indicate that human observers did not perceive encounter duration as a reflection of habituation level. Instead, observer impressions of group G's habituation status were often associated with encounter types (i.e., the group's general reaction toward us), and our ability to collect data. For example, one field assistant often repeated the phrase, "today was good, there were a lot of scans" (i.e., scan samples). Over the course of the study, it became clear that for this field assistant, our ability to collect data, not how

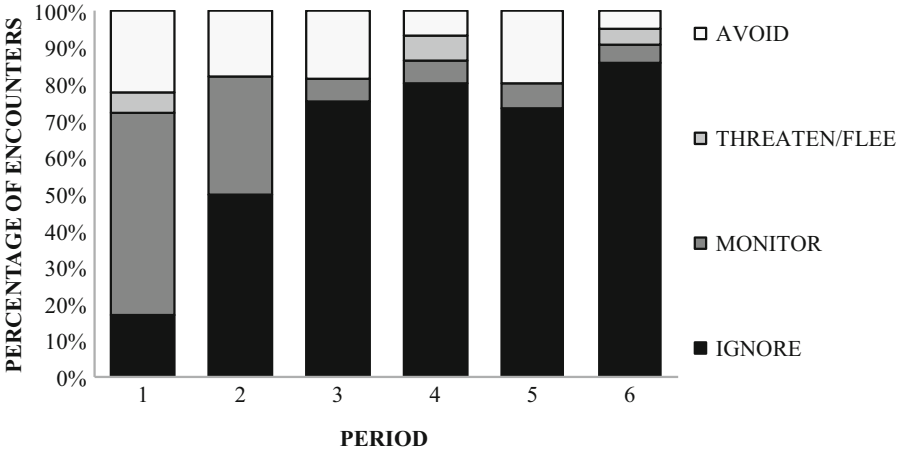

Fig. 3 Percentage of different types of encounters between moor macaques and observers across 138 h, divided into six equal time periods, Bantimurung–Bulusaraung National Park, July 14, 2014–January 25, 2015.

long we followed the group, represented the primary marker of a "good" day (and thus, habituation progress). Other characteristics of a "good" day with group G included close proximity to the group and our ability to identify individuals, as well as the group's behavior toward us. The word *tenang* (calm) was often used to describe the group during a "good" encounter. It follows that increasing "ignore" encounter types aided in data collection despite variable encounter durations. In contrast, "bad" encounters almost always involved low visibility in dense vegetation, resulting in many "out of view" scans and all occurrences, as well as frustration among research team members. The fact that the research team was less concerned about encounter duration as a measure of progress is important, particularly because it remains a common metric for tracking habituation progress in the primatology literature.

Location Efficiency Mean search times were significantly longer for group G than for group B (Mann–Whitney test: $Z = -5.87$, $P < 0.001$) (Table VI). We found significant improvement in location efficiency while following group G (Spearman's rank test: $r_s = -0.28$, $P = 0.006$) (Fig. 4). That is, we located group G more quickly as the study progressed. Location efficiency for group B remained constant over time (Spearman's rank test: $r_s = -0.13$, $P = 0.53$).

While improved location efficiency may partially reflect group G's increasing tolerance of us, qualitative analysis of interviews and reflexive field notes suggests that it may be due to a secondary, parallel process: a learning curve on the research team's part, characterized by increased home range familiarity, alertness to subtle vocalizations, and general "attunement" with group G's daily foraging and resting patterns. As we followed the group daily and for longer periods, we learned more about the areas they frequented, and how to navigate massive karst formations to get there. In addition, we simply got better at listening for them; as one field assistant put it, "searching for monkeys is just waiting for sounds" (FA3, Author field notes, August 11, 2014). An important element of this learning process was frustration at not being able to find group G. On particularly trying days, during which we spent a great deal of time searching for the group without success, we attempted to "think like the monkeys"; *if we were group G, where would we*

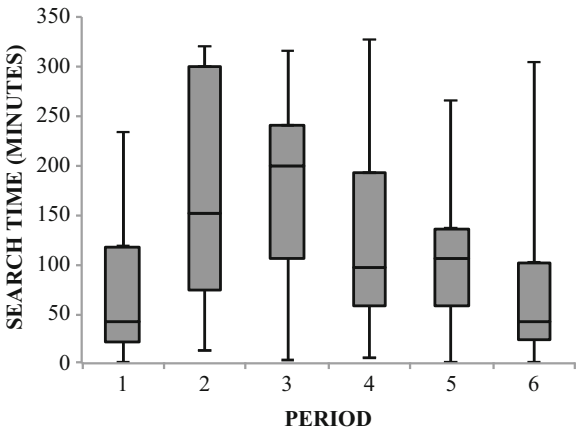

Fig. 4 Search time for a group of moor macaques across 138 h, divided into six equal time periods, Bantimurung–Bulusaraung National Park, July 14, 2014–January 25, 2015.

be? This technique allowed us to envisage the groups' daily routine and anticipate what they might be doing and where they might be based on time of day, temperature, and knowledge of fruiting trees. Paradoxically, our frustration at not finding the group led to better command of G's home range—we were forced to search in new places, and carefully inspect familiar areas for caves or other concealed routes the group might be using. Improvements in our location abilities therefore occurred even when group G was not present.

Similarly, extensive home range familiarity and experience with group B's daily routine among research assistants led to more refined searches. For instance, if it was midday and hot, group B was likely resting in a certain cave, or foraging on their way to the cave; if it was early morning, they were likely foraging in an area they had been spotted the previous evening. One researcher explained it as an accumulation of knowledge: "group B has been studied a lot … there is already a kind of 'know how' … the more you know about a specific group, about their ecology, about the place they live, the easier you will find them" (RE1, group interview, September 2, 2014). At the same time, an exploratory test revealed that it is *specific* experience, not just experience in general, that assists location efficiency: a veteran park ranger with more than 30 yr. of experience following the habituated group was no better at finding group G than a younger ranger with <5 yr. of experience (Mann–Whitney test: $Z = -1.52$, $P = 0.13$, $N(\text{FA2}) = 62$, $N(\text{FA1}) = 36$). Thus, familiarizing oneself with not only the home range, but also the new group and the individuals within—regardless of previous experience tracking primates—plays a crucial role in location efficiency. This finding follows Alcayna-Stevens' (2016, pp. 843, 850) argument that even seasoned researchers need to develop their own "embodied familiarity" of the forest and study group to successfully follow and collect data.

Minimum Distance Tolerated Mean minimum distance was significantly greater between human observers and group G than with group B (Kruskal–Wallis test: $\chi^2 = 62.31$, df = 1, $P < 0.001$) (Table VI). Contrary to our predictions, there was no decrease in minimum distance between observers and group G during the study (Wilcoxon rank-sum test for trend: $Z = -1.16$, $P = 0.245$, $N = 107$) (Fig. 5). We attribute this result to the research team's attempt to mitigate increasingly aggressive human-directed behavior from Kop, group G's alpha male, which began in period 4. We found no significant

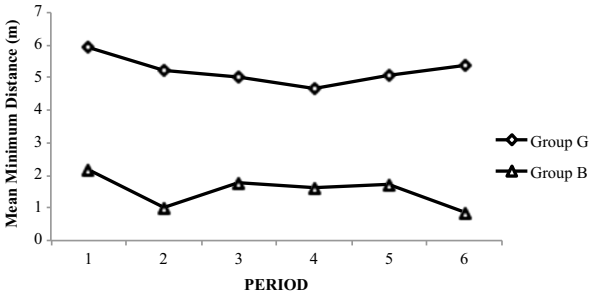

Fig. 5 Mean minimum distance (meters) between observers and two groups of moor macaques in Bantimurung–Bulusaraung National Park, South Sulawesi, Indonesia, July 14, 2014–January 25, 2015. Each period represents one-sixth of the total time spent in contact with each study group.

change in minimum distance over time for group B (Wilcoxon rank-sum test for trend: $Z = -0.41$, $P = 0.68$, $N = 34$).

Although differences in home range structure and forest strata use between groups B and G (Albani 2017) may act as confounding factors influencing proximity between observers and the groups, our qualitative data show that observer distance was associated with perceived habituation level, which in turn, influenced interpretations of human-directed threats. At first, the research team maintained distances so as not to frighten group G: "It seems like this time we are more careful not to scare the group. Moving deliberately, quietly, whispering … we could've gotten closer to see individuals, but we didn't want to scare them away." (Author A field notes, August 20, 2014). In addition, field assistants often commented that the group was "still scared of us" as a response to human-directed threats in early stages of following the group. Later, when we could observe group G at closer distances, field assistants began to describe the same behaviors as "brave," presumably because we represented a greater threat at closer distances. This shift in interpretation of human-directed threats and the resulting distance maintenance observed by the research team reflects two important ideas: 1) that the research team's perception of group G's habituation level influenced our proximity decisions, as well as our interpretation of their responses to us, and 2) that as group G learned we were no longer a direct threat, they were free to intimidate us at closer distances, which consequently "taught us" to observe from a greater distance.

The notion that research team behavior toward group G was often dictated by presumptions related to the group's habituation level suggests that a critical component of effective habituation may be to understand whether observer perceptions of tolerance align with primate behavioral indicators of habituation (see Hanson 2017). Furthermore, group G teaching *us* how to behave around them not only reflects the view of many human–animal studies scholars that study groups are indeed "active agents" in our research (see Hurn 2012; Kirksey and Helmreich 2010; Lestel *et al.* 2006), but also supports popular accounts of bidirectional learning in primate fieldwork (see also Webber and Vedder 2001, p. 48):

> Gradually TP and I worked out an unspoken agreement. If he didn't want me to advance, he would angrily slap or shake the vegetation near him until I stopped moving. I learned that if I didn't make eye contact with TP, I could come within 10 feet. (Galdikas 1995, p. 184)

By recognizing study groups as active participants during research, we suggest that the differential pattern in observer–primate distance between groups B and G is also explained by agency on the part of the primates themselves. In particular, a common theme that emerged from interviews with researchers was the notion that group B "chose" to approach observers in close proximity, and that proximity choice often depended on the individual:

> …but it's happened that when I am close to an individual, it was actually the monkey that got closer to me. Because I try to remain as far as possible … I remember once there was a caterpillar next to my feet and Jaya (a high-ranking male) was *so* happy to see that caterpillar, and he came very close, so I stood there and waited for him [to eat it]. (RE2, group interview, December 28, 2014)

Another researcher interpreted group B's close proximity to observers as a decision not to avoid us, associating this choice with acquiring resources:

> I am always trying to keep my distance. I wouldn't say they choose to come close to me. I would say they choose not to avoid me. So I don't think they're looking for proximity with me, but proximity with something else they need or want, and if I'm there or not there, it's not a problem to them. They just don't care…so if they see a ripe fruit and I am in their way, they will just go around me, but there are some individuals who will avoid me altogether. (RE1, interview, January 21, 2015)

It is evident from these statements that proximity to observers is perceived as an aspect that is somewhat out of the researchers' control. While researchers focus on keeping distance, it is ultimately the macaques' decision to come close to observers or not—a decision that researchers noted may reflect ranking, need for resources, and/or individual tolerance level.

Human-Directed Behavior For both groups, rates of human-directed behavior significantly decreased over time (Wilcoxon rank-sum test for trend: N (group G) = 102, $Z = -3.71$, $P < 0.001$; N (group B) = 123, $Z = -2.72$, $P = 0.007$). In the beginning of the study, human-directed behavior was significantly higher in G (median incidence = 8/h, range = 0–60/h) than in B (median incidence = 0/h, range = 0–60/h) (Mann–Whitney test: $Z = -3.136$, $P < 0.001$); by the end of the study, rates of human-directed behavior in G (median incidence = 4/h, range = 0–12/h) were still higher than B (median incidence = 0/h, range = 0–60/h), but the difference was not significant (Mann–Whitney test: $Z = -1.926$, $P = 0.054$).

The finding that human-directed behavior continues to persist in both groups points to the possibility that "we can never become a truly neutral presence to our study animals" (Jack *et al.* 2008, p. 494; see also Alcayna-Stevens 2016). Indeed, questioning neutrality was a recurring theme in interviews with researchers, as well as our own reflexive field notes. On one particularly frustrating day of encountering and promptly losing group G after hours of searching, one of us wrote in our field book: *how, as primatologists, can we expect our study subjects to ignore us, when we, despite our best efforts, don't also ignore them?* (Author A, field notes, October 16, 2014). The notion that we may never be neutral was also echoed in a statement during an interview with a researcher:

> When we started following group B, I wanted to be as neutral as possible, part of the forest, like a tree or a stone, but I soon realized that it was impossible because I need to move and follow them, so I think the most appropriate description for me is a cow (Note: domesticated cows often range in the nature reserve, and hence, the researcher is likening themselves to a large mammal in the forest), because I'm a big animal, they don't understand what I'm doing, and I'm noisy. So, I'm a cow. (RE1, interview, January 21, 2015)

Though it is true that domesticated cows are often encountered foraging in the forest along with the macaques and are generally regarded by researchers as creatures that the macaques ignore, we have recently observed juveniles and subadults from group B

playing with curious calves, which suggests that even cows are not truly ignored by group B and vice versa; thus, elements of the forest that have been understood as neutral in the past become "suffused with meaning" during fieldwork (Alcayna-Stevens 2016, p. 849). Still, this researcher's sentiment reflects the inevitable paradox of habituation: to collect high-quality data, study groups need to be followed, and they will never be truly ignored by researchers. The "neutrality" that habituation seeks to attain may therefore never be realized; as long as we pay attention to our study groups, they, in turn, will likely pay attention to us.

Our results revealed another interesting pattern: human-directed behavior in group B significantly decreased during the study period (Wilcoxon rank-sum test for trend: $Z = -2.72$, $P = 0.007$, $N = 123$). This finding supports other habituation literature that describes habituation as an ongoing, dynamic process (Alcayna-Stevens 2016; Bertolani and Boesch 2007; Jack *et al.* 2008; Rasmussen 1998). At the beginning of this study, group B was "already habituated"; they have been followed on the basis of individual identification since the late 1980s, and researchers and field assistants referred to the group as "tame" and "used to humans" throughout the study. However, their habituation continued over the course of our research, leading us to question the specific contexts in which they were considered "habituated." One researcher whose protocol involved focal follows, noted in an interview:

> Of course, I needed to learn how to follow each individual, but they also needed to learn how to be followed. In the beginning, group B was annoyed at my insistence in following them, some were like, 'oh you're still here? I'm moving… still here? I'm moving … still here?' Others were distracted by me, they were attracted and curious as to why I was following them so persistently, they looked at me more often. But after a certain point, they just stopped behaving like that. If I were to quantify it, I'd say in the beginning, I was influencing their behavior 50 percent of the time; now, I would say 20 percent of the time. I don't have the illusion that they behave like they would if I wasn't there 100 percent of the time, and I don't pretend to be invisible—I don't think I will ever observe 100 percent natural behavior. (RE1, interview, January 21, 2015)

This statement highlights three important points. First, it is clear that group B became habituated to being followed on an individual basis via focal follows, and that the researcher was also required to learn how to follow them in order to facilitate this process. Second, the researcher notes that individuals reacted differently to his focal follows; some were annoyed, others were curious. Third, the researcher suggests that group B continued to respond to them during focal follows, but became substantially less affected by their presence over the course of the study. These perceptions align with the quantitative results that demonstrate human-directed behavior in group B still persisted, but decreased significantly over time.

Primate-Directed Behavior Rates of primate-directed behavior decreased significantly over time with group G (Wilcoxon rank-sum test for trend: $Z = -2.97$, $P = 0.003$, $N = 102$), but showed no significant change with group B (Wilcoxon rank-sum test for trend: $Z = 0.730$, $P = 0.466$, $N = 123$). Rates of primate-directed behavior were also significantly higher with group G at the beginning of the study (Mann–Whitney: $Z =$

−2.160, $P = 0.031$), but by January 2015, there was no significant difference between the two groups (Mann–Whitney: $Z = 1.820$, $P = 0.069$).

When broken down into specific types of primate-directed behavior, submission-conveying behavior directed at the macaques such as sitting down, redirecting gaze, or backing up when individuals threatened or approached observers was more frequent when following group G, while dominance-conveying behavior, such as pointing, staring, approaching, talking to, laughing at, imitating behavior, coughing or throat clearing to draw macaque attention was more frequent with group B (Pearson chi-square test: $\chi^2 = 24.38$, $P < 0.001$) (Table VII). In fact, group B was almost nine times more likely to receive dominance-conveying primate-directed behavior than group G (logistic regression: $Z = 4.84$, $P < 0.001$, odds ratio = 8.84).

We suggest that this pattern is primarily due to an enhanced level of trust and familiarity between observers and group B, a recurring theme mentioned in the forest and during interviews with researchers. At the beginning of the study, a new male (later named Pado) migrated into group B, and quickly claimed alpha male status. At first, researchers expressed unease in his presence, but later felt more comfortable as they learned to "read" his behavior and trust that he would not react aggressively toward them:

> RE2: Yeah, maybe for a couple weeks I was scared of Pado.
>
> RE4: Well, I felt the same way, I don't know Pado, so I was very cautious about him, and I actually never got a good look at his face, because I didn't want to look at him or stare…plus, I just couldn't read him, because I didn't know him. And now, hearing that he's fine, the last two times I saw group B, I wasn't worried about him. Although I was a little like, "whoa, he's really close to me" but it was fine, he was foraging.
>
> RE2: Every time he gets very close to me, I just stand and look away. If Jaya [the previous alpha male] does the same thing, maybe I'll take pictures. With Jaya, it's fine … we're friends. (Group interview, December 28, 2014)

Establishing *mutual* trust is clearly central to the habituation process, yet is often taken for granted in habituation literature that focuses solely on changes in primate behavioral response. As Rees (2007) notes, successful primatological research relies on explicit and active management between the observer and the observed. Furthermore, she argues that an observer studying a well-habituated group is no longer treated as neutral, but rather, as a "quasi-group member" whose actions within the group are predictable

Table VII Counts of primate-directed behavior by type, performed by researchers and field assistants toward two groups of moor macaques, Bantimurung–Bulusaraung National Park, July 14, 2014–January 25, 2015

	Group G	Group B	Total
Submission-conveying	37	14	51
Dominance-conveying	64	124	188
Total	101	138	239

and nonthreatening. Indeed, such a relationship must be predicated on recognition and trust between both parties. Not only was Pado perceived as a "stranger" and therefore deemed relatively untrustworthy by the research team until they understood his behavioral patterns, but the macaques, too, must perceive the research team as dependable "traveling companions" (Kummer 1997, p. 86).

Patterns of primate-directed behavior were also distinct between field assistants and researchers. Field assistants were more likely to perform dominance-conveying primate-directed behavior toward group G at the beginning of the study and submission-conveying behaviors by the end of the study (Pearson chi-square: $\chi^2 = 6.19$, $P = 0.013$) while researcher primate-directed behavior types remained stable (Pearson chi-square: $\chi^2 = 2.79$, $P = 0.095$) (Table VIII).

This result may reflect field assistants' learning process while following group G; that is, an increasing ability to attune one's own behavior in relation to the macaques. Furthermore, we suggest that stable primate-directed behavior types among researchers likely reflect our more extensive primatological training that teaches us to be unobtrusive observers at all times (see Smuts 2001). Finally, field assistants were 3.5 times more likely than researchers to perform dominance-conveying primate-directed behavior overall (logistic regression: $\chi^2 = 37.24$, $P = 0.003$, odds ratio = 3.52, $N = 187$), while researchers performed significantly more dominance-conveying primate-directed behavior while following group B than while following group G (Pearson chi-square: $\chi^2 = 19.58$, $P < 0.001$).

Field notes capturing our own experience while following group G mirror these patterns of primate-directed behavior exhibited by the field assistants. At the beginning, we often had to remind field assistants to sit or back up when group G was threatening us, but by the end of the study the reminders came from the field assistants themselves; or, they reacted submissively on their own volition, and often without instigation from group G. In addition, increasingly aggressive behavior exhibited by G's alpha male (Kop) toward the end of the study may have functioned as a catalyst for learning to respond "appropriately" (that is, submissively) to human-directed threats. Lack of previous experiences with unhabituated groups in Karaenta may have also contributed to this learning curve, as both field assistants had never followed an unhabituated group. Future work in this area could focus on systematic comparison of field assistants and researchers, to assess how personal and professional contexts shape perceptions and expectations of habituation progress. Such work would also help to illuminate the indispensible (but often invisible) role of field assistants in the process and outcomes of primate field research (Rees 2007).

Table VIII Counts of primate-directed behavior by type, performed by field assistants and researchers toward a group of moor macaques at the beginning (periods 1 and 2) and end (periods 5 and 6) of a study, Bantimurung–Bulusaraung National Park, South Sulawesi, Indonesia, July 14, 2014–January 25, 2015

	Periods 1 and 2		Periods 5 and 6		Total	
	Researcher	Field assistant	Researcher	Field assistant	Researcher	Field assistant
Submission-conveying	7	3	11	9	18	12
Dominance-conveying	12	22	6	11	18	33
Total	19	25	17	20	36	45

Differential patterns of researcher and field assistant behavior appear to exemplify what Candea (2010) points out as the distinction between Western scientific approaches to studying animals—that is, "detached" and "distant"—and non-Western ways of knowing animals—that is, "engaged, relational, and personal" (p. 250). Indeed, Western primatological approaches tend to impart an anti-interactional attitude on primatologists during training, such that remaining physically "distant" and emotionally "detached" so as to minimize one's influence on the study group's behavior has become a standard canon of primate fieldwork (see Rees 2006; Smuts 2001). At the same time, our results indicate that researchers were not always "detached and distant." For example, researchers performed significantly more dominance-conveying primate-directed behavior while following group B than while following group G, demonstrating increased engagement with study animals in the context of following a habituated group. Furthermore, researcher interaction with group B manifested itself differently than field assistant interaction. Researchers primarily spoke to individuals in the group, sometimes having entire conversations (albeit one-sided) with particularly charismatic individuals during breaks in data collection. During data collection, however, researchers attempted to appear as "detached" as possible, often telling us not to write down something they had just said to or about an individual they were following. This effort to remain detached while evidently entangled is also echoed in interviews and focus groups when researchers felt uncomfortable anthropomorphizing group B, especially using the word "personality" to describe individual characteristics despite having come to know the macaques in group B as individuals with distinct personalities (RE1, group interview, October 25, 2014).

Researchers' oscillation between engagement and detachment with groups B and G in this study suggests that the ideal "detached and distant observer" promoted by Western science may, in practice, be a rare phenomenon in primate fieldwork. Such interactive elements of the researcher-study group interface could be perceived as problematic for data collection. However, Candea (2010) argues that "good" data and "good" relations are inseparable—that is, without a relational connection between researchers and study groups, the extent to which researchers are able to collect high-quality, meaningful data remains limited. For example, in his study of the long-term Kalahari Meerkat Project in South Africa, Candea (2013) discovered that data collectors "had learnt to make fine-grained distinctions between actions which involved humans but could still be counted as unaffected natural behavior and behavior which was problematically interactive" (p. 120). Similarly, researchers following group B came to understand that interactions between themselves and individuals in the group were "acceptable" provided that it did not get in the way of their data collection objectives:

> In the beginning there was this strict rule in my mind: *primatologists don't do that* [interact] … it's personal I think. But now, I understand that maybe if you interact with group B, it's no big deal, so just do it, feel free. Also because they actually try to interact a lot … my impression is that it does not affect my data, because it is not the focus of my project … it depends on what data I need in that moment. (RE1, interview, January 21, 2015)

The collection of "good" data hinges, therefore, on the researchers' capacity to "embody a 'scientific' perspective and a 'personal or emotional' one" (Candea 2013, p.

120); a capacity reflected, in this study, among researchers attempting to detach themselves while simultaneously fostering and maintaining relations with group B.

Rethinking Habituation "Success"

By integrating qualitative and quantitative data, we evaluated a variety of quantitative parameters that have been used to assess progress in other habituation studies. These criteria included encounter duration and type, location efficiency, minimum distance tolerated, and rates of human-directed behaviors. Additionally, we analyzed rates of primate-directed behavior to understand patterns of observer interaction with study groups. From a quantitative perspective, most of our predictions were supported: group G's habituation process was characterized by a significant increase in "ignore" encounter types and location efficiency, coupled with a decrease in rates of human-directed behaviors. Contrary to our prediction, we found no increasing trends in encounter duration or minimum distance tolerated by the macaques.

Despite this quantitative evidence of progress, however, the research team remained unconvinced that the group was sufficiently habituated by the end of the study period. When asked directly about whether group G was habituated, both field assistants shook their heads: "We still don't know all the places they like to go yet. We can't always follow them, and we can't consistently identify them" one explained; the other assistant compared group G to their habituated counterparts: "they don't treat us like group B does, they are still naughty" (FA2 and FA1; Author field notes, December 23, 2014). In agreement with our field assistants, we (the authors) also did not consider group G to be habituated by the end of the study; although we were able to gather situational information related to encounters and conduct group scans and all-occurrences, we still could not consistently collect data from group G. Despite advances in our location efficiency and tracking abilities, group G continued to elude us even after several months of following them. They also regularly monitored and threatened us, rendering individual identification without provoking agitated responses particularly difficult. The fact that researcher and field assistant impressions of habituation progress did not match progress as indicated by some of our quantitative results suggests that understandings of habituation do not rest *exclusively* on quantitative indicators.

From the research team's perspective, group G's habituation status was contingent on our capacity to consistently locate and follow the group, and collect data on an individual basis, which was influenced by a number of factors, including our abilities to locate group G and anticipate their movements, to recognize individuals and react to agitated responses, and to observe them at close distances. In other words, "successful" habituation is more than just an increase in ignore response and a decline in other observer-related behavior—it is about being able to identify individuals and collect reliable, valid data. While the majority of the habituation literature adopts Tutin and Fernandez's (1991) definition of habituation (i.e., a process by which wild animals learn to accept human observers as neutral elements in their environment), the notion that habituation concerns the extent to which data can be collected is expressed in only one previous study: "where research is a primary goal, complete habituation of terrestrial species is achieved when observers can move freely within the group and conduct systematic focal follows of individuals" (Doran-Sheehy *et al.* 2007, p. 1355). It therefore follows that what we deem as "successful" habituation largely reflects research design and objectives.

For instance, toward the end of the study period, a researcher whose focus was group B followed group G with the research team. As soon as we encountered the group and spent a few minutes observing them, they congratulated us for the excellent work; they perceived group G to be habituated. However, from our perspective, group G was far from habituated. Though they did not flee from us, individuals continued to monitor and threaten us by lip-pursing—a clear indication of agitation—throughout the encounter (Thierry *et al.* 2000). One interpretation of this moment of divergent perception is that our own distinct research projects shaped not only our awareness of macaque behavior (Alcayna-Stevens 2016), but also our impressions of whether habituation had actually been achieved. While this particular researcher had been examining group B's diet and general activity patterns over the past several months, we had become very attuned to human-directed behaviors and overall group reactions to observers in our own research. From the other researcher's perspective, the most salient elements in the encounter were that group G could be followed at relatively close distances and that behavioral and diet-related data could be collected systematically, not necessarily that the group was "ignoring" us. This is a crucial distinction given that most definitions of habituation in primatology literature entail ignoring the observer.

Moreover, this example illustrates that habituation can be differentially perceived based on the type of data that are collected, leading one to ask, *what exactly are the macaques habituated* to? This same researcher, whose data collection protocol involved focal follows, noted that group B was habituated to group scans, but that they needed to "learn to be followed individually" to collect focal animal data (RE1, interview January 21, 2015). Thus, purely quantitative behavioral criteria limit our understandings of habituation and fail to completely address whether "successful" habituation has been achieved—an accomplishment that appears to fluctuate in relation to specific research designs.

Based on these findings, we suggest that it is more instructive to think of habituation in terms of a spectrum of tolerance. The notion that study groups can be habituated to specific data collection protocols (for instance, focal follows and scan data) indicates that the groups we consider "habituated" are really just "habituated *enough*" to collect data for a specific purpose. In the case presented above, group G was "habituated enough," by the researcher's standards, because we were able to follow the group and collect scan data, even though group G still regularly threatened us. By recognizing habituation as a spectrum, we also imply that habituation and its process are both dynamic and context-dependent, influenced by several factors including (but certainly not limited to) species-related (e.g., group size) and ecological (e.g., home range structure) variables, site-specific human–primate interfaces, research team composition and data collection protocols, study group dynamics, and individual temperament (Blom *et al.* 2004; Doran-Sheehy *et al.* 2007; Hanson 2017; McLennan and Hill 2010; Narat *et al.* 2015).

Habituation: Beyond Neutrality—Toward Intersubjectivity

The idea that habituated primates regard observers as "neutral" elements is widely accepted in primatology literature (Tutin and Fernandez 1991; van Krunkelsven *et al.* 1999; Williamson and Feistner 2011; see also Crofoot *et al.* 2010; Jack *et al.* 2008; McDougall 2012). However, our study revealed that presumed "neutral" observation

was rarely neutral, both with respect to how the research team was perceived by groups B and G, and also in terms of our own relational behavior toward the macaques. Results demonstrate that human-directed behavior was persistent in both groups over the course of the study, though group G exhibited a significant decrease in human-directed behavior as habituation progressed. These results indicate that even for a group that has been followed intermittently by researchers for >30 yr., we are still not perceived as "neutral elements." This is the crux of habituation's inevitable paradox: how can we expect our study subjects to perceive us as neutral elements when we follow them daily with binoculars and notebooks? Despite researcher attempts to remain impartial, peripheral observers, study groups will never be truly ignored. The intrusive nature of the habituation process is particularly relevant here: as we attempt to acquaint ourselves to a new group, we are completely *non-neutral*—we are insistent on following subjects that are already (presumably) agitated by our presence, a state which is further exacerbated by efforts to collect data, track movement, and identify individuals. Moreover, this study demonstrates that even well-habituated groups continue to respond to observer presence; at the very least, we would be remiss to suppose they recognize researchers as "neutral" features of the forest (Crofoot *et al.* 2010; Goldsmith 2005; Jack *et al.* 2008; McDougall 2012; Shutt *et al.* 2014).

Related to this line of reasoning is the inherently intersubjective nature of fieldwork: while intersubjectivity between researchers and study groups is fostered during the habituation process, following already habituated study groups necessitates this mutual understanding, because such relations impact the quality of data being collected. Thus, despite researcher attempts to remain impersonal and "detached" from groups B and G, intersubjectivity was unavoidable. Habituation is therefore unequivocally an ongoing, dynamic, and *bidirectional* process of mutual attunement between observers and study groups (Alcayna-Stevens 2016; Candea 2013; Rees 2007). To become good at following group G, we had to think like the monkeys, anticipate their responses to us and react in predictable ways. Over the course of the study, we established and maintained trust that was predicated on observer-observed intersubjectivity, and our abilities to "read" each other's behavior. This was true for group B, as well: without the maintenance of good relations between the research team and members of group B, the extent to which we could efficiently collect data remained limited. Furthermore, intersubjectivity between the research team and group B extended well beyond mutual trust: field assistants were highly skilled at anticipating where the group was located, and tracking them throughout the day—one field assistant could not precisely describe this kind of foresight; he just simply "knew" where the group would be in the mornings because he had been following them for so long (FA2, Author field notes, September 10, 2014).

For us the sense of "understanding" when the monkeys reacted to us or included us in their behavior became almost intuitive, and following group B constantly generated these intersubjective moments. Over time, the more accustomed we became to certain individuals—their peculiarities, their daily rituals—the closer we felt to their "inner worlds," and the better we became at gathering data. This was especially apparent for the researcher whose protocol involved focal follows:

> There is something different everyday … I think that in the first two hours, you can understand how your work that day will be ... I'm talking about the monkeys and my relationship with the monkeys. And this is something that stays in my

> mind; it's experience that I've acquired. I've been acquiring it for 6 months now. I behave in different ways because of the monkeys. I know that there are some individuals who don't want me too close and some others that don't care if I'm close or not. There are some who are scared of loud noise, some who don't care at all. And also, there's a kind of empathy—if I'm allowed to use this term—between individuals. But, it can change day by day, I need to realize it at the beginning of the focal, and I need to adjust my behavior in that moment… because if the monkeys are scared, they run up the trees and it's hell for me, so it's in my best interest to understand their mindset that day and behave accordingly. (RE1, interview, January 21, 2015)

For this particular researcher, regular intersubjectivity with group B was a crucial aspect of data collection, which demanded their awareness of focal individuals' daily states of mind, ultimately influencing their capacity to follow and collect consistent data from group B. Moreover, intersubjectivity between this researcher and the macaques was a faculty that was honed over time via sensory engagement with the primates and the surrounding forest (Alcayna-Stevens 2016), thereby reinforcing the argument that observer learning processes and *specific* experiences play an equally instrumental role in the habituation process and following a study group thereafter. Although the primatology literature seldom acknowledges the intersubjective nature of primate fieldwork, the evidence presented here demonstrates that *good* research (cf. Candea 2010) necessitates intersubjective fluency between researchers and study subjects.

Implications for Advancing Ethnoprimatology

To date, ethnoprimatology has largely focused on literal zones of sympatry, where humans and nonhuman primates are entangled both socially and ecologically. By recognizing primate fieldwork as yet another sympatric zone, this project represents a new frontier for the discipline of ethnoprimatology. Moreover, while ethnoprimatology has always been both theoretically and methodologically integrative, this study illustrates how further boundary crossing, in this case to social science and humanistic studies on the human-animal nexus, can benefit primatological practice (Dore *et al.* 2017). Today, it is no longer enough to be an ethologist who "knows a monkey as a monkey" (Lestel *et al.* 2006, p. 170), as primates who interface with humans are clearly not bounded biological subjects (Kirksey and Helmreich 2010, p. 556). Instead, we need to be able understand how humans and primates behave together, how they interface and change one another, socially, cognitively, and physiologically (Fuentes 2012; Lestel *et al.* 2006, p. 156).

Because inclusion of the human–primate interface in primatological research frequently shapes research outcomes, it is prudent to study how the primate–primatologist interface shapes subsequent research. Other practitioners of ethnoprimatology have already recognized the examination of relationships between researchers and their study subjects as an essential element of primatological practice, and have noted that methodological, theoretical, and ethical reflexivity is "part and parcel to conducting good primatology" (Fuentes 2012; Malone *et al.* 2010, p. 779; Riley 2013). Indeed, by embracing the subjective (and intersubjective) nature of the habituation process, we were better equipped—methodologically and practically—to carry out our research, to effectively "do science."

Ethnoprimatologists, therefore, are situated at the forefront of an expanding scope of theoretical and methodological possibility, and ultimately hold the potential to advance a more holistic, robust, and reflexive approach to contemporary primatology.

Conclusion

Qualitative impressions from the research team not only helped to explain patterns in quantitative data in some instances, but also contributed additional insight into the overall process of habituation. For example, results from encounter duration analyses showed that there was no increase in encounter duration during group G's habituation process, while qualitative evidence suggested that the research team did not perceive encounter duration as a feature of habituation progress. Together, these findings call into question the use of encounter duration as a marker of progress during the habituation process. Additionally, merging quantitative and qualitative data enabled us to evaluate location efficiency and minimum distances as important metrics indicating progress in not only study group tolerance, but also the research team's ability to "read" the study group. Research team perspectives gleaned from the ethnographic data also shed light on patterns of human-directed and primate-directed behavior, particularly with regard to reevaluating the role of neutrality in habituation and understanding how researchers achieve "good relations" by simultaneously distancing themselves from and engaging with study groups. Examining the habituation process in this way reveals the importance of being aware of, listening to, and tracking the research team's subjective perceptions of habituation progress *in conjunction* with quantitative indicators. We conclude that habituation actively engages both the researcher and the study group, transforming both in the process, and that the state of "being habituated" is perhaps better characterized as a flexible, context-dependent spectrum of heightened observer tolerance.

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