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Animal behaviour

Marching into battle: synchronized walking diminishes the conceptualized formidability of an antagonist in men

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Paralleling behaviours in other species, synchronized movement is central to institutionalized collective human activities thought to enhance cooperation, and experiments demonstrate that synchrony has this effect. The influence of synchrony on cooperation may derive from an evolutionary history wherein such actions served to signal coalitional strength to both participants and observers—including adversaries. If so, then synchronous movement should diminish individuals' estimations of a foe's formidability. Envisioned physical size and strength constitute the dimensions of a representation that summarizes relative fighting capacity. Experiencing synchrony should therefore lead individuals to conceptualize an antagonist as smaller and weaker. We found that men who walked synchronously with a male confederate indeed envisioned a purported criminal as less physically formidable than did men who engaged in this task without synchronizing.

1. Introduction

McNeill [1] observed that a widespread human practice is the use of synchronous movement to enhance within-group cooperation, particularly in situations of intergroup conflict. Subsequent research reveals that synchronous movement signals alliance affiliation in a variety of cetaceans [2–4], predicting the outcome of agonistic intergroup encounters [4]. Likewise, synchronized chorusing is thought to signal alliance affiliation in many primates, and this is demonstrably so in chimpanzees [5]. The use of synchrony in humans is thus plausibly understood as the product of a trait that has evolved in a number of species, whereby synchronized behaviour signals coalitional size, solidarity and capacity for coordination—a signal of particular importance during intergroup competition [1,6–9].

Experiments involving orchestrated or spontaneous synchrony in humans demonstrate that synchrony increases cooperation (e.g. [10–15]; but see [16]), and, conversely, cooperation can spontaneously produce synchrony [17]. The effects of synchrony on cooperation in humans are proximately explicable in terms of the recognition of affordances for joint action [10] and the enhancement of feelings of connectedness (reviewed in [18]).

Although much literature on synchrony in humans stresses its prosocial consequences, increased bonding and cooperation with ingroup members can produce destructive behaviours directed at outgroups: synchrony increases compliance with requests to aggress against an outgroup [19] or kill insects [20]. Elevated aggression is to be expected if the trait at issue evolved in the context of intergroup competition, as, in ancestral populations, much of the adaptive utility of social bonding and cooperation will have derived from collective actions against rival groups. The effects of synchrony should therefore not be limited to affiliative motivation or recognizing affordances for joint action, as other processes relevant to conflict should be similarly influenced.

Table 1. Mean rated bonding, inclusion of other in the self, positive affect, negative affect and task difficulty.

	control mean (s.d.)	synchronous mean (s.d.)	F	p	η_p^2	95% CI
bonding	3.15 (1.01)	3.90 (1.17)	11.50	0.001	0.11	−1.19, −0.31
IOS	1.82 (0.82)	2.53 (1.18)	11.97	0.001	0.11	−1.12, −0.30
positive affect	3.67 (1.19)	3.95 (1.44)	1.05	0.307	0.01	−0.81, 0.26
negative affect	1.98 (1.20)	1.53 (0.61)	5.26	0.024	0.05	0.06, 0.85
task difficulty	1.82 (1.23)	2.86 (1.53)	13.72	<0.001	0.13	−1.60, −0.48

Here, we explore how synchronous behaviour affects representations thought to contribute to decision-making in agonistic contexts.

In agonistic interactions, individuals must rapidly decide whether to fight, flee or appease. One determinant of this decision is relative fighting capacity. Because many factors contribute to relative fighting capacity, decision-making can be facilitated via a representation that serves as a running tally, summarizing these as each is assessed in turn. We have proposed that, owing to the phylogenetic antiquity and ontogenetic ubiquity of the importance of physical size and strength in agonistic contests, in humans, these dimensions form the basis for such a representation [21]. Consonant with this perspective, a foe's envisioned size and muscularity are influenced by his access to weapons [21], propensity to take risks [22], membership in a group stereotyped as dangerous [23] and commitment to conflict [24]; the effectiveness of the foe's leaders [25]; and the perceiver's strength [26], temporary incapacitation [27] and parenthood status [28]. Likewise, inducing changes in perceived social power causes inverse changes in estimates of another's size and weight [29], while feelings of power lead to overestimates of own height and underestimates of another's [30]. Notably, the presence of allies reduces estimates of the size and strength of an antagonist [31]. If synchrony indexes the potential for cooperation—including joint action in agonistic contexts—then experiencing synchrony should lead individuals to decrease their assessments of an adversary's relative formidability, causing them to envision the foe as smaller and less muscular. We tested this prediction.

2. Material and methods

(a) Participants and overview of procedure

See the electronic supplementary material for full methods and discussion of limitations. As men appear particularly sensitive to the possibility of coalitional violence, to provide the clearest test, we limited our sample to men. Data were pre-screened (see the electronic supplementary material), producing a sample of 96 men (31.3% White; 36.5% Asian; 32.3% other; age 18–29 ($M = 20.02$, s.d. = 2.26)).

Participants walked 244 m along a pathway with a male confederate posing as another participant, then completed a survey packet on site. Participants were randomly assigned to either an experimental condition, in which they were asked to walk in sync with the other person, or a control condition, in which they were instructed to walk at a natural pace.

In the survey, embedded within filler visual estimation tasks, participants estimated the bodily attributes of a supposed criminal based on a cropped 'mugshot' of an angry male face. The target's bodily traits were estimated in fixed order: height (to the nearest half-inch), size (assessed using an array of six silhouettes) and muscularity (assessed using an array of six images of male bodies). Estimated physical formidability was composited using standardized values for estimated height, overall size and muscularity ($\alpha = 0.58$).[1]

Participants next answered questions about how they felt while walking. The first three items ($\alpha = 0.65$) pertained to feelings of bonding with the confederate (1 = *not at all*; 7 = *very much*). Next, three items measured the perceived difficulty of the walking task, using the same scale ($\alpha = 0.91$). Participants then rated their feelings towards the confederate using the inclusion of other in the self scale (IOS [33]), composed of seven pairs of circles, labelled as 'self' and 'other', ranging from non-overlapping to almost entirely overlapping. Finally, to assess whether any effects of condition owed to changes in affect, participants rated their current states of positive and negative emotion (*happy, joyful, elated*, $\alpha = 0.87$; *sad, irritated, angry*, $\alpha = 0.75$).

3. Results

(a) Effects of condition on bonding, affect and task difficulty

As predicted, participants in the synchrony condition reported greater feelings of bonding, inclusion of other in the self, and task difficulty, and lower feelings of negative emotion, than did participants in the control condition, $ps < 0.03$. There was no effect of condition on self-reported positive affect (see table 1).

(b) Envisioned physical formidability

As predicted, the target individual's envisioned physical formidability was lower in the synchrony condition ($M = -0.21$, s.d. = 0.79) than in the control condition ($M = 0.19$, s.d. = 0.64), $F_{1,94} = 7.48$, $p < 0.01$, $\eta_p^2 = 0.07$, 95% CI (0.11, 0.69) (see figure 1). Follow-up tests assessing the individual dimensions of envisioned physical formidability revealed significant differences in estimated height (in inches) and estimated size according to the silhouette array, with a similar trend for estimated muscularity (see table 2). To assess whether the effect of walking synchronously on the envisioned physical formidability of the criminal was due to indirect effects of bonding, affect or task difficulty, we ran a simultaneous regression of condition (1 = control; 2 = synchrony) and the bonding, inclusion of the other in the self, negative affect and task difficulty measures, with the target's envisioned physical formidability as the outcome variable. In the model, only synchrony condition predicted the target's envisioned physical formidability (see table 3; see the electronic supplementary material for additional analyses).

Table 2. Mean estimated height, size and muscularity of target.

	control mean (s.d.)	synchronous mean (s.d.)	*F*	*p*	η_p^2	95% CI
height (in.)	69.66 (1.96)	68.71 (2.39)	4.52	0.036	0.05	0.06, 1.83
size	3.82 (0.84)	3.44 (1.01)	4.01	0.048	0.04	0.003, 0.76
muscularity	2.75 (0.82)	2.44 (0.81)	3.24	0.075	0.03	−0.03, 0.63

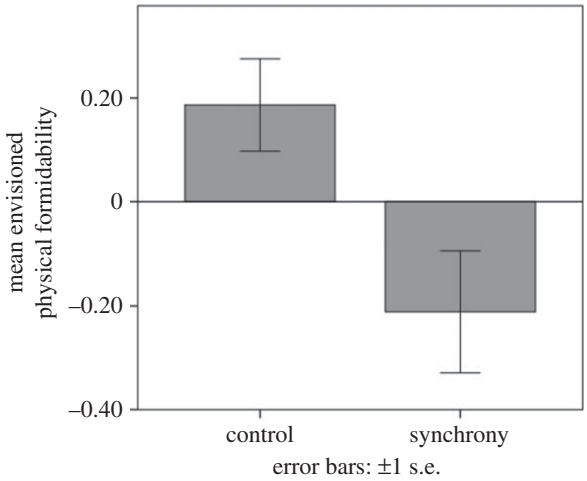

Figure 1. Estimations of target's physical formidability (standardized scores) by condition.

Table 3. Linear regression of potential predictors of target's estimated physical formidability.

	B	*p*
condition	−0.299	0.015
bonding	0.139	0.253
IOS	−0.069	0.566
negative affect	−0.072	0.493
task difficulty	−0.034	0.758

4. Conclusion

Paralleling conclusions from behavioural observations in cetaceans and apes, consonant with the thesis that (i) synchronized movement increases cooperation and (ii) cooperative action potentially includes defence against a foe, men who walked synchronously with another man envisioned a purported criminal as less physically imposing than did men who engaged in the same task without synchronization. Thus, synchrony diminished the perceived relative fighting capacity of the foe.[2]

Although synchrony increased perceived social bonding, this did not mediate the formidability effect, suggesting that these are independent consequences of synchrony. This implies that the diminution of the perceived threat posed by a foe that synchrony induces may not be subjectively experienced as an outgrowth of social bonding. Such experiential independence would be consonant with the utility of cooperation in both agonistic and non-agonistic contexts, and would be consistent with findings that (i) absent an agonistic context, synchrony enhances prosociality towards third parties [14] and (ii) ingroup affiliation is independent from hostility towards outgroups [34]. Future research should therefore further explore the relationship between bonding and perceived formidability following synchronized movement.

Synchronized behaviour can be understood as a multidirectional signal, communicating information to both those who engage in it and observers (including potential adversaries). Changes in assessments of a foe's relative formidability following synchrony can thus be understood as a consequence of the receipt of information concerning affordances for coalitional defence. Correspondingly, observers should assess synchronous groups as more formidable than asynchronous groups—a testable prediction. Lastly, our study employed a threatening target, and thus concerns defensive preparedness. However, if assessments of relative fighting capacity shape behaviour in agonistic contexts, then the experience of synchrony may also upregulate the motivation to aggress, as, ceteris paribus, when interests conflict, individuals are more likely to attack if a foe is viewed as less formidable. Given the ubiquity of institutionalized synchronization in contexts as diverse as athletic competitions and police formations, this disturbing possibility merits investigation.

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Data accessibility. Data archived at http://www.escholarship.org/uc/item/3mc0h2vx.

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Endnotes

[1]Although α of 0.7 is generally considered necessary to establish reliability, scores of 0.5 or higher may be acceptable when the measure comprises few or notably non-redundant items [32].

[2]It is also possible to measure participants' conceptualizations of themselves [27]. However, this requires procedures not suitable to a naturalistic field experiment; such methods may instead prove useful in future laboratory studies of synchrony.

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Electronic Supplementary Material

to accompany

Marching Into Battle: Synchronized Walking Diminishes the Conceptualized Formidability of an Antagonist in Humans

Daniel M. T. Fessler and Colin Holbrook

Methods

A target sample size of 100 was selected in advance of data collection based on prior work on synchrony and aggression (1,2). Anticipating some loss due to noncompliance and similar problems, data collection was therefore stopped at 110.

Male undergraduate students at the University of California, Los Angeles were recruited by female research assistants in a public area on the university campus for a field study, advertised as a survey of "Motor Exertion, Feelings, and Visual Intuition," in exchange for $3 compensation. The study was framed as investigating links between physical activity, emotion, and visual perception.

Data were pre-screened to ensure response completeness, English fluency, correct answers to a "catch question" asking how many letters are in the English alphabet, and the absence of unexpected disruptions (e.g., an ambulance driving through the study area). Data from fourteen participants were removed on the above grounds prior to analysis.

In a between-subjects design, participants were asked to walk 244 meters along a paved public pathway that had been cordoned off by the researchers. A male research confederate posed as another participant; participants were asked to walk the length of the cordoned-off area, then return to the starting point to complete a survey packet. Participants were randomly

assigned to either an experimental condition or a control condition. In the experimental condition, the participant was asked to walk in sync with the other person, starting on the left foot; in the control condition, the participant was instructed to "walk at your own natural pace—there is no need to try to keep up with one another." Immediately upon returning to the starting point, participants were given the survey packet reproduced in its entirety in the next section of this ESM. Having verbally instructed participants as to how to walk, the researcher was not blind to condition. However, the researcher was not able to influence participant responses: upon completing the walking task, participants were simply handed a clipboard and asked to complete the written questionnaire that contained the dependent measures – no further interaction took place between the researcher and the participant, hence experimenter effects are unlikely.

The key stimulus in the survey packet is an image of an angry man's face (pages 6-8 of this ESM); both this image and the filler task image of a woman's face (page 5 of this ESM) are taken from the Radboud Faces Database (3), and are approved for public display and publication.

The third core dependent measure embedded in the survey packet (page 9 of this ESM) is a matrix of computer-generated images of male bodies, used to measure the envisioned muscularity of the target individual. This array was modified with permission from (4).

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Complete Survey Packet

INSTRUCTIONS :

This packet contains a variety of tasks that explore the links between motor exertion, visual perception and visual intuition. Please answer the questions as best you can, without overthinking things or stopping to ask the research assistant for guidance. If in doubt, please just use your best guess or hunch.

Thanks again for your assistance!

This image is grey—
how many colors of jelly beans would you estimate were in the original picture?

# of colors: _____

In your estimation, what is the oldest that this woman could be?

Age (in years): _____

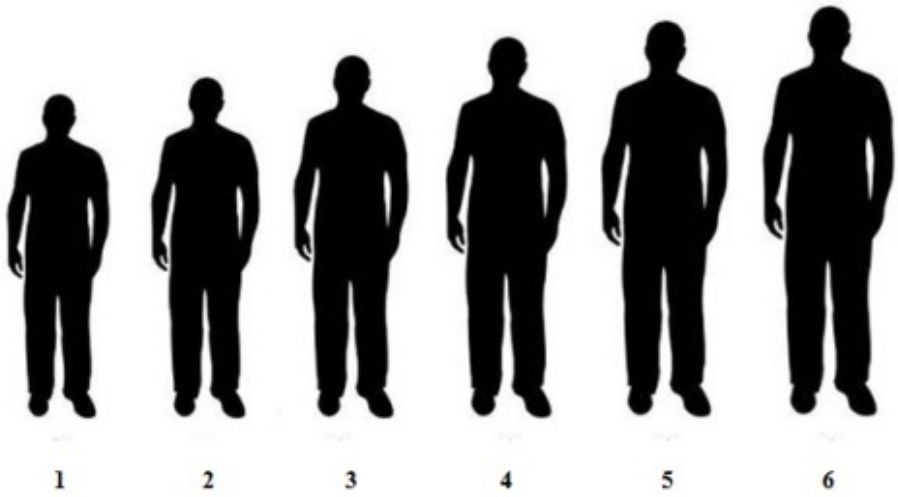
This cropped image was taken from a criminal mugshot.
Please attempt to estimate this man's bodily characteristics.
Answer the questions which follow using your best guess or intuition.

What would you estimate this man's height to be, to the nearest half-inch?

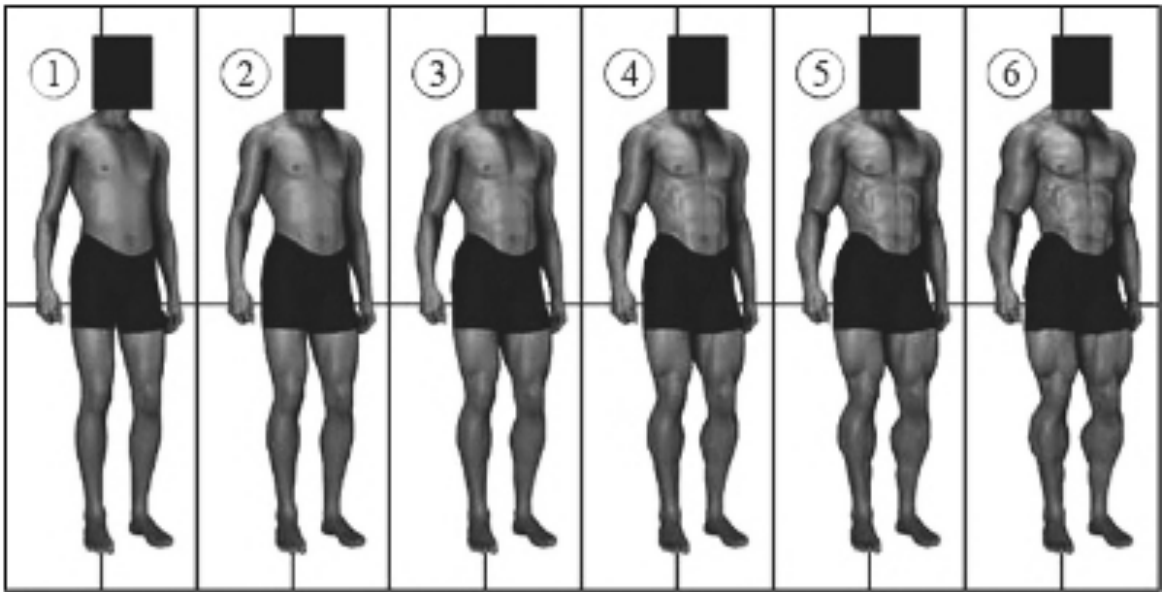
Feet : _____ **Inches** : _____

(If you are more familiar with the metric system, please estimate his height in meters: _____)

Circle the number of the image that best matches how you picture the man in the photo:



Circle the number of the image that best matches the strength of the man in the photo:



Please answer the following questions based on how you felt <u>during the walking task</u>.

- How connected did you feel to the other participant?

O	O	O	O	O	O	O
Not at all						Very much

- How much did you like the other participant?

O	O	O	O	O	O	O
Not at all						Very much

- How similar did you feel to the other participant?

O	O	O	O	O	O	O
Not at all						Very much

- How difficult was it to walk with the other person as you were instructed?

O	O	O	O	O	O	O
Not at all						Very much

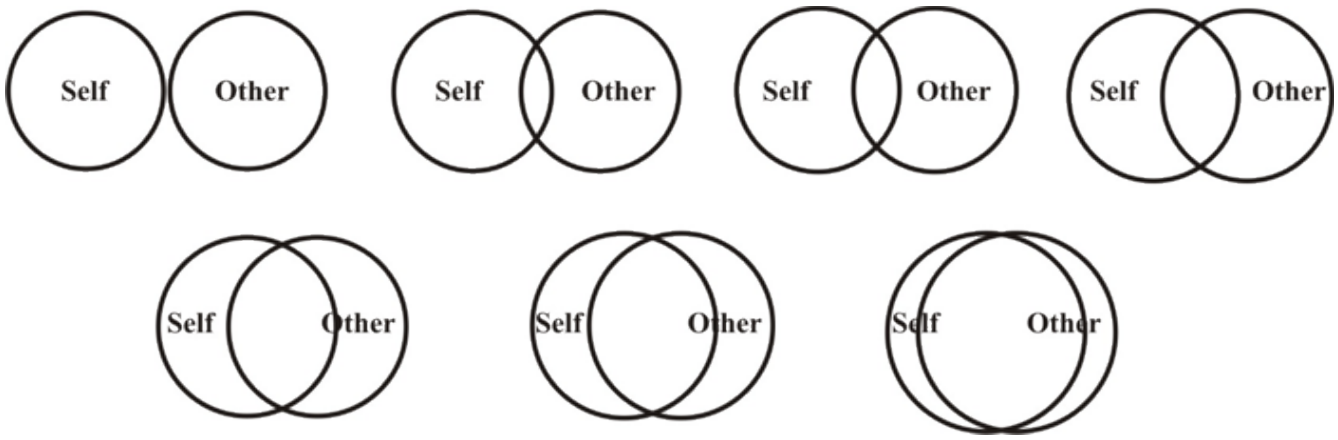
- How demanding was it to walk with the other person as you were instructed?

O	O	O	O	O	O	O
Not at all						Very much

- How much effort did it take to walk with the other person as you were instructed?

O	O	O	O	O	O	O
Not at all						Very much

Please circle the picture that best describes how you feel toward the other participant in today's study:



Please rate how much you feel the following feelings or emotions, **right now** :

1. Sad	o	o	o	o	o	o	o
	Not at all						Very much

_____

2. Happy	o	o	o	o	o	o	o
	Not at all						Very much

_____

3. Irritated	o	o	o	o	o	o	o
	Not at all						Very much

_____

4. Joyful	o	o	o	o	o	o	o
	Not at all						Very much

_____

5. Angry	o	o	o	o	o	o	o
	Not at all						Very much

_____

6. Elated	o	o	o	o	o	o	o
	Not at all						Very much

_____

Demographics

- Age: _____
- Ethnicity: _____

- Your height: *Feet* ____ *Inches* ____
- Your weight (in pounds) : _____

- In your daily life, do you usually use the Metric system or the English system of measurement?
    - Metric
    - English

- How many letters are in the English alphabet? _____

- What is your sex?
    - Female
    - Male

- Is English your first language?
    - Yes
    - No

- To what extent did you walk "in-step" with the other participant?

O	O	O	O	O	O	O	O	O
Not at all synch								100% in