**Is there a lower visual field advantage for objects affordances? A
registered report.**

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Abstract

It's been repeatedly shown that pictures of graspable objects can facilitate visual processing and motor responses, even in the absence of reach-to-grasp actions, an effect often attributed the concept of affordances, originally introduced by Gibson (1979). A classic demonstration of this is the handle compatibility effect, which is characterised by faster reaction times when the orientation of a graspable object's handle is compatible with the hand used to respond, even when the handle orientation is task irrelevant. Nevertheless, whether faster RTs are due to affordances or spatial compatibility effects has been significantly debated. In the proposed studies, we will use a stimulus-response compatibility paradigm to investigate firstly, whether we can replicate the handle compatibility effect while controlling for spatial compatibility. Here, participants will respond with left- or right-handed keypresses to whether the object is upright or inverted and, in separate blocks, whether the object is red or green. RTs will be analysed using repeated-measures ANOVAs. In line with an affordance account, we hypothesise that there will be larger handle compatibility effects for upright/inverted compared to colour judgements, as colour judgements do not require object identification and are not thought to elicit affordances. Secondly, we will investigate whether the handle compatibility effect shows a lower visual field (VF) advantage in line with functional lower VF advantages observed for hand actions. We expect larger handle compatibility effects for objects viewed in the lower VF than upper VF, given that the lower VF is the space where actions most frequently occur.

Word count: 248

1 Introduction

2 In everyday life, we are surrounded by thousands of objects that afford different
3 types of interaction. For example, a spoon affords grasping, whereas a bed might
4 afford lying. According to one of the most influential models of perception, when we
5 look at an object, we not only process its colour, shape and size, but we also
6 automatically perceive the potential action it affords, even before we act (Gibson,
7 1979). Much of the behavioural evidence expanding on Gibson's concept of
8 affordance stems from the classic Tucker and Ellis (1998) handle compatibility effect
9 characterised by faster reaction times (RTs) when the handle orientation of
10 graspable objects is compatible with the hand used to respond, even when handle
11 orientation is task irrelevant (see also Tucker & Ellis, 2001, 2004). Tucker and Ellis
12 (1998) attributed the speeded RT for compatible conditions to an automatic
13 triggering of a motor representation afforded by the object's handle (such as reach-
14 to-grasp) and thus refers to a more representational account of affordances.

15 In line with this, several neuroimaging studies have reported that simply
16 viewing graspable objects activates sensorimotor brain regions typically associated
17 with reaching, grasping and using objects (e.g. Chao & Martin, 2000; Creem-Regehr
18 & Lee, 2005). In fact, we have recently reported that hand-selective visual areas in
19 occipito-temporal and parietal cortices automatically encode how to grasp tools
20 correctly for use (i.e., by their handles), even in the absence of subsequent tool use
21 (Knights et al., 2021).

22 While the Tucker and Ellis (1998) handle compatibility effect has been widely
23 replicated using various task manipulations (Cho & Proctor, 2010; Pappas, 2014;
24 Saccone et al., 2016; Tipper et al., 2006), whether it is solely explained by
25 affordances remains a subject of controversy. Evidence has shown that compatibility

effects are driven by spatial compatibility, and it has been argued that spatial compatibility, rather than object affordances, explains the handle compatibility effect (Cho & Proctor, 2010; Cho & Proctor, 2011; Proctor et al., 2017; see Azaad et al., 2019 for a review). Specifically, a well-known finding is that RTs are faster when the relative spatial location of a stimulus is compatible with the location of the response (e.g. stimulus and response locations are both on the left) even when spatial location is task irrelevant, a phenomenon known as the Simon effect (Simon, 1969). For example, if the handle of a graspable object (e.g., frying pan) protrudes into the right side of space, the right-hand RTs will be faster due to spatial compatibility between stimulus and response, rather than affordances alone.

In line with the spatial compatibility view, studies have found that the handle compatibility effect is affected by how object stimuli are centred. Specifically, when stimuli are centred with respect to their base or pixel area (thus handles protrude further to one side) the handle compatibility effects are larger compared to when stimuli are simply centred by their width (Kostov & Janyan, 2020; Proctor et al., 2017). Moreover, Cho and Proctor (2011) conducted a study where participants responded to upright and inverted teapot silhouettes and reported compatibility effects towards the spout, rather than handle, of the teapots as the spout protruded further towards the response location. Despite this, others have argued that outer shape of an object alone (such as a silhouette) may not be sufficient to elicit affordances. For example, Pappas (2014) found compatibility effects for silhouettes both when judgements were made using two fingers within one hand (within-hand) or separate hands (between-hands) and attributed this to spatial compatibility. However, when participants responded either with two fingers of the same hand or separate hands to photographs, the handle compatibility effect only arose when

1 participants responded with separate hands, indicative of an affordance effect.
2 Pappas (2014) therefore suggested that depth information was critical to eliciting the
3 affordance effects, although this inference has recently been the subject of
4 controversy given the differing distance between response keys when participants
5 responded with one hand to when they responded with both hands (Bub et al.,
6 2021).

7 To dissociate affordances from Simon effects, several manipulations have
8 been added to the Tucker and Ellis' (1998) upright vs inverted judgement task, such
9 as colour judgements. The idea here is that successful performance on upright vs
10 inverted judgements is considered to elicit affordances, whereas colour judgements
11 depend solely on low-level visual processing, thus not requiring object recognition or
12 affordances (Saccone et al., 2016; Symes et al., 2005). In line with this, it has been
13 shown that handle compatibility effects are larger for judgements of upright vs
14 inverted, semantic categorisation or object shape than for colour judgements
15 (Saccone et al., 2016; Symes et al., 2005; Tipper et al., 2006). This demonstrates
16 that spatial compatibility does not fully contribute to handle compatibility effects,
17 highlighting a likely role of affordances. Nevertheless, this stance remains debatable
18 given that differences in handle compatibility effects between shape and colour
19 judgement tasks have not been replicated (Cho & Proctor, 2012). Therefore, more
20 research is needed to resolve the controversy surrounding the contribution of
21 affordances to the handle compatibility effect.

22 Another manipulation used to investigate affordances is reaching distance.
23 Several studies have reported that the handle compatibility effect is smaller, or even
24 eliminated, when objects are presented in far (out of reach), as opposed to near
25 (within-reach) space (Ambrosini & Costantini, 2013; Costantini et al., 2010, 2011).

Moreover, Saccone and colleagues (2018) did not find a difference between near and far objects when 'far' stimuli were still within reach. These findings suggest that the handle compatibility effects depend on an individual's ability to interact with objects.

Interestingly, to the best of our knowledge, object position in the upper vs lower visual field (VF) has never been compared during affordance tasks. This is important since humans are more efficient at reaching and grasping stimuli presented in the lower VF than in the upper VF, suggesting a functional advantage for the lower VF in visuomotor control (e.g., Brown et al., 2005; Danckert & Goodale, 2001; Krigolson & Heath, 2006). At an anatomical level, several brain areas involved in visuomotor processing (such as V6 and V6A) over-represent the lower VF in both macaques and humans (Galletti et al., 1999; Gamberini et al., 2011; Pitzalis et al., 2010). In fact, we and others have found that visuomotor brain areas (along the medial surface of the parieto-occipital cortex) were significantly more activated when participants reached and grasped objects presented in the lower VF relative to the upper VF (Maltempo et al., 2021; Rossit et al., 2013). Altogether, these findings are consistent with the proposed specialisation of the lower VF for analysis and execution of visuomotor responses (such as grasping and tool manipulation) within peripersonal space (Previc, 1990; Danckert and Goodale, 2003). Thus, it seems reasonable to hypothesize that the visual field in which graspable objects are presented may also modulate handle compatibility effects, but this has yet to be investigated.

Therefore, we propose to run a detailed investigation of handle compatibility effects as well as investigating the effect of visual field in two well-powered pre-registered studies. In experiment one, we will contrast upright vs inverted and colour

1 judgements to separate the contribution of Simon and affordance effects and
2 address the debate in the field. We expect to observe larger handle compatibility
3 effects for upright vs inverted judgements than the colour task (e.g., Saccone et al.,
4 2016) which would suggest that affordances contribute to the effects observed. The
5 second experiment will investigate, for the first time, whether the handle compatibility
6 effect varies between the upper and lower VFs. Specifically, participants will be
7 asked to perform upright vs. inverted judgements while fixating on one of two fixation
8 positions allowing objects to be presented in the upper or lower visual field. Crucially,
9 by manipulating fixation position rather than the position of the objects, the proximity
10 between stimuli and hands will not differ across conditions. Given the evidence
11 supporting a lower VF advantage for action (e.g. Rossit et al., 2013; Previc, 1990),
12 we hypothesise that the handle compatibility effect will be larger in the lower VF
13 compared to the upper VF.

14 To our knowledge, this is the first registered report to assess the contribution
15 of affordances to the handle compatibility effect while controlling for spatial
16 compatibility. Some research favouring an affordance account has been subject to
17 failed replications (e.g. Cho & Proctor, 2012; Marshall, 2016; cited in Bub & Masson,
18 2018), however it is possible that these replication studies were underpowered, or
19 the original studies did not provide enough transparency to allow a full replication.
20 Moreover, much of the object-based stimulus response compatibility paradigm
21 literature has employed different methods, for example, number of stimuli, design
22 differences, judgement tasks, sample size justification (or lack of), different exclusion
23 criteria, outlier detection and analyses. This highlights that importance of pre-
24 registering our methods and analysis plans and using a well-powered design. By
25 including our novel experiment manipulating visual field, all our study design will be

fully reproducible and replicable to allow for researchers to build on the experiment's findings in the future.

Methods

Power analysis

An a priori power analysis was performed using *MorePower 6.0.4* (Campbell & Thompson, 2012) to determine the sample size required. As we are looking for a specific interaction between our independent variable (task or VF) and handle compatibility, we performed our power analysis based on the interaction reported by Pappas (2014; experiment 2 - $\eta_p^2 = .143$). Pappas' (2014) experiment 2 used a 2x2 within-subjects design manipulating handle compatibility and, to separate affordances from spatial compatibility, response mode (within vs between hands) which closely reflects our experimental design. The power analysis revealed that a sample size of 66 is required to detect a task x compatibility or VF x compatibility interaction with 90% power and $\alpha = .05$. To allow for equal counterbalancing of blocks, we have chosen a sample size of 68 for each experiment.

Participants

Participants will be recruited through the University of East Anglia undergraduate participant pool and will be given course credits for their participation. Each participant will be required to only take part in one of the two studies. All participants will be aged between 18 and 50. Participants who report colour blindness, history of neurological disease, motor impairments or coordination disorders (e.g. dyspraxia) will be excluded from the study. Participants will also be excluded from analysis if

they fail to complete the entire experiment. Excluded participants will be replaced until the desired sample size is obtained.

Our previous online version of the study was ethically approved by the University of East Anglia School of Psychology ethics committee [reference: 2021-0999-002425] and an amendment has been submitted to carry out the experiments in the lab. All participants will provide informed consent.

Stimuli and piloting

Stimuli are photographs of common household objects with handles affording a unimanual grasp, presented on a white background. Exemplars were identified from a normative dataset of 296 images extracted from the Bank of Standardized Stimuli (Brodeur et al., 2010; Lagacé et al., 2013) of which 91 exemplars were identified as having handles affording a unimanual grasp. Of the remaining exemplars, 47 were excluded due to not having a clear upright-inverted orientation (e.g. a whisk or potato masher has no clear upright orientation when lying horizontally on a table), and duplicates were removed. Thus, fresh images of the 43 object exemplars were photographed using a Nikon D60 camera, fixed onto a tripod slightly above the object, at 52 centimetres distance to provide depth perspective. Objects were photographed in their upright and inverted orientations with handles oriented to the right, 45° towards the camera. Photographs were cropped to exclude the background and flipped horizontally to create symmetrical left-oriented handled objects. All objects will therefore appear in two horizontal (left, right) and two vertical orientations (upright, inverted), resulting in four unique stimuli for each object. All stimuli were black and white for upright vs inverted judgements (Tucker & Ellis, 1998) and coloured red and green for colour judgements (Saccone et al., 2016).

Images were resized so that all objects had the same height, while maintaining aspect ratio, and centred on a transparent background. Since we are comparing tasks and VF, we chose to centre objects centred by their width, rather than base or pixel area (e.g., Cho & Proctor, 2010; Pappas, 2014), as any effects due to object centring will be constant across tasks. Moreover, while the depth cues when the objects are upright or inverted will vary across the vertical axis, these cues will remain constant across tasks.

To ensure that the vertical orientation of our objects and their names are easily identifiable, we ran a small pilot study to select the final stimulus set. Ten participants were presented with the objects in all four orientations for 100ms at the fovea. Participants were asked to name the object, identify whether it was upright or inverted, and specify whether the upright/inverted judgement was easy or a guess. Based on the results, we removed sixteen objects as the upright/inverted accuracy was less than 90%. A further two objects were excluded as their upright/inverted orientation was guessed by more than 10% of the sample, and one object was excluded because it was incorrectly named by more than 10% of the sample. Where there were multiple exemplars of the same object (e.g. knife, steak knife, cheese knife), we included the exemplar that was most accurately judged without guesses. As a result, 20 objects were selected for the final set and will be used as experimental stimuli. The number of stimuli closely matches that used in Tucker and Ellis' (1998) experiment, however many previous experiments have used a very limited stimulus set (e.g. a single object stimulus; Cho & Proctor, 2011; Tipper et al., 2006). We chose a larger stimulus set to improve ecological validity and include objects with varying handle size and orientations to reduce the salience of handle

location between trials. All stimuli are available on Open Science Framework

<https://osf.io/bp8kq/>.

Apparatus

In both experiments, we will use a SR Research (Kanata, Ontario, Canada) Eyelink 1000 Plus with a desktop mount system to record participants' eye gaze and monitor fixation. Monocular vision will be recorded at a sampling rate of 500 Hz. Participants will sit with their head in a chin rest at a fixed distance of 60 cm from a 24" BenQ XL2411Z monitor.

Experiment 1

Our first experiment seeks to replicate the handle compatibility effect while controlling for the spatial compatibility which has previously been shown to influence compatibility effects (Cho & Proctor, 2010; Kostov & Janyan, 2020; Proctor et al., 2017). Using a within-participants design, participants will respond with their left- or right-hand to whether the handled object is upright or inverted or, in separate blocks, whether the object is red or green. Unbeknown to participants, handles will be oriented towards the same side as the correct response (compatible), or the opposite side (incompatible).

Procedure

Following informed consent, participants will complete a short demographics questionnaire to ensure they fulfil the inclusion criteria. Participants will then complete the eye tracking calibration procedure. The eye with higher spatial accuracy will be selected for monocular recording. The eye tracker will be

recalibrated during the experiment if needed and, when necessary, the selected eye changed, at the experimenter's discretion.

In the main handle compatibility task, each trial will begin with a fixation bullseye (1°) presented at the centre of the screen for a fixed duration of 1000ms, followed by a variable delay of 500-1250ms (with a random delay of 250ms intervals). Then, a stimulus (maximum $15^\circ \times 5^\circ$) will appear in the centre of the screen until a response is made (maximum presentation time = 1500ms). In separate blocks, participants will either be asked to judge whether the object is normal (upright) or inverted according to its canonical orientation or respond to the colour (red or green) by pressing either 'q' with their left index finger or 'p' with their right index finger on a QWERTY keyboard as quickly as possible. Note here that the task instructions will use the term 'normal' instead of 'upright' to prevent any response advantages due to the lexical similarity between 'upright' and objects presented in the 'upper' VF in our second experiment (Saccone et al., 2016). Feedback will be provided reiterating the required response buttons in the event of an inaccurate response or when a response is not initiated within 1500ms. In a compatible trial, the hand used to respond will be congruent with the orientation of the object handle, whereas for incompatible trials the hand used to respond, and the handle orientation will be incongruent (see Fig. 1). Response mapping will be counterbalanced across blocks.

The experiment will consist of four blocks: in two consecutive blocks, participants will perform upright vs inverted judgements, and in the other two blocks, participants will perform colour judgements. Block order will be counterbalanced so that half of participants will begin with judging upright/inverted and the other half will begin by judging colour. In each block, each stimulus will be randomly presented

once in each possible horizontal handle orientation (left, right) and vertical orientation (upright, inverted), resulting in $20 \times 2 \times 2 = 80$ trials per block, and a total of 320 trials in the entire experiment. There will be an equal number of compatible and incompatible trials per block. Each block will commence with 16 practice trials (2 independent stimuli $\times$ 2 handle orientations $\times$ 2 vertical orientations $\times$ 2 repetitions). Practice stimuli will be independent exemplars that were excluded based on the pilot study. Participants will initiate each block by pressing the spacebar and will be required to take a break between each block for a minimum of 20 seconds to reduce fatigue and eye discomfort. The experimenter will recalibrate the eye-tracking device during the experiment where necessary. The experiment will be developed using Experiment Builder (SR Research).

[INSERT FIG. 1 HERE]

Data Analysis

Trials in which participants did not respond within 1500ms, or a fixation error of greater than 1.5° was detected, will be excluded from all analyses. RTs from incorrect responses will be excluded from the analysis. For a participant to be included in the final analysis, a minimum of 20 correct trials per condition will be needed to compute a mean. Participants excluded at the data analysis stage will be replaced until the sample size of 68 has been achieved. For each participant, the mean RT for each condition (task: upright/inverted, colour; handle: compatible, incompatible) will be calculated. RTs greater than two standard deviations away from each participant's condition mean will be excluded as outliers (Pappas & Mack,

2008; Symes et al., 2005). A 2 (task: upright/inverted, colour) x 2 (handle: compatible, incompatible) repeated measures ANOVA will be conducted on mean RTs. Post-hoc comparisons will be Bonferroni corrected. In the event of null effects, non-rejection of the null hypothesis will be clarified by using TOST (Lakens, 2018) to give a p-value which is the larger of the two one-sided p-values testing the null hypothesis that the interaction less than (in numerical value) that deemed to be minimally important (from the sample size calculation).

Experiment 2

In experiment 2, we will seek to investigate whether the handle compatibility effect is larger in the lower VF, given the lower VF advantage in visuomotor control (Rossit et al., 2013). Participants will fixate above or below a centrally presented object stimulus and respond with the left- or right-hand depending on whether the object is upright or inverted. As in experiment 1, the object's handle will be either compatible, or incompatible, with the hand used to correctly respond.

Procedure

The procedure for experiment 2 will remain the same as experiment 1. However, in the handle compatibility task, participants will only perform upright vs inverted judgements and not colour judgements. In a typical trial, the fixation bullseye will be randomly presented either 7° above or below the centrally presented object. The fixation bullseye will remain on screen throughout each trial. The next trial will begin with the fixation bullseye presented for 1000ms to allow participants to fixate, following which there will be a variable delay period as in experiment 1 (see Fig. 2).

[INSERT FIG. 2 HERE]

Data Analysis

Data exclusion criteria remain the same as experiment 1. A 2 (handle: compatible, incompatible) x 2 (visual field: upper, lower) repeated-measures ANOVA will be conducted on mean RTs. Post-hoc comparisons will be Bonferroni corrected and null effects will be followed up with the TOST procedure (Lakens, 2018).

Table 1
Design table for Experiment 1.

Question	Hypothesis	Sampling Plan	Analysis Plan	Interpretation given different outcomes
Replicating the handle compatibility effect while controlling for spatial compatibility (Exp 1)				
Can the handle compatibility effect be attributable, at least in part, to affordances?	The handle compatibility effect will be larger when participants respond to whether objects are upright or inverted compared to responding to the colour of objects. This will be further explained by an interaction between handle compatibility and task.	Powered based on the interaction effect size reported by Pappas (2014; experiment 2). To achieve 90% power for detecting an interaction with effect size of $\eta_p^2 = .143$ and an alpha level of .05, we need 66 participants. 68 participants will be recruited to allow for counterbalancing.	2 (compatibility: compatible, incompatible) x 2 (task: upright/inverted, colour) repeated measures ANOVA on mean RTs.	Outcome 1: Interaction between compatibility and task: post-hoc pairwise t-tests indicating that RTs for compatible trials are significantly smaller than RTs in compatible trials when participants judge whether the object is upright or inverted, but not when participants respond to object colour. This interaction would show that the handle effect is not solely explained by spatial compatibility, rather the limb specific motor representations as a result of the objects' affordances contribute to the handle compatibility effect. Outcome 2: No significant interaction, main effect of compatibility and task: A handle compatibility effect is observed regardless of task, while the colour judgement task leads to smaller RTs than the upright/inverted task. Successful replication of the handle compatibility effect however, this would suggest that compatibility effects observed are primarily a result of spatial compatibility rather than affordances, while the easier colour judgement task leads to faster RTs. Outcome 3: No significant interaction, main effect of compatibility, no main effect of task: Similar RTs between in both tasks, and both tasks resulting in a handle compatibility effect. Successful replication of the handle compatibility effect however the compatibility effects observed are a result of spatial compatibility rather than affordances. Outcome 4: No significant interaction, main effect of task, no main effect of compatibility: RTs for judging colour are smaller than when judging upright/inverted. There is no evidence for a handle compatibility effect in either task although the easier colour judgment task leads to speeded RTs. Replication failure. Outcome 5: No significant interaction or main effects: No evidence of a compatibility effect in either task, and similar RTs across tasks. Failed replication.

Table 2
Design table for Experiment 2.

Question	Hypothesis	Sampling Plan	Analysis Plan	Interpretation given different outcomes
The effect of visual field on the handle compatibility effect (Exp 2)				
Is there a lower visual field preference for object affordances?	The handle compatibility effect will be larger when participants respond to objects presented in the lower visual field compared to the upper visual field.	Powered based on the interaction effect size reported by Pappas (2014; experiment 2). To achieve 90% power for detecting an interaction with effect size of $\eta_p^2 = .143$ and an alpha level of .05, we need 66 participants. 68 participants will be recruited to allow for counterbalancing.	2 (compatibility: compatible, incompatible) x 2 (visual field: upper, lower) repeated measures ANOVA on mean RTs.	Outcome 1: Interaction between compatibility and VF: Larger handle compatibility effect in the lower, compared to upper VF. This could be explained by a lower VF preference for affordances, or a stronger spatial compatibility effect in the lower VF. Future research could implement a colour control condition to investigate whether the findings are due to affordances. Outcome 2: No significant interaction, main effect of compatibility and VF: A handle compatibility effect is present regardless of VF of presentation. Faster RTs in lower VF, possibly as a result of the lower VF advantage in action (e.g. Danckert & Goodale, 2001). Affordances, or spatial compatibility, do not differ between the visual fields. Outcome 3: No significant interaction, main effect of compatibility, no main effect of VF: A handle compatibility effect is present in both the upper and lower VFs, and there is no difference between RTs in the upper VF and lower VF. This would provide evidence that affordance, or spatial compatibility effects, are present regardless of the VF of presentation. There would be no evidence for a lower VF action advantage. Outcome 4: No significant interaction, main effect of VF, no main effect of compatibility: RTs faster in the lower VF possibly consistent with the lower VF action advantage. Compatibility effects not observed in the lower or upper VFs, nor do they differ between the VFs. This would suggest that there is a lower VF advantage for action but not necessarily for affordances. Outcome 5: No significant interaction or main effects: There is no evidence for a handle compatibility effect or a lower VF action advantage. Future experiments could use different eccentricities, 3D rather than 2D objects, and utilising reach to grasp rather than keypress SRC paradigms.

Secondary Analyses (all studies)

While some studies report handle compatibility effects on error rates, for example higher errors in incompatible conditions (Pappas, 2014; Tucker & Ellis, 1998), others report have not replicated this (Goslin et al., 2012; Saccone et al., 2016). To clarify this, we will thus explore the effect of handle-response compatibility on error rates in each experiment. In experiment 1, a 2 (handle compatibility: compatible, incompatible) x 2 (task: orientation, colour) repeated-measures ANOVA will be conducted on percentage error (PE). In experiment 2, a 2 (handle compatibility: compatible, incompatible) x 2 (visual field: lower VF, upper VF) ANOVA will be conducted on PE. Post-hoc comparisons will be Bonferroni corrected, and null effects will be followed up using TOST (Lakens, 2018).

Exploratory Analyses

Moreover, to investigate the temporal development of handle effects in each condition, we will conduct a distribution analysis. Participants' correct RTs for compatible and incompatible trials will be rank ordered, divided in to four equal bins, and the mean RT for compatible and incompatible trials in each bin will be calculated. A handle compatibility effect will then be calculated for each bin by subtracting the mean RT for compatible trials from the RT for incompatible trials. This will result in quartile effect sizes from experiment 1 for both the upright/inverted judgement task and the colour judgement task. Here, we expect that the handle compatibility effect will emerge over time when participants judge whether objects are upright/inverted. This pattern would be consistent with previous findings in distribution analyses for handle compatibility effects when tasks require object

recognition (e.g. upright/inverted, kitchen/shed; Saccone et al., 2016; Symes et al., 2005). When the task is to judge colour, however, we expect the handle compatibility effect to be present in the earlier quartiles, but to rapidly dissipate in the latter quartiles, consistent with the literature on the temporal profile of the Simon effect (De Jong et al., 1994; Proctor et al., 2005). We have no predictions for the time course of effects in the upper and lower VFs, however the distribution analysis will provide further details on the patterns of our results and possible mechanisms underlying the effects in the upper and lower VFs. To statistically assess any effects across the RT distribution, participants' mean effect sizes for each bin and condition will be entered into two 4 (bin: 1, 2, 3, 4) x 2 (Task or Visual field) repeated measures ANOVAs.

Timeline

The study will commence as soon as Stage 1 in principle acceptance has been granted. The University of East Anglia's School of Psychology regularly conducts undergraduate cohort participant recruitment and has a pool of 500-600 undergraduate students fitting our inclusion criteria. We expect our data collection and analysis to be completed within 12 months of receiving IPA.

Figure legends

Figure 1 – Timing and sequence for Experiment 1 with example of a compatible trial.

Figure 2 - Timing and sequence for Experiment 2 with example of an incompatible trial in the lower VF.

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