Contents

Method

Participants

A total of 374 subjects completed the online experiment (see Table 1 for a breakdown of the gender and age of the sample). Subjects were recruited from both voluntary participation websites such as Prolific Academic[1] (where they received payment at the rate of £5/hr), and via the in-school research participation system[2] (where they received course participation credits).

Table 1: Gender and age (*sd*) of the current sample.

Gender	N	Age	
Female	*197*	33.18	*(11.26)*
Male	*170*	33.23	*(10.28)*
Non-binary	*2*	23.50	*(-)*
Unspecified	*5*	29.40	*(6.11)*
Total	***374***	**33.10**	***(10.76)***

To meet our YA requirements, all participants were required to be aged between 18-59 years (actual obtained range: 18-59 years). As our experiment involved typing the English labels for a range of image stimuli, subjects were also asked whether English was their first language; all but one participant indicated that English was indeed their first language (99.73%).

[1] https://www.prolific.co/

[2] https://keelepsychology.sona-systems.com/

Materials

Items from the previous experiment were brought forward into the current study; these consisted of a random sample of line-drawn, everyday object stimuli (Rossion & Pourtois, 2004), along with their written-word counterparts. Before sourcing photographs to match these items, some were excluded due to unique restrictions that meant they could not easily be translated into photographic format (for example, the shapes "arrow" and "star" can not be represented similarly as photographs).

Photo stimuli were obtained by searching open-source, copyright-free image websites (e.g. Unsplash[3]; Pexels[4]) for photographs similarly depicting the line-drawn everyday objects (the full list of image references can be found in Appendix A). For each item, three unique photographs were selected. An emphasis was placed on variety when selecting the three images, with the aim of obtaining photographs that very closely resembled the line drawings and those offering more modern depictions. All photographs were imported into Adobe Photoshop (20.0.04 Release), where the background was removed in order to isolate the objects of interest from other potentially distracting visual details (this was completed manually using the magnetic lasso and polygonal lasso tools; the edges were either feathered by 1px or left un-feathered). Next, the orientation of isolated objects was adjusted to ensure they matched as closely as possible to their line-drawn counterparts (e.g. photographs of the 'boot' item were adjusted so the toe was facing left and the heel facing right, as in the line drawing); this was often achieved by flipping or mirroring the object to 'correct' the direction.

Despite isolating objects from their background, a small number of photographs still contained irrelevant and potentially distracting details (e.g. in one photograph of a 'piano', there was a sign atop the object that may have impacted how the item is encoded when ultimately used in recognition tasks). Such details were removed using the clone stamp and content-aware fill tools (some examples of these photo manipulations can be found in Appendix B). Any obvious text (e.g. brand names) and numbers were also removed from photographs using the same method. The primary aim of the current study was to obtain photographic stimuli that could be clearly separated from words and line drawings; if some of our photograph stimuli contained text, whilst others did not, it is conceivable that they may not be directly comparable in terms of recognition. There were a couple of exceptions to this rule, when such details happened to be integral to the depiction of an object (e.g. the numbers found on a ruler or clock).

The photographs were exported from Photoshop in ".png" format in both their original colour and in greyscale (by setting saturation levels to 0). Final edits were completed in Adobe Lightroom (Classic, 8.2 Release): exposure (brightness) adjustments were made on images that appeared too light or too dark; highlights were decreased if some areas were too bright compared to the rest of the photograph; shadows were raised if some areas were too dark compared to the rest of the photograph; noise reduction was applied to some items after isolating the subject had inadvertently made unwanted noise/grain more visible. The changes made to each image were systematically applied to both the colour and greyscale versions (e.g. if one variation of "shoe" had an exposure increase of .010 for the colour version, the greyscale version also received an exposure increase of .010). Some colour-specific adjustments were made to the colour pho-

[3] https://unsplash.com/

[4] https://www.pexels.com/

tographs only, however; common photo artefacts such as chromatic aberration (purple fringing) were corrected, along with white balance normalisation. Finally, all photographs were placed on a 600x600 pixel white background, and made to fill this frame as much as possible (i.e. some items were restrained by height, whilst others were restrained by width).

Design

Across three blocks, all participants provided five types of response toward photo stimuli: i) Naming; ii) Familiarity; iii) Visual Complexity, iv) Colour Diagnosticity; and v) Mental Imagery Agreement. Excluding the Naming task (consisting of a typed single-word answer), all responses were provided on a 5-point Likert scale. Within participants, the maximum number of response type provided for any one item was two; Naming and Familiarity responses were paired in one block, Visual Complexity and Colour Diagnosticity responses were paired in another, and Mental Imagery Agreement responses were always presented in a separate block. The order of these three blocks was counterbalanced across participants. Toward each individual photograph, participants made only one or two types of response before moving on to the next item, and the same items were not repeated to participants. For each photograph, the five types of required data were obtained by counterbalancing between participants (e.g. for the first variation of the "cat" photograph, the Naming and Familiarity data was obtained from one participant, the Visual Complexity and Colour Diagnosticity data was obtained from another, and the Mental Imagery Agreement data was obtained from another).

Procedure

Data collection was conducted via two online platforms; i) Qualtrics[5] - a survey platform that allowed for straightforward collection of consent, demographics, and computer compatibility data, and ii) Pavlovia[6] - an open-source experiment hosting platform for studies programmed in Javascript (Peirce et al., 2019).

In the Naming and Familiarity block, participants were first asked "What is the name of the item depicted?". Subjects were instructed to name each photograph as briefly and unambiguously as possible, with one name only, and respond by typing their answer into the response box. If they did not know the name of an item, or had a tip-of-the-tongue experience, participants were instructed to type "no" for their answer (the term "don't know" was avoided so as not to encourage subjects to deviate from single-word responses, as instructed). Following the naming judgement, with the same photograph still present on-screen, participants were next asked "How familiar is the item depicted?". Subjects were instructed to judge each photo according to how usual or unusual the item was in their realm of experience; specifically, familiarity was defined as "the degree to which you come in contact with, or think about, the concept", and encouraged participants to rate the concept itself rather than the particular way it was currently shown. Participants selected one value from the 5-point scale, ranging from very unfamiliar (1)

[5] https://www.qualtrics.com/uk/

[6] https://pavlovia.org/

to very familiar (5), and were encouraged to use the full range of the scale throughout the set of photographs.

In the Visual Complexity and Colour Diagnosticity block, participants were first instructed to respond to the question “How visually complex is this picture?” using a 5-point scale that ranged from “very simple” (1) to “very complex” (5). Complexity was defined to subjects as “the amount of detail in the picture”; in contrast to the familiarity ratings, participants were encouraged here to rate the complexity of the picture itself, rather than the real-life item. If the photograph shown was greyscale, subjects would simply move on to the next item. If the item shown was in colour, however, participants were also required to make a colour diagnosticity judgement. This concept was defined as “how typical / normal the colour of the item is”, instructing subjects to rate on a 5-point scale ranging from “Not at all diagnostic (i.e. this item could be in any other colour equally well)” (1) to ”Highly diagnostic (i.e. this item appears only in this colour in real life). Participants were instructed to utilise the full range of options on the scale when making visual complexity and colour diagnosticity judgements. After making these ratings, a fixation cross was presented during a 1s interstimulus interval.

Due to the slight change in procedure and increased task complexity, Mental Imagery Agreement ratings were always acquired in an individual block (i.e. not alongside any other response types). First, participants were presented with a written label for 3s (e.g. “cat”) and told to focus their attention on the word. Once the written word disappeared, a beep tone was played alongside the instruction “close your eyes and imagine this item” (subjects were encouraged to close their eyes and begin imagining the item as soon as they heard the tone, but the written instruction were included as a further prompt). After 3s a second beep tone sounded to alert subjects to open their eyes, where they were presented with a photograph of the item they had been instructed to imagine. On a 5-point scale, participants were asked to “rate the agreement between your mental image and the picture”, from “low agreement” (1) to “high agreement” (5). The degree of agreement was defined as “how similar your mental image of the item is to the picture shown”. A fixation cross was displayed for 1s before the next word item was shown.

All responses were self-paced; the timing was only controlled during the study/imagine section of the Mental Imagery Agreement block.

Results

Naming

The naming responses for each photograph item were manually assessed for spelling and typing errors. Automatic spell checking software was avoided in an effort to avoid inadvertently introducing unique names that were not actually given by participants. The vast majority of errors were unambiguous and easy to correct (e.g. “anker” = “anchor”, “peguin” = “penguin”, “ssnowman” = “snowman”), or consisted of transforming plural words to singular (or vice versa, depending on the form of the intended label - e.g. “sock” to “socks”). Some responses were a little more ambiguous, and necessitated comparison to the photographs they were in response to for additional clarity (e.g. a photograph depicting a plug that would fit into North American

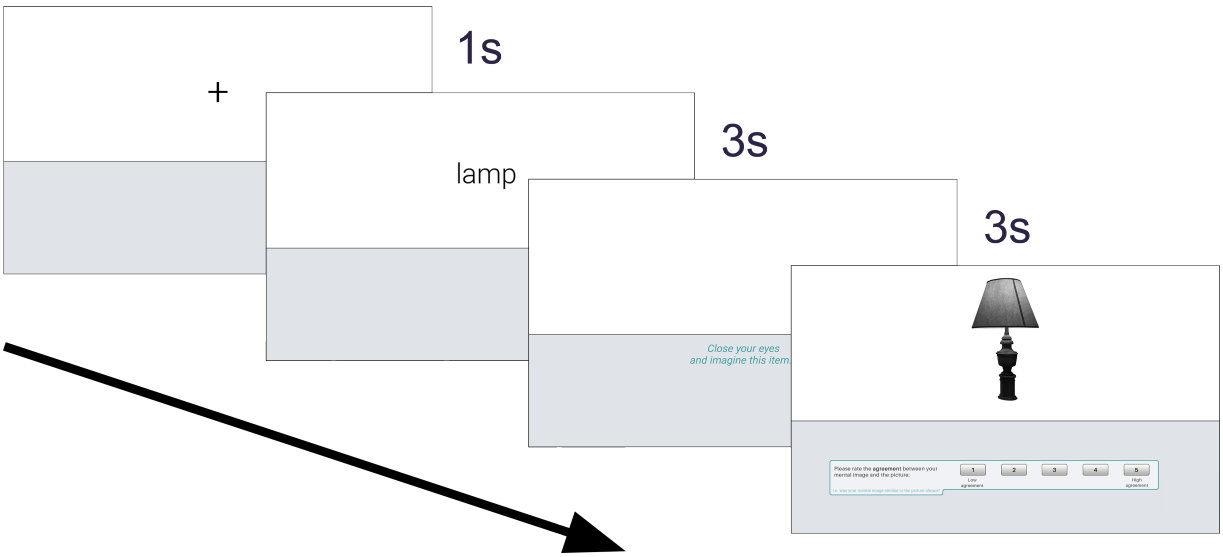

Figure 1: Figure 1: Data collection procedure for Mental Imagery Agreement responses.

electrical sockets was labelled as “usplug” - given the nature of our UK-based sample, it’s likely the subject was responding: “U.S. (i.e. United States) plug”.

There were instances where subjects provided a sensible and correctly spelled English word, but that were clearly typos when examined against the photograph they were in response to (e.g. “dock” for a photograph depicting a duck, “frock” for a frog, and “beer” for a “bear”, etc). The most ambiguous spelling error to correct was “bittle”, which was provided by more than one participant and to more than one item; separate inspections of the photographs participants were responding to made this easy to correct though, with one participant clearly meaning to respond “bottle”, whilst the other meant to respond “beetle”. Though participants were instructed to only give a single label for each item, some multiple word responses were found (without spaces) during the spell checking process. On such occasions, a judgement was made regarding whether multiple words were retained, or whether the response could be shortened into a single word. A general rule was applied whereby if the other words provided additional information, they were retained (e.g.“maledear” - presumably “male deer” - was kept as a two-word answer). Multiple word responses were generally shortened into a single word when the intended label for the item was clearly present, and no information was lost in the process (e.g. “haircomb” was shortened to the intended answer “comb”). It is noted that there was some inherent subjectivity in this process, though as such items were not common among straightforward responses, their overall effects are estimated to be negligible.

Finally, there were some responses that were changed to “no” as they were clearly intended to signify that the responder did not know the name of the item shown; the experiment instructed participants to type “no” in these instances, though the labels “none” and “idk” (common abbreviation for “I don’t know) were provided instead. There was also a single response that was manually changed to”no”, as the provided label was a single letter and thus entirely unclear what the intended answer should be. All manipulations to naming responses can be found at

Appendix C.

References

Peirce, J., Gray, J. R., Simpson, S., MacAskill, M., Höchenberger, R., Sogo, H., Kastman, E., & Lindeløv, J. K. (2019). PsychoPy2: Experiments in behavior made easy. *Behavior Research Methods*, *51*(1), 195–203. https://doi.org/10.3758/s13428-018-01193-y

Rossion, B., & Pourtois, G. (2004). Revisiting Snodgrass and Vanderwart's Object Pictorial Set: The Role of Surface Detail in Basic-Level Object Recognition. *Perception*, *33*(2), 217–236. https://doi.org/10.1068/p5117

Appendices

Appendix C

Response	Correction	Response	Correction	Response	Correction
idk	no	canle	candle	giaraffe	giraffe
none	no	canon	cannon	glases	glasses
a	no	carrott	carrot	gutair	guitar
anker	anchor	carott	carrot	gitaur	guitar
ancher	anchor	cerlery	celery	gitter	guitar
anchore	anchor	celary	celery	hemmar	hammer
ancor	anchor	cellary	celery	hand5	hand
ashtry	ashtray	celeary	celery	hamp	harp
;ashtray	ashtray	chain2	chain	kacket	jacket
aparagus	asparagus	cockrel	cockerel	kangroo	kangaroo
ballon	balloon	cockaroach	cockroach	lader	ladder
baloon	balloon	cochroach	cockroach	latter	ladder
ballone	balloon	chissel	chisel	leafe	leaf
ballun	balloon	chizel	chisel	lettace	lettuce
balloone	balloon	chestofdraws	chest of drawers	leamon	lemon
bannan	banana	chestofdrawerserss	chest of drawers	leema	lemur
bamnna	banana	chisle	chisel	olobster	lobster
bananna	banana	claranet	clarinet	maledear	maledeer
bannana	banana	combe	comb	mortle	mortar
bananaa	banana	dear	deer	monkeybut	monkeynut
barrell	barrel	deere	deer	mousse	moose
barrle	barrel	draws	drawers	neddle	needle
barel	barrel	doormouse	dormouse	nectarinee	nectarine
barrow	barrel	eagal	eagle	onions	onion
busket	basket	eeagle	eagle	ostrage	ostrich
bellpepp34	bellpepper	eclipses	eclipse	osterich	ostrich
beatle	beetle	eclipes	eclipse	ostrige	ostrich
bettle	beetle	eclipsse	eclipse	ostrisge	ostrich
blueberrys	blueberries	falg	flag	ostritch	ostrich
bycycle	bicycle	footstall	footstool	ostridge	ostrich
bicucle	bicycle	fott	foot	apricorte	apricot
bicyle	bicycle	frog/	frog	nectarin	nectarine
bootle	bottle	girafffe	giraffe	nectrine	nectarine
bolw	bowl	giraffee	giraffe	pecock	peacock
broon	broom	girrafe	giraffe	peacck	peacock
broon	broom	girafe	giraffe	pair	pear
brum	broom	giraff	giraffe	oencil	pencil
camal	camel	giaffee	giraffe	pengiuin	penguin
canddle	candle	girraffe	giraffe	pengiun	penguin

(continued)

Response	Correction	Response	Correction	Response	Correction
penguine	penguin	timbil	thimble	drums	drum
penquin	penguin	thunb	thumb	feet	foot
peguin	penguin	toitouse	tortoise	geese	goose
peper	pepper	tomatoe	tomato	gloves	glove
pestleandmorter	pestleandmortar	grape	grapes	ladders	ladder
tabaccopipe	tobaccopipe	tomoato	tomato	lip	lips
piccalo	piccolo	tortiste	tortoise	mice	mouse
pliars	pliers	tortise	tortoise	mittens	mitten
plier	pliers	tortus	tortoise	onions	onion
plyers	pliers	volion	violin	cock	cockerel
pilers	pliers	vioin	violin	cycle	bicycle
pliyers	pliers	violen	violin	dolly	doll
vicescripts	vicegrips	valture	vulture	eyeglass	eyeglasses
usplug	plug	waistcoast	waistcoat	fencing	fence
potatoe	potato	wastecoat	waistcoat	haircomb	comb
pottato	potato	wale	well	longdress	dress
pumkin	pumpkin	whistel	whistle	mit	mitten
pumpkim	pumpkin	whsitle	whistle	plugin	plug
punpkin	pumpkin	whisell	whistle	rule	ruler
rabit	rabbit	whitle	whistle	specs	spectacles
racoon	raccoon	windown	window	teakettle	kettle
mercat	meerkat	peneut	peanut		
meercat	meerkat	beer	bear		
acoop	scoop	dock	duck		
eele	seal	frock	frog		
seel	seal	glass	glasses		
snakw	snake	glassesbottle	bottle		
ssnowman	snowman	hose	house		
showel	shovel	noise	nose		
soak	socks	paper	pepper		
spon	spoon	harper	hamper		
steplader	stepladder	muscat	muskrat		
sterss	step	bittle	bottle		
sweetcirn	sweetcorn	bittle	beetle		
rubarb	rhubarb	carrots	carrot		
thinbell	thimble	clouds	cloud		
thmble	thimble	draw	drawers		
timble	thimble	drawer	drawers		