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Mood Influences the Perception of the Sitting Affordance

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Abstract

This study tested the influence of mood on the perception of the sitting affordance in two experiments. The objective of Experiment 1 was to evaluate participants' perception of the sitting affordance, without mood induction. Forty-three participants assessed their maximum sitting height (SHmax) from different seat heights (perceptual SHmax) before performing the action (motor SHmax). They accurately perceived the sitting affordance, in body-scaled intrinsic units. Indeed, participants all perceived they could sit as long as the seat height did not exceed 82% (perceptual πc) of their total leg length (*L*), while the actual value of this intrinsic relationship was 83% (motor πc). In Experiment 2, forty participants were subjected to a mood induction procedure before performing the task employed in Experiment 1. Neutral participants accurately perceived the sitting affordance, as their perceptual πc was equivalent to their motor πc. However, both joyful and sad participants had their perceptual πc significantly lower than their motor πc. These differences between mood groups were not explained by a variation in maximal effective action capabilities. Indeed, participants had equivalent motor πc, whatever their mood. Two interpretations are offered to explain how joyful and sad moods could influence the accuracy of affordance perception. The first is based on their potential effect on organism's energy level. The second is related to the disruption of participants' attunement to optical variables relevant for action guidance and/or to perceptual-motor calibration.

Keywords action · perception · mood · reachability · ecological psychology

Every day, individuals perceive many affordances such as climbing a step (Warren, 1984), sitting in a chair (Mark, 1987; Mark & Vogele, 1987), grabbing an object (Carello et al., 1989), stepping over an obstacle (Sakurai et al., 2013) or passing through an aperture (Warren & Whang, 1987). Affordances are, basically, possibilities of action offered by the environment. This concept was developed within the framework of Gibson's ecological approach to visual perception (Gibson, 1977, 1979).

Perception of affordances is intrinsically dependent on the relationship between physical properties of the environment (e.g., dimensions, surface, textures) and organism's action capabilities (e.g., anthropometric variables, strength, muscle elasticity; Bootsma et al., 1992; Fajen & Matthis, 2011; Franchak et al., 2010; Gibson, 1979; Konczak et al., 1992; Mark, 1987; Thomas et al., 2018; Warren, 1984; Warren & Whang, 1987). For instance, an object affords the action of grasping if its size, texture or shape is compatible with the morphological and dynamic characteristics of our hand. More precisely, affordances would be perceived through "intrinsic" optical variables. These variables could be body-scaled (i.e., scaled to anthropometric variables only) or more generally action-scaled (i.e., scaled to anthropometric and dynamic variables such as muscular force). For a given affordance, these variables would be the same for all humans and would constitute a relevant "*natural standard*" for action guidance. This has already been shown by several seminal studies that have operationalized body-scaled affordances using the methodological "intrinsic scaling paradigm" (Mark, 1987; Warren, 1984; Warren & Whang, 1987).

For example, regarding the sitting affordance, Mark and Vogele (1987) divided participants' perceived maximum sitting height (perceptual SHmax) by their total leg length (*L*). They showed in their Experiment 2 that all participants perceived they could seat as long as the seat height did not exceed 90% of their *L*. This latter percentage, traditionally referred to as the "perceptual critical point" [perceptual πc (perceptual SHmax/*L*)] is a strong argument supporting that

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affordance perception is intrinsically scaled, in line with the basis of Gibson's ecological theory of visual perception (Gibson, 1977, 1979; Warren, 1984). Furthermore, Mark and Vogele (1987) showed that participants' perceptual πc was very close to their motor πc (i.e., motor SHmax/*L*, determined from action execution), indicating that participants perceived the sitting affordance accurately.

However, numerous studies have shown that perception of affordances is influenced by a variety of factors, which consequently influence individuals' active relationship towards their environment. Among these factors, we can find age (Konczak et al., 1992; Sakurai et al., 2013), anxiety (Graydon et al., 2012; Pijpers et al., 2006), sleep deprivation (Connaboy et al., 2020; Daviaux et al., 2014), concussion history (Eagle et al., 2019), egocentric distance of affordance perception (Mark, 1987), or practice (Mark et al., 1990; Ramenzoni et al., 2010; Wagman et al., 2014). However, one factor has not yet been tested despite its omnipresence in everyday life and the existence of theoretical premises that encourage its study. This factor is mood.

To our knowledge, no empirical study has tested the effect of mood on affordance perception. However, several theoretical works suggest an influence of affective state. Based on patient reports, de Haan et al. (2013) developed a model based on affordance perception in healthy individuals and psychiatric patients (depressive and obsessive-compulsive disorders). Depending on different dimensions [e.g., degree of solicitation (sometimes referred to as "intensity") and temporality of the perceived affordances], the "field of affordances" would differ between healthy individuals, depressed and obsessive-compulsive patients. Interestingly, de Haan et al. included the "affective salience" of perceived affordances in these dimensions. In other words, patients with depression or obsessive-compulsive disorder as well as healthy individuals would have a particular affective-related functioning (Bianchi et al., 2017; Bowen et al., 2015; Laurent et al., 2017; Tan et al., 2017), which could be characteristic of how they perceive affordances. For instance, healthy individuals would perceive an affordances field in which variation in the affective allure of affordances is observed. Conversely, depressed individuals would perceive a field in which all affordances would have the same affective allure.

The inclusion of affective state as a potential influencing factor of affordance perception was supported by Withagen's (2018) theoretical paper, which discusses an ecological approach to emotions. As Withagen points out, we are always affectively engaged in our environment. Therefore, ecological psychology would have no other option to deal with affective processes. In the light of James (1884) and Dewey (1895) founding theories of somatic emotion, one of the relevant points evoked by Withagen (2018) is that emotions would be equivalent to "organic pulses". Emotions would contribute to the coordination of individuals in their active relationship to the environment, through a concrete mobilization of their body components. In this way, rather than being understood in a high-level serial cognitive process, emotions would be embodied information that would inform - and thus influence - the perception of affordances.

However, as discussed by de Haan et al. (2013) and Withagen (2018), early empirical studies are needed to develop and make more concrete the ecological conceptualization of affective processes. Therefore, the aim of this study is to provide a first empirical test of the influence of mood on affordance perception, a key component of the ecological approach. This empirical investigation could provide new insight to the ecological conceptualization of affective processes in the field of visual perception. It could also allow a better understanding of the role of affective factors in the behavioral regulation of individuals with their environment (made up of multiple affordances). In this framework, two experiments have been conducted.

Experiment 1

Experiment 1 was a replication of Experiment 2 of Mark and Vogele's (1987) study on the perception of the sitting affordance. We selected the sitting affordance because each day we are exposed to it, many times. The primary aim of this replication was to define a baseline to evaluate the participants' accuracy in the sitting affordance perception when their mood is not manipulated. We hypothesized that participants would accurately perceive the sitting affordance as in Mark (1987) and Mark & Vogele (1987) studies. In addition, this replication allowed us to retest whether the perception of the sitting affordance is intrinsically body-scaled (Mark, 1987; Mark & Vogele, 1987), before testing the influence of mood in Experiment 2. Perception in intrinsic units (body-scaled or more generally action-scaled) would be a principle at the root of affordance perception (Fajen, 2005; Fajen et al., 2009; Gibson, 1979; Thomas et al., 2018; Warren, 1984; Warren & Whang, 1987).

Method

Participants

Forty-three healthy students (16 men, 27 women) from University Bourgogne Franche-Comté ($M_{age\ (year)}$ = 19.9, *SD* = 1.57) participated in the study.[1] Their involvement

[1] The sample size was determined to be at least equivalent to Experiment 2 of Mark and Vogele's (1987) study (i.e., 28 participants concerning the sitting affordance). Consistently with previous findings, we did not expect any particular effect of the SHmax assessment modality (perceptual and motor) on πc, but rather the absence of effect of it. In this context of H_0 testing and replication study, the *a*

was in partial fulfilment of the requirements for the BA in psychology in Besançon. Their participation in the experiment allowed the validation of a compulsory education unit, which could otherwise be validated (very short report following readings) for those who did not want to be involved in the experiment. Contrary to Mark and Vogele (1987), we decided not to exclude men from the sample. We set up a board stacking mechanism to assess the maximum seat height (SHmax) of both men and women.

Consent and health–impairment forms were completed and signed by each participant before the experiment began. The health-impairment form included information regarding the presence or absence of any vision and/or motor disorder. Participants who reported having a vision disorder were asked to indicate its nature and whether they had a means to have their vision corrected. Eleven participants participated in the study with corrected-to-normal vision. Participants who reported a motor disorder were asked to indicate its nature and whether they had a means to have normal motor skills. None of the participants reported having a motor disorder. The participants did not receive any financial compensation for their participation in the experiment. For each participant, the ethical principles of both the American Psychological Association and the Declaration of Helsinki were followed (World Medical Association, 2013).

Apparatus

Mark and Vogele (1987) constructed an adjustable chair to assess the SHmax of participants. We replaced it with a board stacking system that allowed to reach a higher SHmax. Thus, even for "very" tall men, the height limits of the apparatus were not reached, allowing us to include men in addition to women in the sample contrary to Mark (1987) and Mark and Vogele (1987).

The board stack was composed of 24 extrusion-reinforced polystyrene boards with dimensions (length x width) = 41.5 x 30 cm. These dimensions were slightly larger than the dimensions of the seat used by Mark and Vogele (1987; i.e., 33 x 28 cm) in order to increase the stability of the board stack and thus participants' safety. A single board supported a weight of more than 200 kg. The height of each board had to correspond to the height incremented by Mark and Vogele (i.e., 4 cm). Imperfections related to the design of the boards in factory resulted in 19 boards measuring 4.1 cm and 5 boards measuring 4.2 cm. The 4.2 cm boards were placed at the base of the stack composed of 8 fixed boards, for a total height of 33.3 cm. Thus, the modification of the stack height was always done by successively adding or removing a 4.1 cm high board starting from a fixed base of 33.3 cm. The total height of the stack varied from 33.3 cm to 98.9 cm (i.e., 17 possible heights). Each board was marked with a number, ranging from 1 to 24, that was not visible by the participants. Therefore, the location of each board in the stack was known to the experimenter and did not vary. All measurements relating to the dimensions of the stack were taken using a rigid tape measure. Participants' *L* was measured with a soft tape measure.

Procedure

In order to control the constraint of clothing style on the motor action required to sit, participants were informed before they arrived in the experimental room that they would have to wear trousers during the experiment. Once inside the experimental room, participants completed the consent and health–impairment forms. They were located in the adjacent room to the one where their perceptual and motor SHmax were assessed. Thus, they could not analyse the board stack before starting the experiment. In this adjacent room, the participants had to remove their shoes, because the thickness of their soles could influence both perceptual and motor assessments of their SHmax as well as the measurement of their total leg length (*L;* Mark, 1987; Mark & Vogele, 1987). They also had to remove their coats and place the contents of their front and back trouser pockets in a cardboard box. This ensured that once seated, no objects or materials elevated the participants and that they were not hindered by sharp objects such as keys. Then, the participants were guided to the main room in which the three phases of the experiment occurred: (1) perceptual assessments of the SHmax, (2) motor assessments of the SHmax, and (3) measurements of *L*. Participants could put their shoes and coat back on at the end of these three phases. A large uniform grey blind prevented outside light from entering the room. The room was systematically illuminated by two neon lights that did not vary in intensity and location.

Perceptual assessment of the SHmax In the first phase illustrated in Fig. 1, participants assessed their SHmax perceptually. They had to position themselves and stay on a ground marker that was 3 m in front of the stack. Participants first observed the experimenter presenting the definition of the action of sitting. This definition consisted of two rules (Mark, 1987; Mark and Vogele, 1987), which the experimenter clearly explained: (a) "*In moving from a standing to a sitting posture, both of your feet must remain flat on the ground*" and (b) "*When seated, you should be able to lift both feet straight up off the floor without using your hands or losing balance and falling off the chair for 3s*". As with

Footnote 1 (continued)

priori determination of the sample size was based on the sample size employed by Mark & Vogele. In addition to the use of frequentist statistics, we introduced the use of Bayesian statistics into this literature as a more adapted and complementary statistical strategy to test H_0.

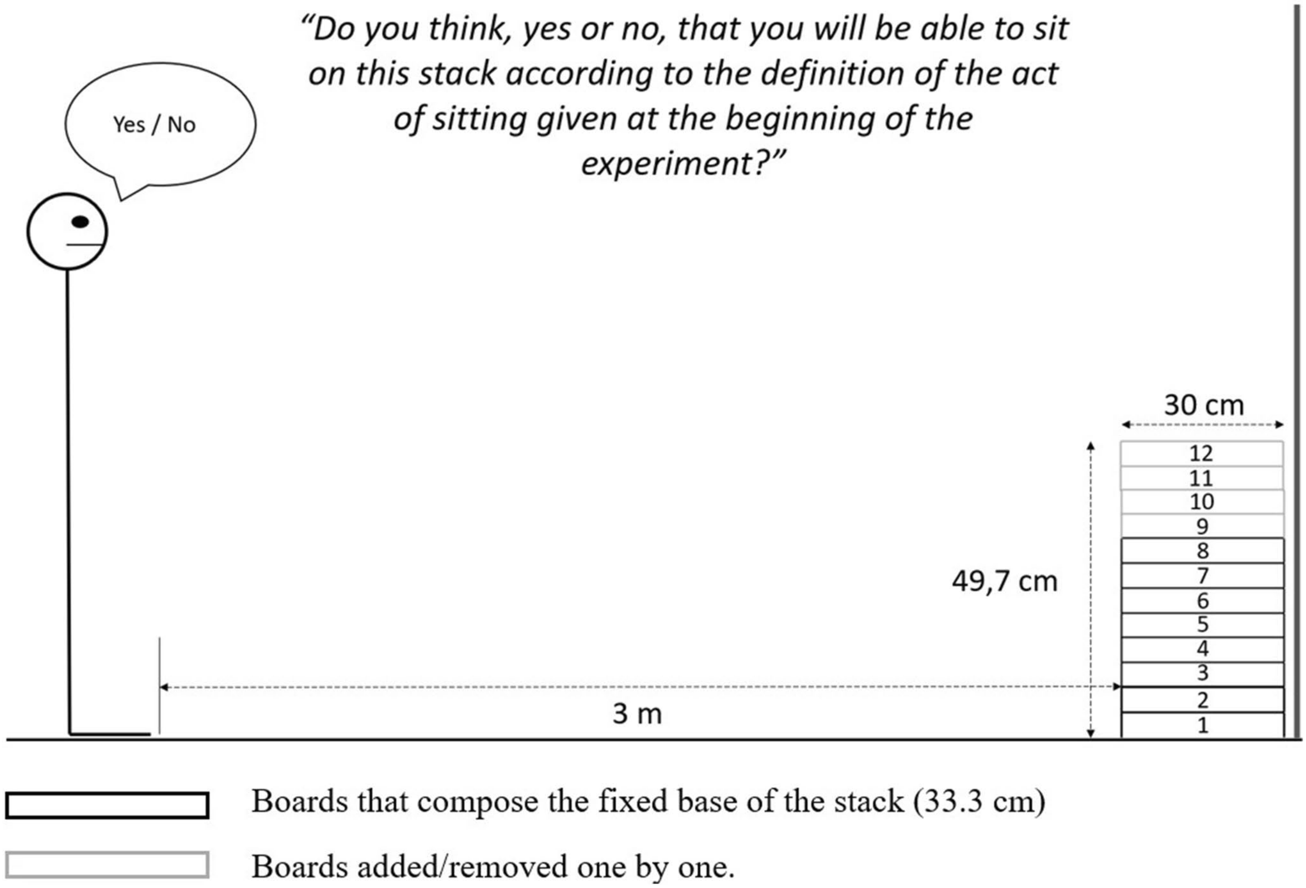

Fig. 1 Perceptual assessment of the SHmax. Here the participant assesses the 5th (AS) or the 13th (DS) height presented (board 12)

most studies that have investigated the sitting affordance, the experimenter added to the definition several demonstrations of the action that met the rules and others that did not (Mark, 1987; Mark et al., 1990; Mark & Vogele, 1987). These demonstrations were systematically performed at the same height (i.e., 10th board, 41.5 cm off the floor). The experimenter then informed the participants that the height of the stack would be modified by adding or removing one board at a time. For each height, the participants had to answer if "yes" or "no" they thought they could sit on the stack according to the definition of the action. The height of the stack was systematically changed with 2 ascending series (AS) and 2 descending series (DS). Their order of presentation was counterbalanced: *AS1-DS1-AS2-DS2* for half of the participants and *DS1-AS1-DS2-AS2* for the other half. The height of the stack thus increased from 33.3 cm (8th board) to 98.9 cm (24th board) from the lower position and decreased by the same amount in increments of 4.1 cm (i.e., one board) from the upper position. Each time a board was added or removed, participants were asked to close and open their eyes at the experimenter's signal ("*close your eyes please*" and "*open your eyes please*" said verbally), to ensure that they were not taking cues for their perceptual SHmax using the experimenter's body height. When the participants opened their eyes, the experimenter was no longer in their field of vision.

For each of the 4 series, participants made 17 assessments, because 17 different heights were presented to them. The same height was assessed (i.e., "yes I can sit" or "no I can't sit") 4 times because there were 4 series (2 AS and 2 DS). Participants' perceptual SHmax was the last height for which the percentage of "yes I can sit" (100% = 4 "yes I can sit") was equal to or greater than 50% [e.g., if the participant's "yes I can sit" percentage was 75% for 53.8 cm (13th board) versus 25% for 57.9 cm (14th board), its perceptual SHmax was 53.8 cm (Mark & Vogele, 1987)].

Motor assessment of the SHmax Directly after the perceptual assessment of their SHmax, participants carried out the motor assessment of their SHmax. They were asked to try to sit on the board that corresponded to their perceptual SHmax according to the rules (a) and (b) that the experimenter repeated at the beginning of this 2nd phase. The action of sitting was therefore divided into two times.

Time 1 corresponded to the application of rule (a) and time 2 to the application of rule (b). If any of rules (a) and (b) was not applied by the participants, the action of sitting was not validated. Depending on whether the participant's action was validated [i.e., compliance of the action with rules (a) and (b)] or not, the experimenter added or removed a board until the limit board for which the action of sitting was validated. This height corresponded to the motor SHmax.

Total leg length measurement (*L*) In a third phase, the experimenter measured participants' *L*. Participants were instructed to put their feet flat and place their heels against the wall, standing upright, as if a doctor wanted to measure their height. Then, the same experimenter systematically leaned towards the outer side of the participants' left leg and stretched a flexible tape measure from the head of their femur to the ground along their malleolus. The distance between the head of the femur and the ground was *L*. This measurement method has been commonly used in sitting affordance studies (Mark, 1987; Mark et al., 1990; Mark & Vogele, 1987).

Statistical analysis

The results were calculated using JASP statistical processing software (version 0.11.1). Confidence intervals (CIs) of effect sizes were calculated using R (version 4.0.2). To statistically test the validity of both extrinsic and intrinsic scalings, simple linear regressions [*b* (slope), *y* (intercept)] were performed, with *L* as a predictor. Cook's distance (*D*) was calculated for each of the values in each of the regressions performed. None of the regressions had a value with $D > 1$, meaning that none of the regressions were distorted by an outlier (Chatterjee et al., 1999). This strengthened the validity of the interpretations from each model.

Bayesian statistics were used to test our hypotheses (i.e., intrinsic body-scaled perception of the sitting affordance and no effect of the SHmax assessment modality), because they required the confirmation of the null hypothesis (i.e., H_0: absence of effect) rather than the alternative hypothesis (i.e., H_1: significant effect; Kelter, 2020; Wagenmakers et al., 2018). The frequentist approach only allows us to conclude to the acceptation or rejection of H_1 depending on the value of *p*, but not to accept H_0. The rejection of H_1 does not mean that H_0 is true. Bayesian statistics provide a better quantitative estimate of the probability that H_0 is true. For this reason, the use of Bayesian statistics in addition to frequentist statistics to test H_0 was relevant (Kelter, 2020; Wagenmakers et al., 2016, 2018).

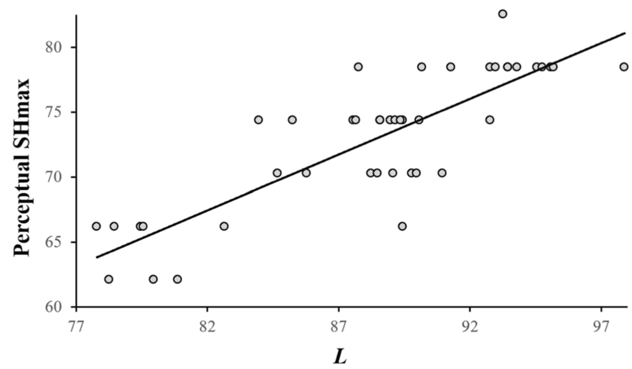

Fig. 2 Linear regression of the perceptual SHmax depending on *L* (extrinsic scaling)

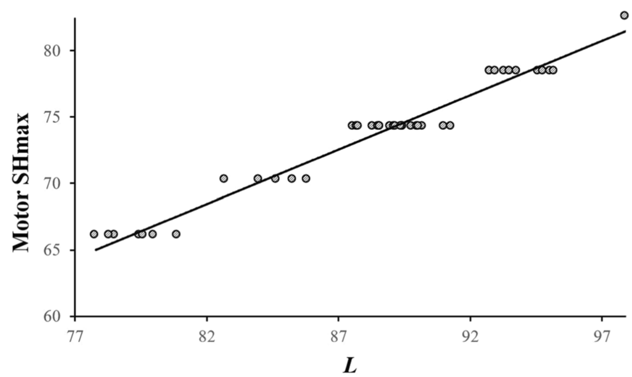

Fig. 3 Linear regression of the motor SHmax depending on *L* (extrinsic scaling)

Results

Extrinsic scaling validity test

A frequentist simple linear regression was performed to assess whether *L* predicted participants' perceptual SHmax (Fig. 2). The analysis revealed a significant relationship between *L* and the perceptual SHmax, $b = .86$, $y = -3.05$, $t(41) = 9.76$, $p < .001$. When *L* was increased by 1 cm, perceptual SHmax increased by .86 cm. The coefficient of determination R^2 was .70, 95% CI [.56, .84], meaning that *L* explained 70% of the variance of perceptual SHmax.

A simple linear regression was performed to assess whether *L* predicted participants' motor SHmax (Fig. 3). The analysis revealed a significant relationship between *L* and motor SHmax, $b = .82$, $y = 1.24$, $t(41) = 32.53$, $p < .001$. The coefficient of determination R^2 was .96, 95% CI [.94, .98].

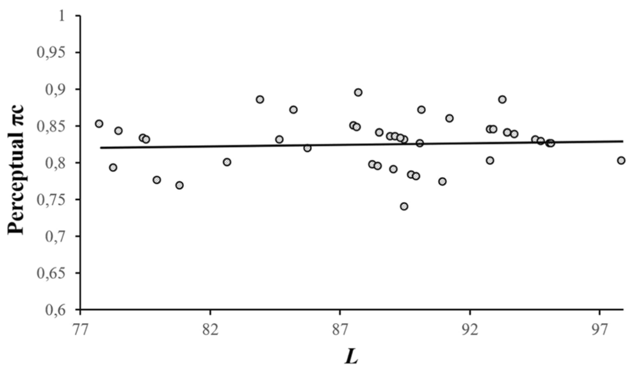

Fig. 4 Linear regression of the perceptual πc (i.e., perceptual SHmax/L) depending on L (intrinsic scaling)

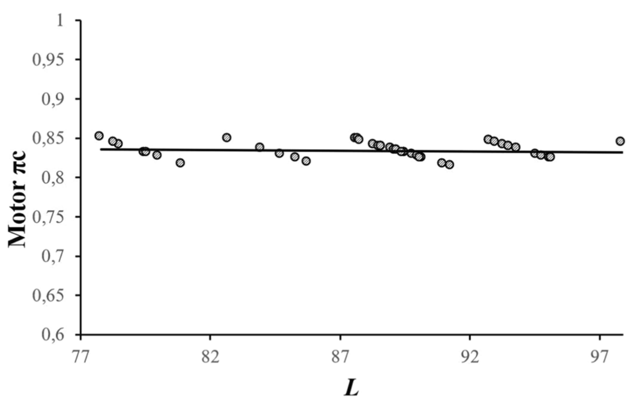

Fig. 5 Linear regression of the motor πc (i.e., motor SHmax/L) depending on L (intrinsic scaling)

Intrinsic scaling validity test

A simple linear regression was conducted to assess whether L predicted the participants' perceptual πc (Fig. 4). The analysis revealed no significant relationship between L and perceptual πc, $b = .0004$, $y = .79$, $t(41) = .43$, $p = .67$. The coefficient of determination R^2 was .004, 95% CI [-.03, .04]. A Bayesian simple linear regression on the same statistical parameters showed that it was 3.1 times more likely that the null model H_0 (i.e., the model that did not include the influence of the predictor, in this case L) was true, compared to the new model H_1 (i.e., the model that included the influence of L), $BF_{01} = 3.1$. Conversely, it was .32 times more likely that the H_1 model was true compared to the H_0 model, $BF_{10} = .32$.

A simple linear regression was performed to assess whether L predicted the participants' motor πc (Fig. 5). The analysis revealed no significant relationship between L and motor πc, $b = -.0002$, $y = .85$, $t(41) = -.63$, $p = .53$. The coefficient of determination R^2 was .01, 95% CI [-.04, .06]. A Bayesian simple linear regression on the same parameters showed that the H_0 model was 2.84 times more likely to be true compared to the H_1 model, $BF_{01} = 2.84$. Conversely, it was .35 times more likely that model H_1 was true compared to model H_0, $BF_{10} = .35$.

Effect of the SHmax assessment modality

The nonparametric Wilcoxon paired-sample test was performed to test the effect of the SHmax assessment modality (perceptual and motor) on the πc.[2] Results showed that the perceptual πc ($M = .82$, $SD = .03$) did not differ significantly from the motor πc ($M = .83$, $SD = .01$), $W = 51$, $p = .08$, rank-biserial correlation = -.46, 95% CI [-.77, .01]. A Bayesian paired t-test was performed on the same statistical parameters. The results showed that it was 1.45 times more likely that H_0 (no difference) was true, compared to H_1 (significant difference), $BF_{01} = 1.45$, *error %* < .001.[3] Conversely, it was .69 times more likely that H_1 was true compared to H_0, $BF_{10} = .69$, *error %* < .001.

The results also indicated the absence of main effect of sex and age, as well as the absence of interaction effect between each of these two variables with the SHmax assessment modality on the πc, $p > .05$.

Discussion

The results of Experiment 1 showed that the sitting affordance was again perceived in body-scaled intrinsic units, as a "*natural standard*" for action guidance (Mark, 1987; Mark & Vogele, 1987). Indeed, all participants perceived they could sit as long as the seat height did not exceed 82% of their L, regardless of their respective L. In addition, participants were able to sit as long as the seat height did not exceed 83% of their L. This strong proximity between the perceptual πc (.82) and the motor πc (.83) indicates that participants, without mood manipulation, accurately perceived the sitting affordance, as in Mark and Vogele's (1987) study.

However, Mark and Vogele (1987) obtained a perceptual and motor πc of .90 in their Experiment 2. In the related literature, this is not the first time that the motor πc of the sitting affordance has not exactly the same value across studies (Mark, 1987; Stoffregen et al., 1999). This could be explained by the fact that participants from different populations may have different action capabilities potentially related to factors that extend beyond their L (e.g., muscular strength and/or flexibility). As Konczak et al. (1992)

[2] The Shapiro-Wilk test showed that the data for perceptual and motor πc were not normally distributed ($p < .001$). Therefore, the nonparametric Wilcoxon test was preferred to the student test.

[3] *Error %* indicates the size of the error in the integration routine relative to the Bayes factor, similar to a coefficient of variation (Wagenmakers et al., 2018).

showed, although the climbability affordance has been operationalized as a body-scaled affordance (Warren, 1984), it may also depend on participants' flexibility and strength. This could potentially apply to the sitting affordance, but additional empirical studies are needed to test this hypothesis. Furthermore, participants in the present Experiment 1 and those in Mark and Vogele's (1987) Experiment 2 accurately perceived the sitting affordance from a different motor πc. This is why the perceptual πc found in each of these two experiments would be different.

Experiment 2

The objective of Experiment 2 was to test whether mood could have a significant influence on the perception of the sitting affordance. For this purpose, three moods were induced: Joy, sadness, and neutrality, which are presumed to be omnipresent in everyday life and which constitute the central points of the mood valence continuum (Sedikides, 1992). The subjective levels of three major affective dimensions (Bradley & Lang, 1994) that is, valence (hedonic feeling), arousal (intensity) and dominance (control of the situation), were measured repeatedly during the experiment to test the effectiveness of the induction procedure.

Method

Participants

Forty-two healthy students (25 women, 17 men) from University Bourgogne Franche-Comté ($M_{age\ (year)} =$ 20.4, $SD =$ 4.65) participated in the Experiment.[4] As in Experiment 1, participation was in partial fulfilment of the requirements for the BA in psychology in Besançon. Participants completed a consent and health–impairment forms. Twelve participants had corrected-to-normal vision. None of the participants reported having a motor disorder. For each participant, the ethical principles of both the American Psychological Association and the Declaration of Helsinki were followed (World Medical Association, 2013).

All participants completed the French version of the 21-item Beck Depression Inventory, version 2 (BDI-II; Beck et al., 1996). They also completed the French version of the 9-item Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001). The purpose of these measures was to assess participants' levels of depressive symptoms, in order to exclude participants with a provisional evaluation of depression from the mood induction procedure. Two participants had a score of "severe depression" according to the cut-offs of the BDI-II (44 and 33, respectively; Beck et al., 1996). For ethical purposes, these 2 participants were proposed a modified version of the experiment (without any mood induction) and were then suggested to find help with care services (including those provided by the university). Their data were not included in statistical analysis, reducing the sample size to 40 participants (23 women, 17 men, $M_{age\ (year)} =$ 20.27, $SD = 4.75$). Participants also completed the Self-Assessment Manikin (SAM; Bradley & Lang, 1994) to assess their valence, arousal and dominance levels several times during the experiment. Neutral mood was induced in 14 participants (7 women, 7 men), positive mood (i.e., joy) in 13 participants (9 women, 4 men) and negative mood (i.e., sadness) in 13 participants (7 women, 6 men).

Materials

The apparatus (i.e., board stacking system) used in Experiment 1 was used in the same way in the present experiment. The additional materials used in this experiment were related to the mood induction procedure. The induction was performed on a computer equipped with a 15.6-inch screen with a resolution of 1920 x 1080 pixels. Each participant was given a black pen and a sheet of paper to write an autobiographical essay (see § *Procedure*, *infra*). Three film clips were presented. They all came from a battery of 70 film clips standardized for affects induction and composed of French dialogues (Schaefer et al., 2010). For the joyful mood induction, participants watched an extract from the film "The Dinner Game" (video 12). For the sadness mood induction, the extract from the film "City of Angels" (video 36) was used. For the neutral mood induction, an extract from the film "Blue 2" (video 45) was used. The sound volume, adjusted using the computer connected to the headphones, was the same for all participants (i.e., 60 decibels).

The level of participants' depressive symptoms was measured with both BDI-II and PHQ-9. For the PHQ-9, the cut-off used was a score ≥ 15, corresponding to a provisional evaluation of moderately severe depression. We have chosen this cut-off because it has the highest likelihood ratio (i.e., 13.6) and specificity score (95%) compared to other lower cut-offs (Kroenke et al., 2001). For the BDI-II, we have chosen to use the cut-off of the "severe" category (i.e., > 28; Beck et al., 1996) because the depressive symptoms in this category are those that would correspond most closely to the

[4] To our knowledge, no study to date has tested the influence of mood on the perception of the sitting affordance. Therefore, no effect size or variance from previous studies were available to *a priori* calculate sample size (Kadam & Bhalerao, 2010). Therefore, we have chosen to use a sample size equivalent to that of Experiment 1. Statistical power was calculated posteriorly with G*Power (version 3.1), following the appropriate protocol (see Appendix Fig. 9). Statistical power was calculated for the interaction between SHmax assessment modality and mood induction group (i.e., the most important effect of the study), and was high (i.e., > .99).

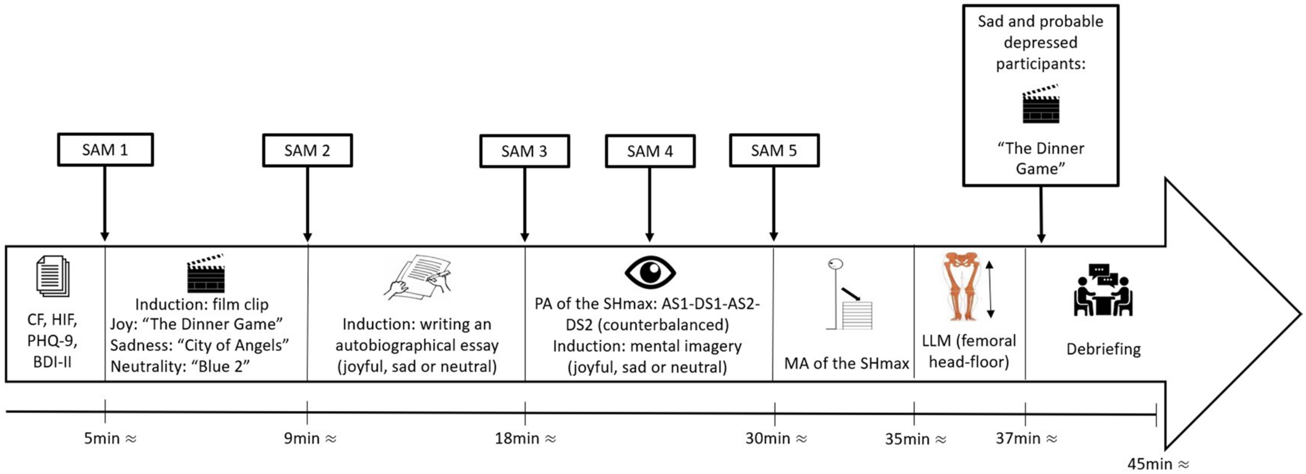

Fig. 6 Time-sequencing of the stages of Experiment 2. AS = Ascending Series, BDI-II = Beck Depression Inventory version 2, CF = Consent Form, DS = Descending Series, HIF = Health-Impairment Form, LLM = Leg Length Measurement, MA = Motor Assessment, PA = Perceptual Assessment, PHQ-9 = Patient Health Questionnaire 9 items, SAM = Self-Assessment Manikin

depressive symptoms observed in the "moderately severe" category of the PHQ-9 (Kneipp et al., 2010).

Mood level was measured using the SAM. It is a self-report scale that was designed as an index of valence (from sadness to joy), arousal (from calm to aroused) and dominance (from being controlled by the situation to being in control of the situation). Each of the dimensions presents itself as a scale composed of manikins associated with different expressions and sizes and coded into numerical values from 1 to 9 (Bradley & Lang, 1994).

Procedure

The procedure was synthesized and chronologically sequenced using a timeline presented in Fig. 6. Participants started by filling out a consent and health–impairment forms in the adjacent room to the SHmax assessment room. They also completed the BDI-II, the PHQ-9 (measurements of depressive symptoms), and the SAM to assess their pre-induction mood level (SAM 1). Participants were then subjected to the mood induction procedure, always in the same adjacent room. The induction was composed of 3 phases: (1) viewing a standardized film clip (2) writing an autobiographical essay, and (3) performing mental imagery.

Viewing a standardised film clip Firstly, participants were asked to view a short film clip (Schaefer et al., 2010; Westermann et al., 1996). For the induction of joy, this was an extract from the film "The Dinner Game" in which "Monsieur Pignon" realized that he had confused his friend's wife with his friend's mistress. For the induction of sadness, it was an extract from the film "City of Angels" in which Maggie dies in the arms of Seth. For the induction of a neutral mood, it was an extract from the film "Blue 2", in which a man tidies his desk, and a woman walks in a courtyard. Following this first induction task, participants completed the SAM a second time to obtain a post-film measure of their mood level (SAM 2).

Writing an autobiographical essay Secondly, participants were asked to write about an autobiographical event (Gilet, 2008; Jallais & Gilet, 2010; Riener et al., 2011). The instructions for this task were displayed on the screen in front of them (font: arial, size 36), which was used to view the film clips. For the induction of joy, the instruction was: "*Write about the event in your life that made you feel joyful and positive*". For the sadness induction, the instruction was: "*Write about the event in your life that made you feel sad and negative*". For neutral mood induction, the instruction was: "*Write about a typical and banal day of the week*". Below each instruction, participants were also told that their writing was anonymous and not shared with anyone other than the experimenter. Participants had a maximum of 9 minutes to write their autobiographical event. The task ended when the participant informed the experimenter that he finished, or when the 9 minutes had elapsed. Participants then completed the SAM a third time in order to obtain a post-autobiographical event measure of their mood level (SAM 3).

Mental imagery Thirdly, participants were guided into the room where perceptual and motor assessments of their SHmax took place, as well as the measurement of their *L*.

After explaining to the participants that they had to close and open their eyes on the instructions of the experimenter when he changed the height of the stack, the experimenter explained to them the instructions for the mental imagery (Zhang et al., 2014). The instruction was: "*Each time you will close your eyes at my signal, I will ask you to mentally imagine the event you described when you wrote your autobiographical event, as if you were reliving it.*". The duration of eye closing was the same for all participants (15s). For this, the experimenter had a silent manual chronometer. During the perceptual assessment of their SHmax, participants completed the SAM twice, in the middle of the task (i.e., at the end of the second series; SAM 4) and at the end of the task (i.e., at the end of the fourth series; SAM 5). Afterward, the motor assessment of their SHmax and the measurement of their *L* occurred, as in Experiment 1.

Ethics The experiment ended with a "debriefing" with each participant to explain the purpose of the experiment and to answer any questions or comments they could have. All participants who had a score indicating a moderately severe level of depressive symptoms on the PHQ-9 (i.e., score ≥ 15), or a score indicating a severe level on the BDI-II (i.e., score > 28), or both, were not subjected to the mood induction (i.e., 2 participants).[5] They still conducted the rest of the experiment (i.e., perceptual and motor tasks), so that they could validate their education unit. Before the debriefing, these two participants as well as those subjected to the induction of sad mood watched the film extract used for joy induction ("The Dinner Game"). At the end of the debriefing, the two participants with high levels of depressive symptoms were recommended to contact a general practitioner and/or a psychiatrist for medical monitoring. They were also informed that free psychological monitoring sessions were offered by the university.

Statistical analysis

Results were calculated using JASP statistical processing software (version 0.11.1). CIs of effect sizes were calculated using R (version 4.0.2). The effectiveness of the mood induction procedure on mood-related variables (valence, arousal, dominance) was tested using a mixed ANOVA in which the mood induction group (joy, neutrality, sadness) was a between-participant factor and the measurement time (SAM 1, 2, 3, 4 and 5) was a within-participant factor. The potential effect of mood on the perception of the sitting affordance was also tested using a mixed ANOVA that included the mood induction group (joy, neutrality, sadness) as a between-participant factor, and the SHmax assessment modality (perceptual and motor) as a within-participant factor. All post-hoc comparisons were performed using the Holm's test, which provides good statistical power while being protected against error rate inflation (Holm, 1979). Mixed ANOVAs that were performed focused on the classical test of H_1. Carrying out the same statistical analyses in this specific context using the Bayesian approach was not relevant.

Results

Mood Induction

Valence A mixed ANOVA that included the valence measurement time (SAM 1, 2, 3, 4 and 5) x the mood induction group (joy, neutrality, sadness) was performed on the valence level. Results showed a significant main effect of the mood induction group, $F(2, 37) = 21.02$, $p < .001$, $\eta^2_p = .53$, 90% CI [.31, .64], $\eta^2_G = .44$, and a significant interaction effect between the mood induction group and the valence measurement time, $F(6.42, 118.78) = 26.57$, $p < .001$, $\eta^2_p = .59$, 90% CI [.47, .64], $\eta^2_G = .31$.[6]

Concerning the main effect of the mood induction group, post-hoc comparisons showed that joyful participants had a significantly higher valence level ($M = 7.41$, $SD = 1.27$) than neutral ($M = 6.\ 49$, $SD = 1.09$), $p < .01$, $d = .41$, 95% CI [-.36, 1.17], and sad participants ($M = 5.08$, $SD = 1.54$), $p < .001$, $d = 1.02$, 95% CI [.19, 1.83]. Also, neutral participants had a significantly higher valence level than sad participants, $p < .001$, $d = .62$, 95% CI [-.16, 1.39].

Concerning the interaction effect, post-hoc comparisons showed no significant difference between valence levels of joyful, neutral, and sad participants in SAM 1, $p = 1$.

[5] Participants subjected to the mood induction had a score indicating "mild" or lower level of depression according to both PHQ-9 and BDI-II. Only 5 participants had a score indicating a "moderate" level of depressive symptoms according to the PHQ-9 (i.e., 10, 10, 10, 13) or the BDI-II (i.e., 20). Participants with moderate depressive symptoms according to PHQ-9 had a score on the BDI-II indicating a "minimal" level of depression. Participants with moderate depressive symptoms on the BDI-II had a score on the PHQ-9 indicating a "mild" level of depression. Therefore, we chose to include these 5 participants.

[6] A Greenhouse-Geisser adjustment of the degrees of freedom was performed in anticipation of a sphericity assumption violation. A test of the homogeneity of variance assumption revealed no violation of homogeneity of variance for valence, arousal and dominance levels, for all modalities (SAM 1, 2, 3, 4 and 5).

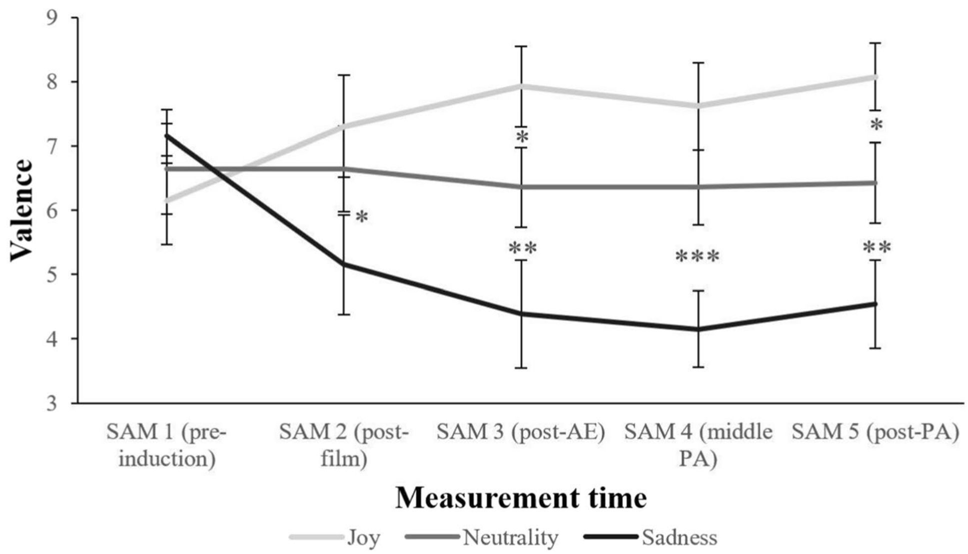

Fig. 7 Valence level depending on the measurement time and the mood induction group. Error bars show 95% CI. AE = Autobiographical Essay, PA = Perceptual Assessment, SAM = Self-Assessment Manikin. *$p < .05$, **$p < .01$, ***$p < .001$

In contrast, joyful participants had a significantly higher valence level in SAM 3 ($M = 7.92$, $SD = 1.04$) than in SAM 1 ($M = 6.15$, $SD = 1.14$), $p < .001$, $d = 1.03$ 95% CI [.20, 1.84]. For sad participants, the valence level in SAM 3 ($M = 4.38$, $SD = 1.39$), was significantly lower than in SAM 1 ($M = 7.15$, $SD = .69$), $p < .001$, $d = -1.62$ 95% CI [-.71, -2.50]. For neutral participants, the valence level in SAM 3 ($M = 6.36$; $SD = 1.08$) was not significantly different from the one in SAM 1 ($M = 6.64$, $SD = 1.22$), $p = 1$, $d = -.17$ 95% CI [-.91, .57]. Post-hoc comparisons between the different mood induction groups can be viewed in Fig. 7.

Overall, these different comparisons showed that the induction procedure generated the expected valence level for each mood induced. It was possible to differentiate between joyful, neutral, and sad participants just before and during the perceptual assessment of the SHmax.

Arousal A mixed ANOVA that included the arousal measurement time x the mood induction group was performed on the arousal level. The results indicated the absence of a significant main effect of the mood induction group, $F(2, 37) < 1$, $p = .54$, $\eta^2_p = .03$, 90% CI [0, .13], $\eta^2_G = .02$, and the absence of a significant interaction effect between the mood induction group and the arousal measurement time, $F(5.90, 109.14) = 2.11$, $p = .06$, $\eta^2_p = .10$, 90% CI [0, .24], $\eta^2_G = .02$ (see footnote 6). Post-hoc comparisons showed no significant difference between arousal levels of joyful, neutral, and sad participants in SAM 1, $p = 1$.

Dominance A mixed ANOVA that included the dominance measurement time x the mood induction group was performed on the dominance level. The results indicated the absence of a significant main effect of the mood induction group, $F(2, 37) < 1$, $p = .96$, $\eta^2_p = .00$, 90% CI [0, 1], $\eta^2_G = .00$, and the absence of a significant interaction effect between the mood induction group and the dominance measurement time, $F(4.83, 89.27) < 1$ $p = .57$, $\eta^2_p = .04$, 90% CI [0, .14], $\eta^2_G = .01$ (see footnote 6). Post-hoc comparisons showed no significant difference between dominance levels of joyful, neutral, and sad participants in SAM 1, $p = 1$.

PHQ-9 A one-way ANOVA that included the mood induction group was performed on the PHQ-9 score. The results indicated the absence of a significant effect of the mood induction group, $F < 1$, $p = .96$, $\eta^2 = .00$, 90% CI [0, 1] (equality of variance: $p = .054$).

BDI-II A one-way ANOVA that included the mood induction group was performed on the BDI-II score. The results indicated the absence of a significant effect of the mood induction group, $F < 1$, $p = .85$, $\eta^2 = .01$, 90% CI [.00, .07] (equality of variance: $p = .95$).

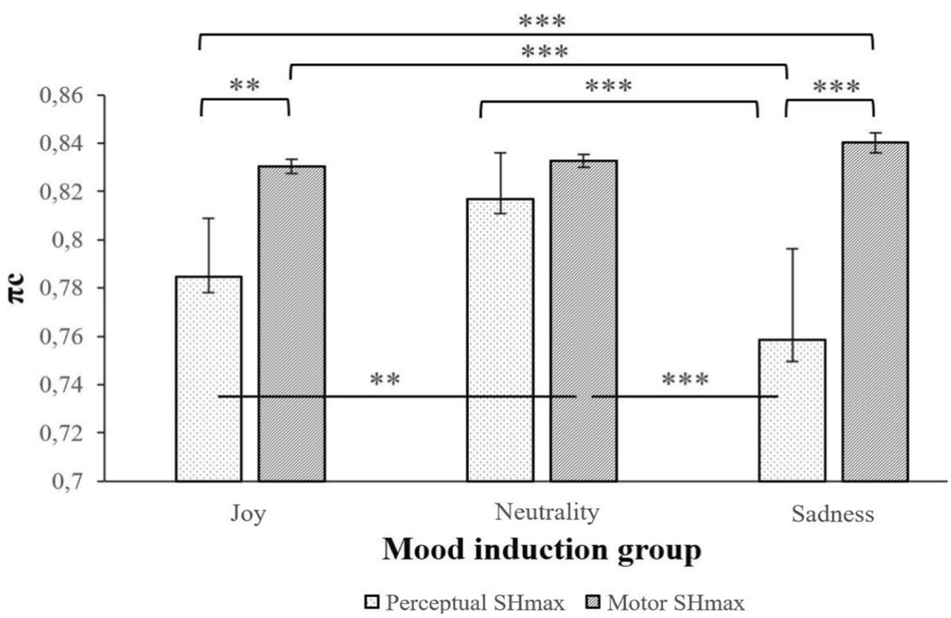

Fig. 8 πc value depending on the SHmax assessment modality (perceptual and motor) and the mood induction group. Error bars show 95% CI. $^{**}p < .01$, $^{***}p < .001$

Effect of the SHmax assessment modality depending on the mood induction group

A mixed ANOVA that included the SHmax assessment modality (perceptual and motor) x the mood induction group (joy, neutrality, sadness) was performed on the πc. The results showed a significant main effect of the SHmax assessment modality, $F(1, 37) = 43.12$, $p < .001$, $\eta^2_p = .54$, 90% CI [.34, .65], $\eta^2_G = .35$, and a significant interaction effect between the mood induction group and the SHmax assessment modality, $F(2, 37) = 6.87$, $p < .01$, $\eta^2_p = .27$, 90% CI [.07, .42], $\eta^2_G = .14$.[7]

Concerning the main effect of the SHmax assessment modality, post-hoc comparisons showed that the perceptual πc ($M = .79$, $SD = .05$) was significantly lower than the motor πc ($M = .83$, $SD = .01$), $p < .001$, $d = -.90$, 95% CI [-1.38, -.41].

Concerning the interaction effect, post-hoc comparisons within and between each mood induction group depending on the SHmax assessment modality can be viewed in Fig. 8. Mainly, the perceptual πc of both joyful and sad participants was significantly lower than their motor πc. For neutral participants, their perceptual πc was not significantly different from their motor πc, as participants in Experiment 1. There was no significant difference in the motor πc depending on the mood induction group.

The results also indicated the absence of main effect of sex and age, as well as the absence of interaction effect between each of these two variables with the SHmax assessment modality on the πc, $p > .05$.

Between-experiment analysis

A mixed ANOVA that included the SHmax assessment modality x the mood induction group of Experiments 1 (without mood induction) and 2 (joy, neutrality, sadness) was performed on the πc. The results showed a significant interaction effect between the mood induction group and the SHmax assessment modality, $F(3, 79) = 12.69$, $p < .001$, $\eta^2_p = .32$, 90% CI [.17, .43], $\eta^2_G = .18$.

Post-hoc comparisons showed that the perceptual πc of participants without mood induction was significantly higher than the perceptual πc of joyful, $p < .001$, $d = .47$, 95% CI [-.14, 1.01] and sadness participants, $p < .001$, $d = .78$, 95% CI [.16, 1.40]. In contrast, the perceptual πc of participants without mood induction was not significantly different of the perceptual πc of neutral participants, $p = 1$. There was no significant difference between joyful, neutral,

[7] The assessment modality variable was repeated twice. In this case the sphericity of the data is always confirmed. A test of homogeneity of variance assumption (Levene's) revealed no significant difference in the πc value for both perceptual and motor assessment.

sad and without induction participants regarding the motor πc, $p = 1$.

Discussion

The results obtained in Experiment 2 show that experimentally-induced mood (valence level) influences the perception of the sitting affordance. Indeed, perceptual πc was significantly lower than motor πc in both joyful and sad participants, but not for "neutral" participants. This means that the inductions of joy and sadness have been associated with participants' perceptual underestimation of their actual maximum ability to sit (AMAS). On the other hand, the induction of neutrality has been associated with participants' accurate perception of their AMAS, since their perceptual πc were not significantly different from their motor πc. Moreover, these differences between participants' perceptual assessment of their AMAS depending on mood were not accompanied by any significant differences in their AMAS (i.e., all participants had nearly the same motor πc, whatever their mood). Prior to the mood induction, participants also had similar levels of valence, arousal, dominance, and depressive symptoms on the PHQ-9 and BDI-II. Furthermore, a between-experiment analysis showed that joyful and sad participants had a perceptual πc that was also lower than the perceptual πc of Experiment 1 participants who were not submitted to mood induction. In contrast, neutral participants had the same perceptual πc as the participants without mood induction. Together, these results support that the observed differences in the sitting affordance perception between mood groups in Experiment 2 are due to a specific effect of mood induction rather than to intrinsic differences between participants.

The results also suggest that the induced affective state is mood rather than emotion. Indeed, the inductions of joy, sadness, and neutrality caused an evolution of valence level over time in accordance with their respective expected effects (i.e., increase for joy, decrease for sadness, and stabilization between joy and sadness for neutrality). However, in contrast to what was observed for the valence level there was no significant interaction effect between mood induction group and measurement time for arousal and dominance levels. This pattern of results is consistent with mood functioning. That is, a change in the valence level that would occur at low intensity (arousal) without decrease in the control level of the situation (dominance; Beedie et al., 2005; Bradley & Lang, 1994; Clore et al., 1994; Garrido, 2014; Gilet, 2008; Laurent & Vandel, 2016; Västfjäll, 2001).

General discussion

To the best of our knowledge, no study to date has tested the influence of mood on the perception of affordances. However, in everyday life, the co-occurrence between mood and the perception of affordances is systematic. There is no moment when we perceive an affordance "without a given mood" in the background. Determining if and how mood influences the perception of affordances should allow us to better understand how mood could contribute to the organisation of our behaviour in its active relationship with the environment. This could also contribute to developing an ecological conceptualization of affective processes in relation to previous work on affordance perception (de Haan et al., 2013; Withagen, 2018).

We conducted two experiments. Experiment 1 was a replication of Mark and Vogele's (1987) experiment 2 related to the sitting affordance perception. Its primary purpose was to establish a baseline to assess the participants' accuracy in the sitting affordance perception when their mood was not manipulated. The results showed that participants accurately perceived the sitting affordance, in body-scaled intrinsic units, as in Mark and Vogele's (1987) study. Indeed, regardless of their respective total leg lengths (*L*), all participants could sit as long as the seat height did not exceed 83% of their *L* [i.e., motor πc (motor SHmax/*L*)]. Before performing the action, all participants perceived that they could sit as long as the seat height did not exceed 82% of their *L* [i.e., perceptual πc (perceptual SHmax/*L*)]. Thus, they obtained a perceptual πc very close to their motor πc.

Experiment 2 tested the influence of mood on the perception of the sitting affordance. As in Experiment 1, the participants assessed their SHmax from perceptual exposure to different seat heights before performing the action. However, this task was preceded by a mood induction procedure this time. The results suggest that mood influenced the perception of the sitting affordance. Participants in a neutral mood accurately perceived the sitting affordance unlike participants in a joyful or sad mood. More precisely, both joyful and sad participants underestimated their actual maximum ability to sit (AMAS; i.e., their perceptual πc was significantly lower than their motor πc) while "neutral" participants perceived it accurately (i.e., their perceptual πc was not significantly different from their motor πc). These differences in the accuracy of the sitting affordance perception depending on mood cannot be explained by differences in participants' AMAS, since they all had a similar motor πc, whatever their mood state. Interestingly, neutral participants and Experiment 1 participants had the same perceptual and motor πc (i.e., .82 and .83, respectively). This match supports the reliability of our control condition (i.e., neutral mood) and the view that the sitting affordance is generally accurately perceived when participants' mood corresponds to intermediate valence levels.

This evidence for an influence of mood on the visual perception of the sitting affordance raises complementary questions about the processes that might underpin this influence. A first probable explanation, based on mood self-regulation and embodiment of the body's energy level by the visual system, could explain the mood influence obtained in Experiment 2. Several studies have shown that participants in a joyful or sad mood make an effort to self-regulate their mood: Those who are sad in order to improve their mood (Garrosa et al., 2008; Isen, 1985; Thayer et al., 1994) and those who are joyful in order to maintain their mood (Wegener & Petty, 1994) or to reach neutrality (Erber & Erber, 2000; Erber & Tesser, 1992; Martin & Tesser, 1996). In a series of 9 experiments, Gailliot et al. (2007) showed that self-regulatory effort caused a decrease in the body's energy level (i.e., decrease in blood glucose level). Moreover, according to Proffitt's (2006) theory of “economy of action”, human beings would be thrifty with their body's energetic resources to optimize their health. Therefore, they would perceive their environment as a function of this body energy level, as supported by several empirical data (Bhalla & Proffitt, 1999; Schnall et al., 2010; Zadra et al., 2015). Furthermore, tasks that require accuracy and/or personal effort to be achieved, such as affordance perception, would favour mood self-regulation towards neutrality (Erber & Erber, 2000; Erber & Tesser, 1992; Therriault et al., 1996).

With this in mind, in the present study it is possible that joyful and sad participants tried to self-regulate their mood during the perception of the sitting affordance. This self-regulation effort would have caused a decrease in their body energy level. This depletion of their body energy level would have been embodied by their visual system probably through neurosensory integration mechanisms (Clore & Proffitt, 2016; Lenggenhager et al., 2006; Molotchnikoff & Rouat, 2012; Svensson & Ziemke, 2004). This embodiment process would have led both joyful and sad participants to perceptually underestimate their AMAS, in order to economise energetic resources when performing the action. Conversely, neutral participants would not have tried to self-regulate their mood because neutral mood would have been already appropriate for the situation. Indeed, the sitting affordance perception would favour mood regulation towards neutrality because it would require accuracy and personal effort to be achieved (Erber & Erber, 2000; Erber & Tesser, 1992; Therriault et al., 1996). As a result, neutral participants would have had an energy level that remained stable and the need to save their energetic resources would have been less important. This could explain why they accurately perceived the sitting affordance unlike both joyful and sad participants.

Although this probable interpretation could be consistent with the ecological conceptualization of affective processes in relation to affordance perception (Gibson, 1979; Withagen, 2018), it currently remains speculative since the present study does not provide measures of body's energy level or mood self-regulation. In addition, we are aware that embodied perception has been confronted for several years with important criticisms that are opposed to the possibility of a visual system functioning influenced by non-visual factors (Durgin et al., 2012; Firestone & Scholl, 2016). According to these criticisms, perception would be "pure" and what is thought to be embodied perception could be a bias in judgment or in the orientation of attentional resources, or a task demand effect (Firestone & Scholl, 2016). However, these criticisms have been strongly disputed by Clore & Proffitt (2016). The latter authors presented empirical studies (White et al., 2013; Zadra et al., 2015) for which the results could not be explained by the 'pitfalls' put forward by Firestone and Scholl (2016).

The effect of the visually embodied organism's body energy level as a function of mood self-regulation may not be the only way to explain how mood could influence the perception of the sitting affordance. As Fajen (2005) emphasized, two consecutive processes would underlie the accurate perception of affordances. The first would be “(re)attunement” (or “education of attention”), which refers to the identification of optical variables that are, in a perception-action context, relevant for action guidance (Withagen & Michaels, 2005). The second process would be the (re)calibration of these relevant optical variables to our maximum effective action capabilities. This “perceptual-motor (re)calibration” determines the boundary between possible and impossible actions (Fajen, 2005; Fajen et al., 2009; Ruginski et al., 2019; van Andel et al., 2017). Several studies have already shown that these two processes can be influenced by several factors such as practice and anxiety in basic visually guided actions such as sitting and braking to avoid a collision (Fajen & Devaney, 2006; Mark, 1987; Ruginski et al., 2019).

Therefore, in Experiment 2, the induction of joyful or sad moods could have disrupted participants' attunement to critical optical stimulation and/or perceptual-motor calibration. In contrast, the induction of neutral mood would not lead to such disruption. Indeed, previous data suggest that joy and sadness (but not “neutrality”) would impair individuals' ability to focus their attention on task-relevant information (Biss & Hasher, 2011; Irrmischer et al., 2018; Mor & Winquist, 2002; Rowe et al., 2007). However, this ability would be necessary for (i) detecting the optical variables that are relevant for action guidance and (ii) calibrating them to maximal effective action capabilities (Daviaux et al., 2014; Ruginski et al., 2019). Thus, both joyful and sad participants might have had more difficulties in detecting and/or calibrating the optical variables relevant for sitting action guidance due to their attentional lapse. However, future empirical investigations are needed to clarify the relationship between mood and attention orientation, in the context of detection and calibration of optical variables that are relevant for action guidance.

Study limitations

The use of a single post-induction estimate rather than two estimates (before and after mood induction) increases the risk that the observed variations in the sitting affordance perception are due to intrinsic differences between participants rather than a specific mood effect. However, we have addressed several arguments in the discussion of Experiment 2 that support a mood-specific effect. We have deliberately not included a pre-induction estimate because it raises several methodological issues that could (more) seriously compromise the reliability of our results.

Firstly, repeated perception of an affordance generates a well-documented practice effect on the accuracy of estimations that may overlap with the mood effect (Mark, 1987; Mark et al., 1990; Ramenzoni et al., 2010). Secondly, having two estimates rather than one increases the risk of contaminating the results with the "task demands effect". This effect has led to the reconsideration of many findings, particularly in the field of embodied cognition (Firestone & Scholl, 2016). Thirdly, the similarity of the participants' valence level with “neutrality” in a pre-induction estimate cannot be guaranteed due to mood variability between individuals (Hepburn & Eysenck, 1989; Shuman et al., 2013). In addition, a pre-induction estimate may produce an order effect that requires counterbalancing the presentation of the conditions. However, it cannot be guaranteed that both joyful and sad participants will return to a neutral mood at an equivalent time because of the individual differences in mood regulation capabilities (Marszał-Wiśniewska & Nowicka, 2018). Therefore, the inclusion of a second estimate would require two mood manipulations for each participant (before and after the first estimate). However, given that mood is characterized by its temporal durability (Garrido, 2014; Sirota et al., 1987), repeated manipulation of it for the same participant makes the results particularly vulnerable to the “carry-over effect” (Sirota et al., 1987; Van der Does, 2002; Dalgleish et al., 2009). This well-known effect severely deteriorates the internal validity of study and thus the causal relationship between outcomes and experimental variables (Charness et al., 2012; Greenwald, 1976). In addition, repeatedly changing a participant's mood increases his need for mood regulation, which reduces energetic resources (Gailliot et al., 2007). This could generate a fatigue effect in all participants that would overlap with the mood effect (Connaboy et al., 2020; Daviaux et al., 2014) or result in a carry-over effect when mood regulation has failed (Fiori & Shuman, 2017). To avoid practice and carry-over effects, several authors have favoured a single post-induction judgment in their tasks (e.g., Stanton et al., 2014). We did the same in the present research.

As a second limitation, we also regret that we did not include measures of the body’s energy level, mood self-regulation or attentional orientation. These measures would probably have allowed a faster generation of arguments in favor of, or opposed to, the two interpretations we have proposed to explain how mood would influence the perception of affordances.

Concluding remarks

By giving a special care to the operationalization of the sitting affordance (intrinsic scaling validity test) and to the statistical treatment of the null hypothesis using Bayesian statistics (Experiment 1), this study shows that mood influences the perception of - the sitting - affordance (Experiment 2). Indeed, participants in a neutral mood accurately perceived the sitting affordance while participants in a joyful or sad mood did not. Specifically, both joyful and sad participants significantly underestimated their actual maximum ability to sit whereas neutral participants accurately perceived it. These data suggest that mood would shape our active (motor) relationship with the environment by influencing the perception of affordances. Thus, these results support the relevance of an ecological conceptualization of both perception and affective processes in which what we perceive as a “doable” depends on current mood states. Further research is needed to account for the potential moderators of this relationship (e.g., attention, energetic resources).

Appendix

F tests – ANOVA: Repeated measures, within-between interaction

Analysis:	Post hoc: Compute achieved power		
Input:	Effect size f	=	0.6081636
	α err prob	=	0.05
	Total sample size	=	40
	Number of groups	=	3
	Number of measurements	=	2
	Corr among rep measures	=	.045
	Nonsphericity correction ϵ	=	1
Output:	Noncentrality parameter λ	=	30.9832850
	Critical F	=	3.2519238
	Numerator df	=	2.0000000
	Denominator df	=	37.0000000
	Power (1–β err prob)	=	0.9987616

Fig. 9 Protocol of Power Analysis for Experiment 2. The "effect size f" was determined with G*Power from the η^2_p obtained in the referenced F test [i.e., significant interaction effect between the mood induction group (between-participant factor) and the assessment modality (within-participant factor), $F(2, 37) = 6.87$, $p < .01$, $\eta^2_p = .27$, 90% CI [.07, .42], $\eta^2_G = .14$].

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Data Availability The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request. It will be made public on a permanent repository if the manuscript is accepted for publication.

Code availability not applicable.

Declarations

Role of funding sources The authors did not receive support from any organization for the submitted work.

Conflicts of interest/Competing interests The authors have no conflicts of interest to declare that are relevant to the content of this article.

Consent to participate Informed consent was obtained from all individual participants included in the study.

Consent for publication Not applicable (no data or photograph can be related to participants' identity).

Ethics This study was performed in line with the principles of both the Declaration of Helsinki (World Medical Association, 2013) and the American Psychological Association.

References

Beck, A. T., Steer, R. A., Ball, R., & Ranieri, W. (1996). Comparison of Beck Depression Inventories -IA and -II in psychiatric outpatients. *Journal of Personality Assessment*, *67*(3), 588-597. https://doi.org/10.1207/s15327752jpa6703_13

Beedie, C., Terry, P., & Lane, A. (2005). Distinctions between emotion and mood. *Cognition and Emotion*, *19*(6), 847-878. https://doi.org/10.1080/02699930541000057

Bhalla, M., & Proffitt, D. R. (1999). Visual-motor recalibration in geographical slant perception. *Journal of Experimental Psychology. Human Perception and Performance*, *25*(4), 1076-1096. https://doi.org/10.1037//0096-1523.25.4.1076

Bianchi, R., Schonfeld, I. S., Vandel, P., & Laurent, E. (2017). On the depressive nature of the « burnout syndrome »: A clarification. *European Psychiatry: The Journal of the Association of European Psychiatrists*, *41*, 109-110. https://doi.org/10.1016/j.eurpsy.2016.10.008

Biss, R. K., & Hasher, L. (2011). Delighted and distracted: Positive affect increases priming for irrelevant information. *Emotion*, *11*(6), 1474-1478. https://doi.org/10.1037/a0023855

Bootsma, R. J., Bakker, F. C., Snippenberg, F. E. J. van, & Tdlohreg, C. W. (1992). The effects of anxiety on perceiving the reachability of passing objects. *Ecological Psychology*, *4*(1), 1-16. https://doi.org/10.1080/10407413.1992.10530790

Bowen, R., Balbuena, L., Baetz, M., & Marwaha, S. (2015). Mood instability in people with obsessive compulsive disorder and obsessive-compulsive personality traits. *Journal of Obsessive-Compulsive and Related Disorders*, *6*, 108-113. https://doi.org/10.1016/j.jocrd.2015.07.003

Bradley, M. M., & Lang, P. J. (1994). Measuring emotion: The self-assessment manikin and the semantic differential. *Journal of Behavior Therapy and Experimental Psychiatry*, *25*(1), 49-59. https://doi.org/10.1016/0005-7916(94)90063-9

Carello, C., Grosofsky, A., Reichel, F. D., Solomon, H. Y., & Turvey, M. T. (1989). Visually perceiving what is reachable. *Ecological Psychology*, *1*(1), 27-54. https://doi.org/10.1207/s15326969eco0101_3

Charness, G., Gneezy, U., & Kuhn, M. A. (2012). Experimental methods: Between-subject and within-subject design. *Journal of Economic Behavior & Organization*, 81(1), 1-8. https://doi.org/10.1016/j.jebo.2011.08.009

Chatterjee, S., Hadi, A. S., & Price, B. (1999). *Regression Analysis by Example, 3rd Edition* (3rd Edition). Wiley-Interscience.

Clore, G. L., & Proffitt, D. R. (2016). The myth of pure perception. *The Behavioral and Brain Sciences*, *39*, e235. https://doi.org/10.1017/S0140525X15002551

Clore, G. L., Schwarz, N., & Conway, M. (1994). Affective causes and consequences of social information processing. In *Handbook of social cognition: Basic processes; Applications, Vols. 1-2, 2nd ed* (p. 323-417). Lawrence Erlbaum Associates, Inc.

Connaboy, C., LaGoy, A. D., Johnson, C. D., Sinnott, A. M., Eagle, S. R., Bower, J. L., Pepping, G.-J., Simpson, R. J., & Alfano, C. A. (2020). Sleep deprivation impairs affordance perception behavior during an action boundary accuracy assessment. *Acta Astronautica*, *166*, 270-276. https://doi.org/10.1016/j.actaastro.2019.10.029

Dalgleish, T., Yiend, J., Schweizer, S., & Dunn, B. D. (2009). Ironic effects of emotion suppression when recounting distressing memories. *Emotion* (Washington, D.C.), 9(5), 744-749. https://doi.org/10.1037/a0017290

Daviaux, Y., Mignardot, J.-B., Cornu, C., & Deschamps, T. (2014). Effects of total sleep deprivation on the perception of action capabilities. *Experimental Brain Research*, *232*(7), 2243-2253. https://doi.org/10.1007/s00221-014-3915-z

de Haan, S., Rietveld, E., Stokhof, M., & Denys, D. (2013). The phenomenology of deep brain stimulation-induced changes in OCD: An enactive affordance-based model. *Frontiers in Human Neuroscience*, *7*, 653. https://doi.org/10.3389/fnhum.2013.00653

Dewey, J. (1895). The theory of emotion. *Psychological Review*, *2*(1), 13-32. https://doi.org/10.1037/h0070927

Durgin, F. H., Klein, B., Spiegel, A., Strawser, C. J., & Williams, M. (2012). The social psychology of perception experiments: Hills, backpacks, glucose and the problem of generalizability. *Journal of experimental psychology. Human perception and performance*, *38*(6), 1582-1595. https://doi.org/10.1037/a0027805

Eagle, S. R., Nindl, B. C., Johnson, C. D., Kontos, A. P., & Connaboy, C. (2019). Does concussion affect perception-action coupling behavior? Action boundary perception as a biomarker for concussion. *Clinical Journal of Sport Medicine: Official Journal of the Canadian Academy of Sport Medicine*. https://doi.org/10.1097/JSM.0000000000000731

Erber, R., & Erber, M. W. (2000). The self-regulation of moods: Second thoughts on the importance of happiness in everyday life. *Psychological Inquiry*, *11*(3), 142-148. https://doi.org/10.1207/S15327965PLI1103_02

Erber, R., & Tesser, A. (1992). Task effort and the regulation of mood: The absorption hypothesis. *Journal of Experimental Social Psychology*, *28*(4), 339-359. https://doi.org/10.1016/0022-1031(92)90050-T

Fajen, B. R. (2005). Perceiving possibilities for action: On the necessity of calibration and perceptual learning for the visual guidance of action. *Perception*, *34*(6), 717-740. https://doi.org/10.1068/p5405

Fajen, B. R., & Devaney, M. C. (2006). Learning to control collisions: The role of perceptual attunement and action boundaries. *Journal of Experimental Psychology: Human Perception and*

Performance, *32*(2), 300-313. https://doi.org/10.1037/0096-1523.32.2.300
Fajen, B. R., & Matthis, J. S. (2011). Direct perception of action-scaled affordances: The shrinking gap problem. *Journal of Experimental Psychology. Human Perception and Performance*, *37*(5), 1442-1457. https://doi.org/10.1037/a0023510
Fajen, B. R., Riley, M. A., & Turvey, M. T. (2009). Information, affordances, and the control of action in sport. *International Journal of Sport Psychology*, *40*(1), 79-107.
Fiori, M., & Shuman, V. (2017). The joint contribution of activation and inhibition in moderating carryover effects of anger on social judgment. *Frontiers in Psychology, 8*, 1435. https://doi.org/10.3389/fpsyg.2017.01435
Firestone, C., & Scholl, B. J. (2016). Cognition does not affect perception: Evaluating the evidence for "top-down" effects. *Behavioral and Brain Sciences*, *39*. https://doi.org/10.1017/S0140525X15000965
Franchak, J. M., van der Zalm, D. J., & Adolph, K. E. (2010). Learning by doing: Action performance facilitates affordance perception. *Vision Research*, *50*(24), 2758-2765. https://doi.org/10.1016/j.visres.2010.09.019
Gailliot, M. T., Baumeister, R. F., DeWall, C. N., Maner, J. K., Plant, E. A., Tice, D. M., Brewer, L. E., & Schmeichel, B. J. (2007). Self-control relies on glucose as a limited energy source: Willpower is more than a metaphor. *Journal of Personality and Social Psychology*, *92*(2), 325-336. https://doi.org/10.1037/0022-3514.92.2.325
Garrido, S. (2014). A systematic review of the studies measuring mood and emotion in response to music. *Psychomusicology: Music, Mind, and Brain*, *24*(4), 316-327. https://doi.org/10.1037/pmu0000072
Garrosa, E., Moreno-Jiménez, B., Benadero, M. E. M., & Rodríguez-Carvajal, R. (2008). Individual differences in energy-tension cycle and self-regulation of mood. *Psicologia Em Estudo*, *13*(1), 3-11. https://doi.org/10.1590/S1413-73722008000100002
Gibson, J. J. (1977). The theory of affordances. In J. B. Robert E Shaw (Éd.), *Perceiving, acting, and knowing: Toward an ecological psychology* (p. pp.67-82). Hillsdale, N.J.: Lawrence Erlbaum Associates. https://hal.archives-ouvertes.fr/hal-00692033
Gibson, J. J. (1979). *The ecological approach to visual perception* (p. xiv, 332). Houghton, Mifflin and Company.
Gilet, A.-L. (2008). [Mood induction procedures: A critical review]. *L'Encephale*, *34*(3), 233-239. https://doi.org/10.1016/j.encep.2006.08.003
Graydon, M. M., Linkenauger, S. A., Teachman, B. A., & Proffitt, D. R. (2012). Scared stiff: the influence of anxiety on the perception of action capabilities. *Cognition & Emotion*, *26*(7), 1301-1315. https://doi.org/10.1080/02699931.2012.667391
Greenwald, A. G. (1976). Within-subjects designs: To use or not to use? *Psychological Bulletin*, 83(2), 314-320. https://doi.org/10.1037/0033-2909.83.2.314
Hepburn, L., & Eysenck, M. W. (1989). Personality, average mood and mood variability. *Personality and Individual Differences*, 10(9), 975-983. https://doi.org/10.1016/0191-8869(89)90062-7
Holm, S. (1979). A Simple Sequentially Rejective Multiple Test Procedure. *Scandinavian Journal of Statistics*, *6*(2), 65-70. JSTOR.
Irrmischer, M., Wal, C. N. van der, Mansvelder, H. D., & Linkenkaer-Hansen, K. (2018). Negative mood and mind wandering increase long-range temporal correlations in attention fluctuations. *PLOS ONE*, *13*(5), e0196907. https://doi.org/10.1371/journal.pone.0196907
Isen, A. M. (1985). Asymmetry of happiness and sadness in effects on memory in normal college students: Comment on Hasher, Rose, Zacks, Sanft, and Doren. *Journal of Experimental Psychology: General*, *114*(3), 388-391. https://doi.org/10.1037/0096-3445.114.3.388
Jallais, C., & Gilet, A.-L. (2010). Inducing changes in arousal and valence: Comparison of two mood induction procedures. *Behavior Research Methods*, *42*(1), 318-325. https://doi.org/10.3758/BRM.42.1.318
James, W. (1884). What is an Emotion? *Mind*, *9*(34), 188-205.
Kadam, P., & Bhalerao, S. (2010). Sample size calculation. *International Journal of Ayurveda Research*, *1*(1), 55-57. https://doi.org/10.4103/0974-7788.59946
Kelter, R. (2020). Bayesian alternatives to null hypothesis significance testing in biomedical research: A non-technical introduction to Bayesian inference with JASP. *BMC Medical Research Methodology*, *20*(1), 142. https://doi.org/10.1186/s12874-020-00980-6
Kneipp, S. M., Kairalla, J. A., Stacciarini, J. M. R., Pereira, D., & Miller, M. D. (2010). Comparison of depressive symptom severity scores in low-income women. *Nursing research*, *59*(6), 380-388. https://doi.org/10.1097/NNR.0b013e3181f84ee9
Konczak, J., Meeuwsen, H. J., & Cress, M. E. (1992). Changing affordances in stair climbing: The perception of maximum climbability in young and older adults. *Journal of Experimental Psychology. Human Perception and Performance*, *18*(3), 691-697. https://doi.org/10.1037//0096-1523.18.3.691
Kroenke, K., Spitzer, R. L., & Williams, J. B. (2001). The PHQ-9: Validity of a brief depression severity measure. *Journal of General Internal Medicine*, *16*(9), 606-613. https://doi.org/10.1046/j.1525-1497.2001.016009606.x
Laurent, É., Bianchi, R., Schonfeld, I. S., & Vandel, P. (2017). Editorial: Depression, burnout, and other mood disorders: Interdisciplinary approaches. *Frontiers in Psychology*, *8*, 282. https://doi.org/10.3389/fpsyg.2017.00282
Laurent, É., & Vandel, P. (2016). *De l'humeur normale à la dépression en psychologie cognitive, neurosciences et psychiatrie*. De Boeck Supérieur. https://hal.archives-ouvertes.fr/hal-02469763
Lenggenhager, B., Smith, S. T., & Blanke, O. (2006). Functional and neural mechanisms of embodiment: Importance of the vestibular system and the temporal parietal junction. *Reviews in the Neurosciences*, *17*(6), 643-657. https://doi.org/10.1515/revneuro.2006.17.6.643
Mark, L. S. (1987). Eyeheight-scaled information about affordances: A study of sitting and stair climbing. *Journal of Experimental Psychology. Human Perception and Performance*, *13*(3), 361-370. https://doi.org/10.1037//0096-1523.13.3.361
Mark, L. S., Balliett, J. A., Craver, K. D., Douglas, S. D., & Fox, T. (1990). What an actor must do in order to perceive the affordance for sitting. *Ecological Psychology*, *2*(4), 325-366. https://doi.org/10.1207/s15326969eco0204_2
Mark, L. S., & Vogele, D. (1987). A biodynamic basis for perceived categories of action: A study of sitting and stair climbing. *Journal of Motor Behavior*, *19*(3), 367-384. https://doi.org/10.1080/00222895.1987.10735418
Marszał-Wiśniewska, M., & Nowicka, M. (2018). Individual differences in mood changes. *Journal of Happiness Studies*, 19(5), 1415-1438. https://doi.org/10.1007/s10902-017-9879-5
Martin, L. L., & Tesser, A. (1996). *Striving and feeling: Interactions among goals, affect, and self-regulation*. Psychology Press.
Molotchnikoff, S., & Rouat, J. (2012). Visual Cortex: Current status and perspectives. *IntechOpen* https://doi.org/10.5772/3018
Mor, N., & Winquist, J. (2002). Self-focused attention and negative affect: A meta-analysis. *Psychological Bulletin*, *128*(4), 638-662. https://doi.org/10.1037/0033-2909.128.4.638
Pijpers, J. R., Oudejans, R. R. D., Bakker, F. C., & Beek, P. J. (2006). The role of anxiety in perceiving and realizing affordances. *Ecological Psychology*, *18*, 131-161. https://doi.org/10.1207/s15326969eco1803_1
Proffitt, D. R. (2006). Embodied perception and the economy of action. *Perspectives on Psychological Science*, *1*(2), 110-122. https://doi.org/10.1111/j.1745-6916.2006.00008.x

Ramenzoni, V. C., Davis, T. J., Riley, M. A., & Shockley, K. (2010). Perceiving action boundaries: Learning effects in perceiving maximum jumping-reach affordances. *Attention, Perception, & Psychophysics*, *72*(4), 1110-1119. https://doi.org/10.3758/APP.72.4.1110

Riener, C. R., Stefanucci, J. K., Proffitt, D. R., & Clore, G. (2011). An effect of mood on the perception of geographical slant. *Cognition and Emotion*, *25*(1), 174-182. https://doi.org/10.1080/02699931003738026

Rowe, G., Hirsh, J. B., & Anderson, A. K. (2007). Positive affect increases the breadth of attentional selection. *Proceedings of the National Academy of Sciences*, *104*(1), 383-388. https://doi.org/10.1073/pnas.0605198104

Ruginski, I. T., Thomas, B. J., Geuss, M. N., & Stefanucci, J. K. (2019). Anxiety influences the perceptual-motor calibration of visually guided braking to avoid collisions. *Journal of Motor Behavior*, *51*(3), 302-317. https://doi.org/10.1080/00222895.2018.1474335

Sakurai, R., Fujiwara, Y., Ishihara, M., Higuchi, T., Uchida, H., & Imanaka, K. (2013). Age-related self-overestimation of step-over ability in healthy older adults and its relationship to fall risk. *BMC Geriatrics*, *13*(1), 44. https://doi.org/10.1186/1471-2318-13-44

Schaefer, A., Nils, F., Sanchez, X., & Philippot, P. (2010). Assessing the effectiveness of a large database of emotion-eliciting films: A new tool for emotion researchers. *Cognition and Emotion*, *24*(7), 1153-1172. https://doi.org/10.1080/02699930903274322

Schnall, S., Zadra, J. R., & Proffitt, D. R. (2010). Direct evidence for the economy of action: Glucose and the perception of geographical slant. *Perception*, *39*(4), 464-482. https://doi.org/10.1068/p6445

Sedikides, C. (1992). Changes in the valence of the self as a function of mood. In *Emotion and social behavior* (p. 271-311). Sage Publications, Inc.

Shuman, V., Sander, D., & Scherer, K. (2013). Levels of valence. *Frontiers in Psychology*, 4, 261. https://doi.org/10.3389/fpsyg.2013.00261

Sirota, A. D., Schwartz, G. E., & Kristeller, J. L. (1987). Facial muscle activity during induced mood states: Differential growth and carry-over of elated versus depressed patterns. *Psychophysiology*, 24(6), 691-699. https://doi.org/10.1111/j.1469-8986.1987.tb00351.x

Stanton, S. J., Reeck, C., Huettel, S. A., & LaBar, K. S. (2014). Effects of induced moods on economic choices. *Judgment and Decision Making*, 9(2), 167-175.

Stoffregen, T. A., Gorday, K. M., Sheng, Y. Y., & Flynn, S. B. (1999). Perceiving affordances for another person's actions. *Journal of Experimental Psychology. Human Perception and Performance*, *25*(1), 120-136. https://doi.org/10.1037//0096-1523.25.1.120

Svensson, H., & Ziemke, T. (2004). Making sense of embodiment: Simulation theories and the sharing of neural circuitry between sensorimotor and cognitive processes. *Proceedings of the Annual Meeting of the Cognitive Science Society*, *26*(26). https://escholarship.org/uc/item/2th0p4m1

Tan, O., Metin, B., Ünsalver, B. Ö., & Sayar, G. H. (2017). Seasonal mood changes in patients with obsessive-compulsive disorder. *Psychiatry Research*, *258*, 166-170. https://doi.org/10.1016/j.psychres.2016.04.088

Thayer, R. E., Newman, J. R., & McClain, T. M. (1994). Self-regulation of mood: Strategies for changing a bad mood, raising energy, and reducing tension. *Journal of Personality and Social Psychology*, *67*(5), 910-925. https://doi.org/10.1037//0022-3514.67.5.910

Therriault, N., Erber, R., & Oktela, C. (1996). Mood and self-perception in response to negative self-information: To ruminate or regulate. Paper presented at the 68th Annual Meeting of the Midwestern Psychological Association, .

Thomas, B. J., Hawkins, M. M., & Nalepka, P. (2018). Perceiver as polar planimeter: Direct perception of jumping, reaching, and jump-reaching affordances for the self and others. *Psychological Research*, *82*(4), 665-674. https://doi.org/10.1007/s00426-017-0858-6

van Andel, S., Cole, M. H., & Pepping, G.-J. (2017). A systematic review on perceptual-motor calibration to changes in action capabilities. *Human Movement Science*, *51*, 59-71. https://doi.org/10.1016/j.humov.2016.11.004

Van der Does, W. (2002). Different types of experimentally induced sad mood? *Behavior Therapy, 33*(4), 551-561. https://doi.org/10.1016/S0005-7894(02)80016-8

Västfjäll, D. (2001). Emotion induction through music: A review of the musical mood induction procedure. *Musicae Scientiae*, *Spec Issue, 2001-2002*, 173-211. https://doi.org/10.1177/10298649020050S107

Wagenmakers, E.-J., Love, J., Marsman, M., Jamil, T., Ly, A., Verhagen, J., Selker, R., Gronau, Q. F., Dropmann, D., Boutin, B., Meerhoff, F., Knight, P., Raj, A., van Kesteren, E.-J., van Doorn, J., Šmíra, M., Epskamp, S., Etz, A., Matzke, D., … Morey, R. D. (2018). Bayesian inference for psychology. Part II: Example applications with JASP. *Psychonomic Bulletin & Review*, *25*(1), 58-76. https://doi.org/10.3758/s13423-017-1323-7

Wagenmakers, E.-J., Morey, R. D., & Lee, M. D. (2016). Bayesian benefits for the pragmatic researcher. *Current Directions in Psychological Science*, *25*(3), 169-176. https://doi.org/10.1177/0963721416643289

Wagman, J. B., Taheny, C. A., & Higuchi, T. (2014). Improvements in perception of maximum reaching height transfer to increases or decreases in reaching ability. *The American Journal of Psychology*, *127*(3), 269-279. https://doi.org/10.5406/amerjpsyc.127.3.0269

Warren, W. H. (1984). Perceiving affordances: Visual guidance of stair climbing. *Journal of Experimental Psychology: Human Perception and Performance*, *10*(5), 683-703. https://doi.org/10.1037/0096-1523.10.5.683

Warren, W. H., & Whang, S. (1987). Visual guidance of walking through apertures: Body-scaled information for affordances. *Journal of Experimental Psychology. Human Perception and Performance*, *13*(3), 371-383. https://doi.org/10.1037//0096-1523.13.3.371

Wegener, D. T., & Petty, R. E. (1994). Mood management across affective states: The hedonic contingency hypothesis. *Journal of Personality and Social Psychology*, *66*(6), 1034-1048. https://doi.org/10.1037/0022-3514.66.6.1034

Westermann, R., Spies, K., Stahl, G., & Hesse, F. W. (1996). Relative effectiveness and validity of mood induction procedures: A meta-analysis. *European Journal of Social Psychology*, *26*(4), 557-580. https://doi.org/10.1002/(SICI)1099-0992(199607)26:4<557::AID-EJSP769>3.0.CO;2-4

White, E., Shockley, K., & Riley, M. A. (2013). Multimodally specified energy expenditure and action-based distance judgments. *Psychonomic Bulletin & Review*, *20*(6), 1371-1377. https://doi.org/10.3758/s13423-013-0462-8

Withagen, R. (2018). Towards an ecological approach to emotions and the individual differences therein. *New Ideas in Psychology*, *51*, 21-26. https://doi.org/10.1016/j.newideapsych.2018.04.004

Withagen, R., & Michaels, C. (2005). The role of feedback information for calibration and attunement in perceiving length by dynamic touch. *Journal of Experimental Psychology: Human Perception and Performance*, *31*(6), 1379-1390. https://doi.org/10.1037/0096-1523.31.6.1379

World Medical Association. (2013). World Medical Association Declaration of Helsinki: Ethical principles for medical research

involving human subjects. *JAMA*, *310*(20), 2191-2194. https://doi.org/10.1001/jama.2013.281053
Zadra, J., Weltman, A., & Proffitt, D. (2015). Walkable distances are bioenergetically scaled. *Journal of experimental psychology. Human perception and performance*, *42*. https://doi.org/10.1037/xhp0000107
Zhang, X., Yu, H. W., & Barrett, L. F. (2014). How does this make you feel? A comparison of four affect induction procedures. *Frontiers in Psychology*, *5*. https://doi.org/10.3389/fpsyg.2014.00689

Open Practices Statement

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request. None of the experiments was preregistered.