Contents

Experiment 2

Development of a new set of standardised photographic stimuli

The Picture Superiority Effect (PSE) is highly robust and replicable. In recognition memory paradigms, the PSE has been shown to manifest as both increased recollection [] and familiarity (Dewhurst & Conway, 1994; Rajaram, 1996, 1993; Wagner et al., 1997; Yonelinas, 2002). Studies utilising event-related potentials (ERPs) have also demonstrated how pictures enhance parietally-based ERP components (linked to recollection processes) compared to words (Ally & Budson, 2007; Curran & Doyle, 2011).

The effect is also present in children, adolescents and healthy older adults [Whitehouse et al. (2006); need ref for healthy OAs], though perhaps more striking is the fact that patients with Alzheimer's disease or those presenting early isolated memory impairments, known as amnestic mild cognitive impairment (aMCI), also show memorial benefits toward pictures (Ally, 2012). This is supported by ERP studies demonstrating comparable enhancements to recollection-based ERP components between healthy older and aMCI groups when pictures, rather than words, are utilised (Ally et al., 2009). There is debate within the literature attempting to characterise the nature of memory deficits in aMCI, whereby despite general agreement that recollection processes are impaired in such individuals, findings show great inconsistency with regard to familiarity (Algarabel et al., 2012; Belleville, 2011; Pitarque, 2016; Wolk et al., 2011, 2013). The PSE may have been largely overlooked as an area for further research in an effort to help settle this debate, despite recent reviews highlighting methodological differences across studies as the potential source of inconsistent findings (Koen & Yonelinas, 2014; Migo et al., 2012; Schoemaker et al., 2014). The level at which stimuli distinctiveness impacts successful recognition is currently unclear, and there is little consistency across studies with regard to what is considered a 'picture'.

Many experiments utilise line-drawn illustrations for their picture stimuli (van der Meulen et al., 2012; Westerberg et al., 2013; Wolk et al., 2011) - a set of items published by (**???**) are perhaps among the most-used illustrated picture stimuli, at least within the domain of memory research (**???**; **???**; van der Meulen et al., 2012; Wagner et al., 1997; Wammes et al., 2016; Whitehouse et al., 2006)

. The set features

common, everyday objects

Normative data for the (**???**) items has been continually revisited, including additional testing of the relationship between reaction time and naming agreement (Székely et al., 2003), as well gathering localised norms for use across different cultures - for example, China (Yoon et al., 2004) and Russia (Tsaparina et al. (2011)). The popularity of the stimuli within cognitive research led to a revision of the items by Rossion & Pourtois (2004), whereby each item was carefully re-drawn A notable addition to

The Rossion & Pourtois (2004) revision now appears to be favoured over the original (**???**) set among cognitive researchers (Wolk et al., 2008)

while others use photographs (Embree et al., 2012; Pitarque, 2016; Troyer et al., 2016, 2012; Wang et al., 2013). Methodological differences make it difficult to reconcile the effects of drawing

vs. photograph. It is unclear whether the magnitude of picture superiority effects are mediated by the format pictures are presented in, and

While similar sets of photograph stimuli have been published Viggiano et al. (2004) Moreno-Martínez & Montoro (2012)

"visually poor from an ecological point of view"

to our knowledge, no study has systematically matched items across formats in an effort to determine the point at which stimuli distinctiveness impacts recognition. Throughout a number of planned recognition experiments, we aim to systematically compare the impact different stimuli formats (written words, line-drawings, and photographs) have on the recollection and familiarity processes.

In order to make such comparisons, and ensure any differences in memory test performance are indeed attributable to stimuli format, we must ensure the same to-be-remembered concepts are similarly depicted across different 'levels' of stimuli format. The formats we have chosen to compare present common, everyday objects in either: i) written word format; ii) line-drawn illustrations; iii) photographs. Two of our stimuli formats were obtained from a pool provided by Rossion & Pourtois (2004); these objects consisted of line-drawings and their written-word labels.

To examine our research questions, it was necessary

The current study aims to develop a standardised pool of photographic stimuli that act as an extension to the set of drawings/words obtained from Rossion & Pourtois (2004).

will act as a precursor to the planned recognition memory experiments, and will seek to determine which of the three photograph variations we have already selected for each item most closely resembles the depiction in the line-drawings by Rossion and Pourtois (2004). We aim to achieve this by gathering normative data for all of the newly-obtained photographs, and then comparing this to the existing normative data for the line-drawings, in order to select the most suitable photograph variations to take forward into the proposed memory experiments. The data we plan to collect includes: i) the most commonly used name; ii) how familiar the object is; iii) how complex the image is; iv) whether the colour the object is currently depicted in is essential; and v) how closely the current depiction matches ones' mental image for the object). In addition to furthering our own research goals, the newly established set of photographic stimuli (and accompanying normative data) may also be useful to a range of other cognitive researchers looking for up-to-date, high quality stimuli.

The aim is to establish a new set of photograph stimuli for use in future planned memory experiments; the selected photographs will be supported by pilot data that help ensure they accurately depict the everyday objects in a similar fashion as those presented in line-drawings by Rossion & Pourtois (2004).

Whilst every effort has been made to source photographs that depict the everyday objects in a similar fashion to the line-drawings, the inherent subjectivity of this process may lead to images that are not an accurate 'match' of the objects they were chosen to depict; for example, the photograph chosen to convey "bottle" may inaccurately provoke the label "wine" in the majority of participants. To address this issue - and ensure all photographs objectively depict the same objects as their line-drawn counterparts when included in the planned memory experiments

Participants will view a sample of the potential photographs and be asked to provide the name of the object currently depicted. This process will produce data that will either support the chosen photographs (e.g. 100% of participants labelled the object “bottle”, which accurately matches the intentions of the researchers), or refute particular photographs (e.g. on 50% of participants labelled the item “bottle”, whilst the other 50% used the label “wine”). Photographs showing poor agreement across participant-generated labels, or those where the majority of produced labels differ from that intended by the researcher, can be replaced with more accurate depictions prior to inclusion in the planned memory experiments.

Normative data is to be obtained for a newly-developed set of realistic object stimuli. This new set of stimuli consists of 816x high-quality photographs of innocuous everyday items (e.g. shoe – see example below). Items were matched with those from an existing set of line-drawn, illustrative stimuli (Rossion & Pourtois, 2004), with a goal of ultimately assessing how different stimuli formats impact recognition (realistic photographs vs. illustrations). In order to publish the new stimuli set – and later compare recognition for these items against recognition for line-drawn illustrations (Rossion & Pourtois, 2004) – the following normative data is required: i) the most commonly used name; ii) how familiar the item is; iii) how complex each depiction of the item is; iv) whether the colour is diagnostic (regularly seen in this colour vs. can be seen in a range of colours);
v) how well the current depiction matches mental images of the object.

The proposal to gather such normative data was made by reviewers during my progression, and it will form an important basis for the photographs that will be taken forward into planned memory research. For each item (e.g. shoe), we selected 3x potential photograph variations; in an effort to reduce researcher bias, we will rely on the newly-acquired normative data to determine which photograph variation best ‘matches’ the items from the set of line-drawings (Rossion & Pourtois, 2004).

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). This sample size provided 20 data points for each of the five response types, while also ensuring the experiment did not last too long for participants (approx 25-mins). 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%).

Materials

A pool of 136 line-drawings (Rossion & Pourtois, 2004) - depicting common, everyday objects - were brought forward from the previous experiment. These items (along with their written-word labels) formed two unique stimuli formats that would be used in future recognition experiments (words and drawings), but in this study, they were simply used as a reference in the photograph matching process. Corresponding photographs were obtained online with the aim of depicting the everyday objects in a similar manner to the drawings; due to the inherent subjectivity of this latter task, three different photographs were found for each everyday object, with the aim of taking the best 'match' forward. An emphasis was placed on variety across these variations, with the aim of obtaining at least one photograph that very closely resembled the line-drawn depiction, and another offering a more modern depiction. Some items were substituted 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];

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

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

[3] https://unsplash.com/

Pexels[4]) for photographs that depicted the same everyday objects as the line-drawings (the full list of image references can be found in Appendix A).

The matching process produced a total of 408 unique photographs. All were imported into Adobe Photoshop (20.0.04 Release), where the background was removed to isolate the object of interest from other potentially distracting visual details. This was completed manually using the magnetic lasso and polygonal lasso tools (edges were either feathered by 1px or left un-feathered). The orientation of isolated objects was adjusted to ensure they matched as closely as possible with their line-drawn counterpart (e.g. all photograph variations of the item 'boot' 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. For example, in one photograph variation of the item 'piano', there was a sign on the object that may have impacted how the item was named or rated. Such details were removed as best as possible using the clone stamp and content-aware fill tools. Any obvious text (e.g. brand names) and numbers were also removed from photographs using the same method (see Figure 8). The primary aim of the current study was to obtain photographs that could be clearly distinguished as a unique stimuli format among words and line drawings; it is conceivable that combining these formats (i.e. inadvertently including photographs that also contain written words) might affect recognition performance in ways that are not directly comparable to items defined only by a single category. Any text in our photographs was therefore removed, apart from a couple of exceptions whereby such details happened to be integral to the depiction of the object (e.g. the numbers found on a ruler or clock).

All 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 photographs 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).

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

Original Manipulated

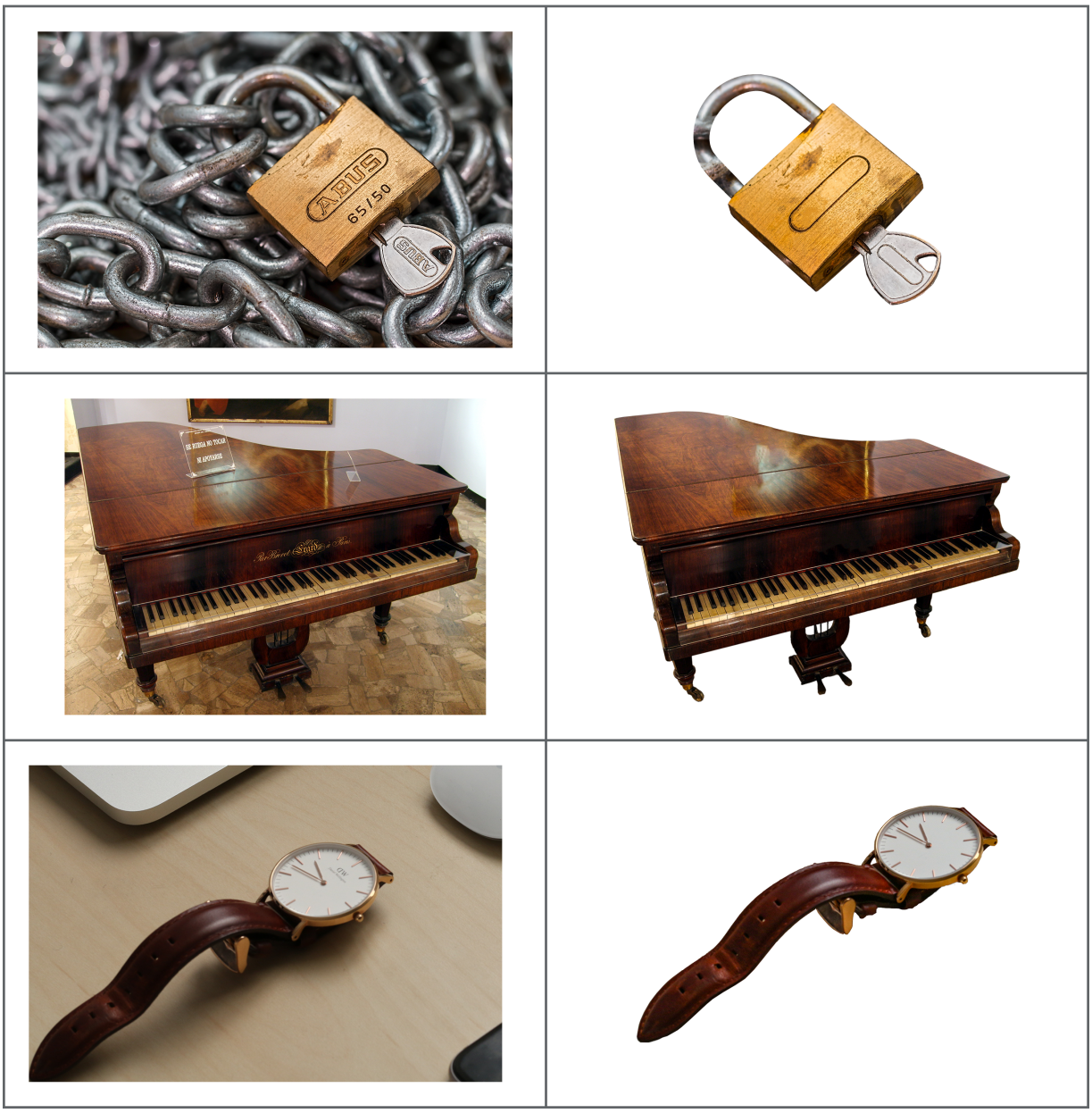

Figure 8: Examples of text removal in photograph items.

Design

This was a descriptive study; a mix of qualitative and quantitative data were gathered in the absence of hypothesis testing. Across three blocks, all participants provided five types of response toward photograph 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 ordinal scale. Within par-

ticipants, 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) 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

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

[6]https://pavlovia.org/

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.

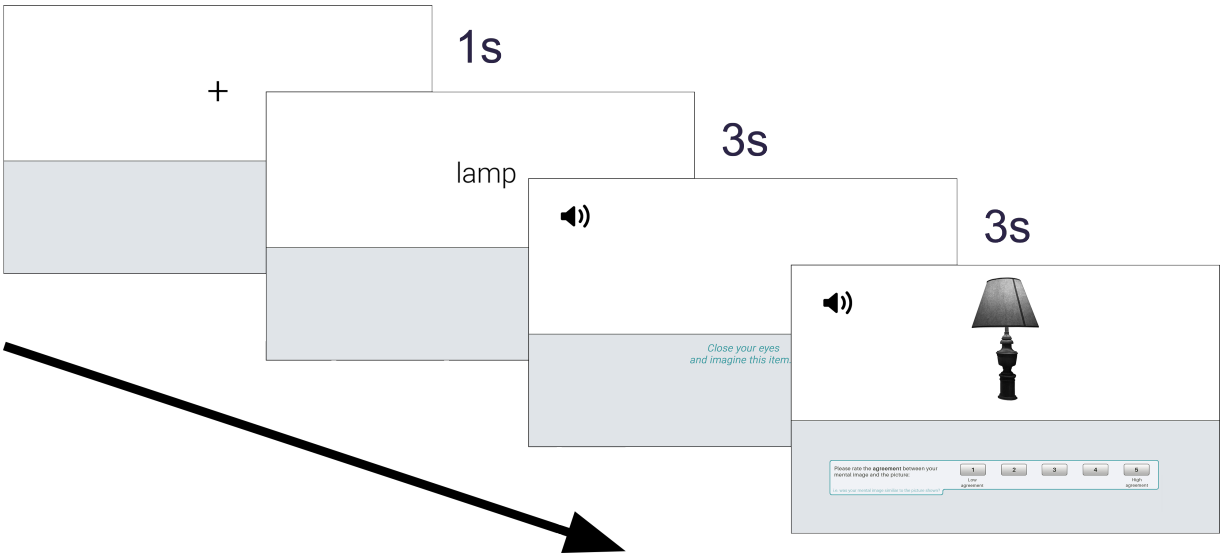

Figure 9: Data collection procedure for Mental Imagery Agreement responses.

Data processing and analysis

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 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 in Appendix C.

A number of variables were calculated prior to analysis. The output variables for the naming responses included the most frequent name, percentage agreement (proportion of subjects reporting this most frequent name), and the statistic *H*. Like percentage agreement, the *H* statistic (ref) also reflects the naming agreement between participants, however, it also takes into account the number of unique names provided for any given item. A *H* value of 0 indicates perfect naming agreement (all subjects responded alike), whilst a *H* value of 1 shows that two unique names were given, but with identical proportions (i.e. 10 subjects responded with Name A, and 10 subjects responded with Name B). As the *H* value increases,

Mean reaction times (RTs) and standard deviations (SDs).

Mean ratings were calculated for Familiarity, Visual Complexity, Colour Diagnosticity, and Mental imagery agreement.

Results

Selection of final items

For each item represented in the photographs, one variation (of a possible three) was selected for inclusion in a final list of stimuli that would be taken forward into subsequent recognition experiments. The selection process was conducted on the basis of naming data only. If an item was found to primarily convey a different concept than intended during the naming task, then it could not be sufficiently compared to it's line-drawn and written-word counterpart during recognition studies. Naming data from all participants was collated, resulting in a minimum of 20 naming responses for each of the 816 photographs (408 colour items / 408 greyscale items). The proportion of 'correct' responses (i.e. names that were congruent with the intended label) and the proportion of 'don't know' responses were calculated for each item. Photographs were subjected to a number of criteria to determine whether they should be taken any further. First, items were excluded if they received a high proportion of "don't know" responses (20%) - all of the photographs depicted common, everyday objects, and so if a number of subjects were unable to name the item, that particular photograph was considered to be a poor representation of the item. Similarly, items were excluded if they were incorrectly named by the majority of subjects (i.e. if the proportion of correct responses equalled .50 or lower), since it was essential for the photograph items to depict the same concepts as those found in the line drawings and word stimuli. Finally, items with particularly poor naming agreement were also excluded (i.e. 20% or fewer subjects named the object similarly). A total of 54 photographs matched at least one of these criteria. Regardless of whether flagged items were grey or colour, both items had to be removed since it was necessary to have otherwise identical grey and colour versions in our final stimuli list. Thus, a total of 64 items (32 grey / 32 colour) were excluded at this stage.

Next, the proportion of correct responses were compared between grey and colour photographs in order to identify items showing the lowest difference. In order to manipulate colour in later recognition experiments, it was important to select items where naming was congruent across colour/grey items; in other words, it would be difficult to attribute particular recognition response patterns to the addition of colour (if a difference were found) when the grey version could not be identified (or encoded) similarly. Variations exhibiting the least difference between colour and grey items (for the proportion of correct responses) were taken forward, while the rest were excluded. In a number of instances, multiple variations for the same object had the same 'difference' score. For example, all three variations of the item "balloon" exhibited perfect naming agreement, irrespective of whether they were presented in colour or grey (and thus "balloon1", "balloon2", and "balloon3" had a difference score of 0). For items where more than 1 variation remained, manual rankings were obtained from two of the researchers to determine which variation best depicted the intended concept. For each item, the researchers independently studied the remaining variations and provided a rank of which they thought was best (1) to worst (2 or 3, depending on the number of variations that remained). The ratings from both researchers were collated; items where there was agreement as to which variation best depicted the intended concept were selected for inclusion in the final stimuli list. For all the items where there was disagreement between the researchers rankings, one of the variations was simply selected at random.

Colour vs. grey

Mean values for

t-tests

mean scores of Familiarity (

)

To compare responses across stimuli formats, separate one-way ANOVAs were conducted on the following variables:

(Naming) H (Naming) RT

(Familiarity) Mean (Familiarity) RT

(Visual Complexity) Mean (Visual Complexity) RT

(Colour Diagnosticity) Mean (Colour Diagnosticity) RT

(Mental Imagery Agreement) Mean (Mental Imagery Agreement) RT

Naming

Experiment 3

Method

Participants

A total of 158 subjects completed the online experiment (see Table 4 for a breakdown of the gender and age of the sample).

To meet our YA requirements, all participants were required to be between 18-59 years of age (actual range: 18-58). As our experiment involved English word stimuli, we also asked subjects whether English was their first language; the vast majority (95.57%) reported that English was indeed their first language.

The current sample was comprised of participants sourced from voluntary participation websites such as Prolific Academic[7] (72.78%), where payment at the rate of £5/hr was given, and via the in-school research participation system[8] (15.19%), where they received course participation credits. A small number of participants were also recruited from Psychological Research on the Net[9] (12.03%).

Table 4: Gender and age (SD) of the current sample.

Gender	N	Age	
Female	*96*	29.53000	*(10.18)*
Male	*58*	31.36000	*(11.19)*
Questioning	*1*	21.00000	*(-)*
Unspecified	*3*	50.33333	*(4.93)*
Total	***158***	**30.54000**	***(10.84)***

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

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

[9] https://psych.hanover.edu/research/exponnet.html

Results

Overall hits, false alarms (FAs), and recognition

Separate 3 (stimuli format: words, drawings, photographs) x 2 (response-option condition: RFG-judgments, RFBG-judgments) mixed ANOVAs were conducted on the mean proportion of hits and false alarms (FAs; see Table 5).

Table 5: Mean proportion of hits and FAs by stimuli format and response-option condition.

	Hits	FAs
Stimuli format		
Words	0.55	0.21
Drawings	0.76	0.09
Photographs	0.86	0.05
Response option		
RFG	0.78	0.13
RFBG	0.74	0.11

Proportion of total hits For the proportion of hits, there was a significant main effect of stimuli format [$F(1.75, 273.58) = 229.89$, *MSE* $= 0.02$, $p < .001$]. The interaction effect was not significant [$F(1.75, 273.58) = 0.74$, *MSE* $= 0.02$, $p = .461$]. Post-hoc comparisons for the main effect of stimuli format showed that photographs ($M = 0.86$) produced a significantly higher proportion of hits than both words ($M = 0.55$) [$t(312) = -20.96$, $p < .001$] and drawings ($M = 0.76$) [$t(312) = -6.55$, $p < .001$]. Drawings ($M = 0.76$) also produced a significantly higher proportion of hits compared to words ($M = 0.55$) [$t(312) = -14.41$, $p < .001$].

Proportion of total FAs For the proportion of FAs, there was a significant main effect of stimuli format [$F(1.46, 227.29) = 106.64$, *MSE* $= 0.01$, $p < .001$]. The interaction effect was not significant [$F(1.46, 227.29) = 1.22$, *MSE* $= 0.01$, $p = .287$]. Post-hoc comparisons for the main effect of stimuli format showed that photographs ($M = 0.05$) produced a significantly lower proportion of FAs than both words ($M = 0.21$) [$t(312) = 13.98$, $p < .001$] and drawings ($M = 0.09$) [$t(312) = 3.34$, $p = .003$]. Drawings ($M = 0.09$) also produced a significantly lower proportion of FAs compared to words ($M = 0.21$) [$t(312) = 10.65$, $p < .001$].

Overall performance accuracy For overall performance accuracy, there was a significant main effect of stimuli format [$F(1.93, 300.97) = 586.13$, *MSE* $= 0.02$, $p < .001$]. The interaction effect was not significant [$F(1.93, 300.97) = 2.02$, *MSE* $= 0.02$, $p = .136$]. Post-hoc

comparisons for the main effect of stimuli format showed that photographs ($M = 0.81$) produced significantly better performance accuracy than both words ($M = 0.34$) [$t(312.00) = -33.25$, $p < .001$] and drawings ($M = 0.67$) [$t(312) = -9.57$, $p < .001$]. Drawings ($M = 0.67$) also produced significantly better performance accuracy compared to words ($M = 0.34$) [$t(312) = -23.69$, $p < .001$].

Discrimination (d') and response bias (c)

To assess the roles of discrimination and response bias, separate 3 (stimuli format: words, drawings, photographs) x 2 (response-option condition: RFG-judgments, RFBG-judgments) mixed ANOVAs were conducted on d' (d-prime; measure of sensitivity) and c-scores (decision criterion; see Table 6).

Table 6: Mean d' and c scores by stimuli-format and response-option condition.

	d'	c
Stimuli format		
Words	1.06	0.39
Drawings	2.18	0.32
Photographs	2.78	0.22
Response option		
RFG	0.10	0.01
RFBG	0.10	0.02

d' (discrimination) For d' scores, there was a significant interaction between stimuli format and response-option [$F(2.00, 311.73) = 3.60$, *MSE* $= 0.26$, $p = .029$] (see Figure 1).

Photographs ($M = 2.86$) facilitated better discrimination between hits / FAs than both words ($M = 1.13$) [$t(312.00) = -21.66$, $p < .001$] and drawings ($M = 2.13$) [$t(312) = -9.13$, $p < .001$] in the RFG group. Drawings ($M = 2.13$) also showed significantly higher d' scores compared to words ($M = 1.13$) [$t(312) = -12.53$, $p < .001$]. In the RFBG group, the same pattern was evident; photographs ($M = 2.69$) facilitated better discrimination than both words ($M = 0.98$) [$t(312) = -20.79$, $p < .001$] and drawings ($M = 2.24$) [$t(312) = -5.53$, $p < .001$] Again, drawings ($M = 2.24$) also showed significantly higher d' scores than words ($M = 0.98$) [$t(319.09) = -10.22$, $p < .001$].

Comparisons of stimuli format across the response-option groups showed that d' scores for photographs did not significantly differ between the RFG ($M = 2.86$) and RFBG ($M = 2.69$) conditions [$t(319.09) = 1.43$, $p = .709$], nor for drawings (RFG: $M = 2.13$, RFBG: $M = 2.24$, [$t(319.09) = -0.96$, $p = .932$], nor for words (RFG: $M = 1.13$, RFBG: $M = 0.98$, [$t(319.09) = 1.39$, $p = .736$]).

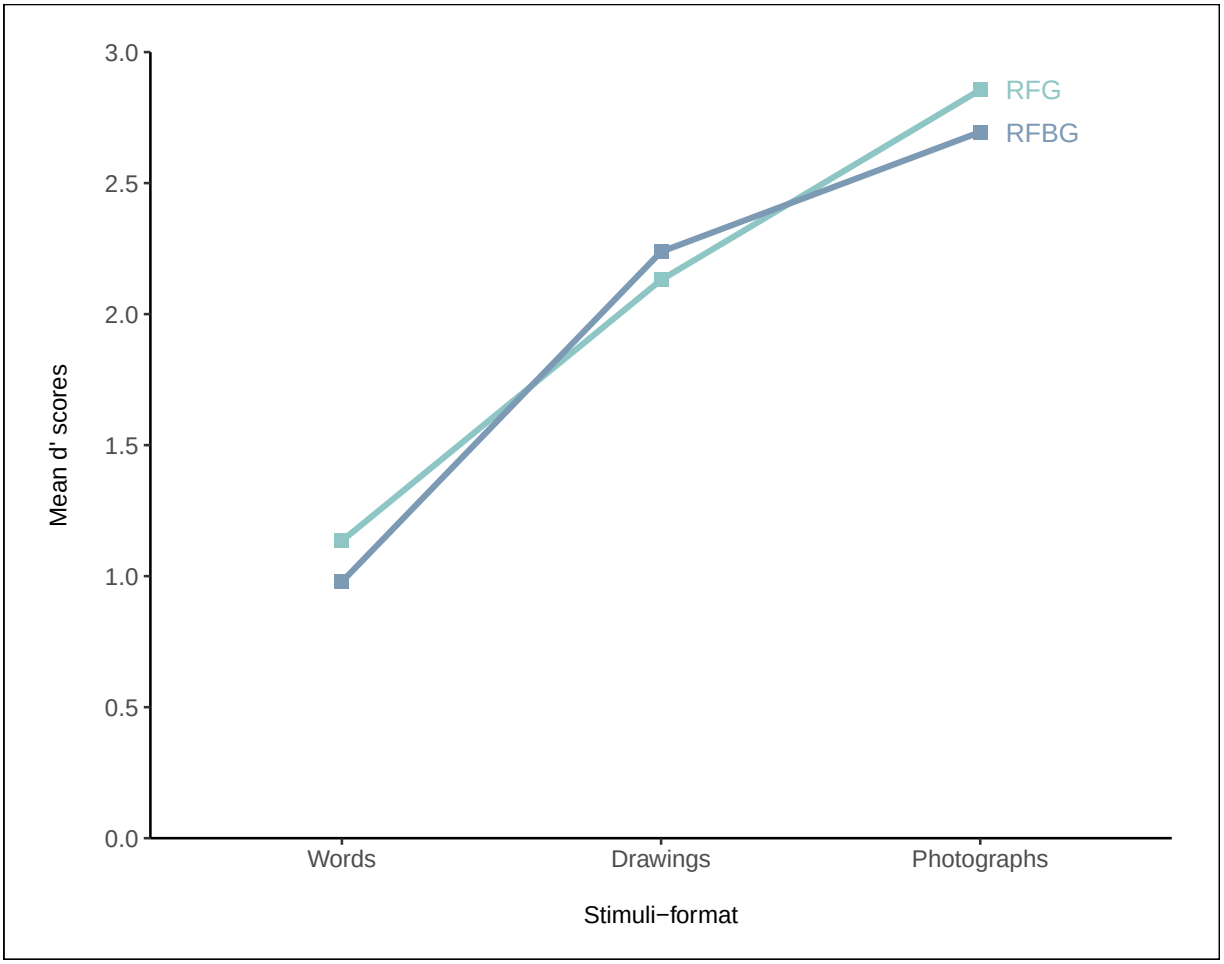

Figure 1: Interaction plot between stimuli format and response-option for d' scores.

c (response bias) For c-scores, there was a significant main effect of stimuli format [$F(1.74, 272.11) = 10.25$, *MSE* $= 0.13$, $p < .001$]. The interaction effect was not significant [$F(1.74, 272.11) = 0.62$, *MSE* $= 0.13$, $p = .518$]. Post-hoc comparisons for the main effect of stimuli format showed that photographs ($M = 0.22$) produced significantly lower c-scores (and thus a less conservative response bias) than both words ($M = 0.39$) [$t(312) = 4.52$, $p < .001$] and drawings ($M = 0.32$) [$t(312) = 2.53$, $p = .032$]. There was no difference in c-scores between drawings ($M = 0.32$) and words ($M = 0.39$) [$t(312) = 1.99$, $p = .116$].

Hits assigned Recollection, Familiarity, and Guessing

To determine the effects of stimuli format and response-option on accurate recognition memory judgments, separate 3 (stimuli format: words, drawings, photographs) x 2 (response-option condition: RFG-judgments, RFBG-judgments) mixed ANOVAs were conducted on the mean proportion of hits assigned Recollection, Familiarity, and Guessing (see Figure 2).

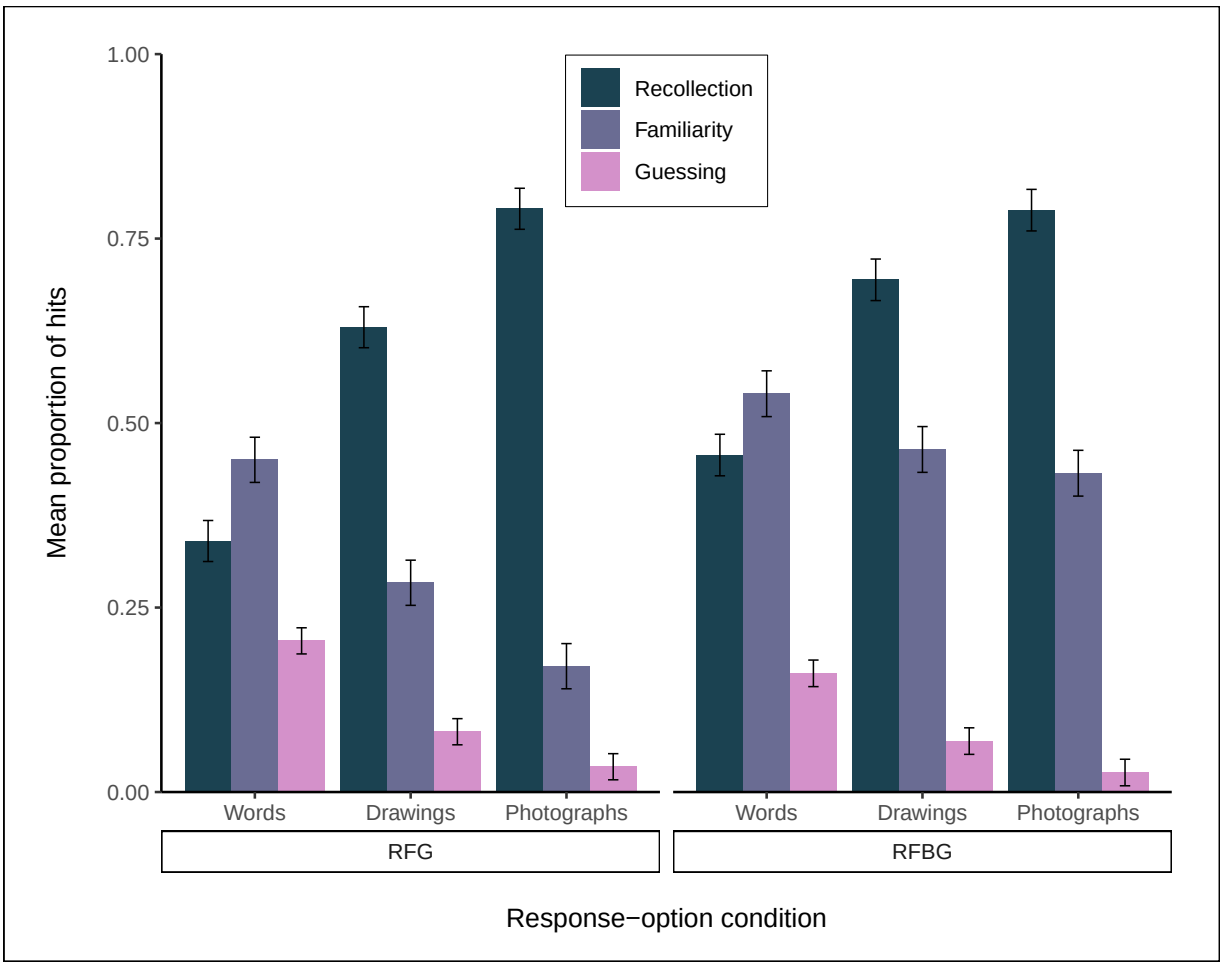

Figure 2: Proportion of hits assigned Recollection, Familiarity, and Guessing, by stimuli format and response-option condition.

Recollection (hits) For hits assigned Recollection, there was a significant interaction effect [$F(1.77, 273.98) = 5.32$, *MSE* $= 0.03$, $p = .007$] (see Figure 4). Photographs ($M = 0.79$) resulted in more Recollection hits than both words ($M = 0.34$) [$t(310) = -17.90$, $p < .001$] and drawings ($M = 0.63$) [$t(310) = -6.38$, $p < .001$] in the RFG group. Drawings ($M = 0.63$) also resulted in more Recollection hits than words ($M = 0.34$) [$t(310) = -11.52$, $p < .001$] in the RFG group. In the RFBG group, there was an identical pattern; photographs ($M = 0.79$) resulted in more Recollection hits than both words ($M = 0.46$) [$t(310) = -12.62$, $p < .001$] and drawings ($M = 0.69$) [$t(310) = -3.59$, $p = .005$]. Drawings ($M = 0.69$) also resulted in more Recollection hits than words ($M = 0.46$) [$t(310) = -9.03$, $p < .001$] in the RFBG group. Comparisons of stimuli format across the response-option groups showed no difference in the number of Recollection hits for photograph stimuli between the RFG ($M = 0.79$) and RFBG ($M = 0.79$) conditions [$t(278.97) = 0.05$, $p > .999$]. The same pattern was evident for drawings (RFG: $M = 0.63$, RFBG: $M = 0.69$ [$t(278.97) = -1.62$, $p = .584$]). Word stimuli, however, produced significantly more Recollection hits in the RFBG group ($M = 0.46$) compared to the RFG ($M = 0.34$) group

[$t(278.97) = -2.94, p = .041$].

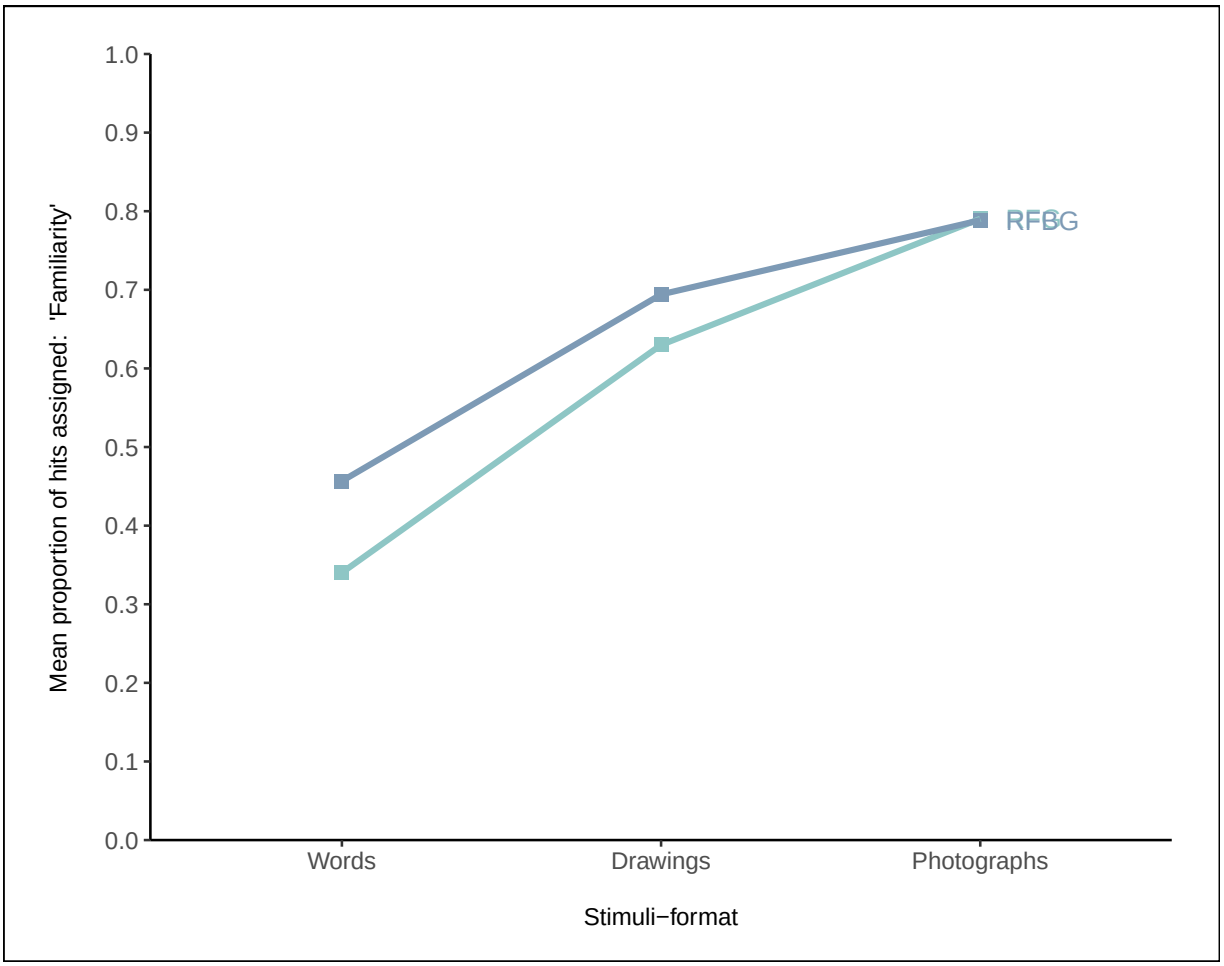

Figure 4: Interaction plot between stimuli format and response-option for the mean proportion of hits assigned 'Familiarity'.

Familiarity (hits) For hits assigned Familiarity, there was a significant interaction between stimuli format and response-option [$F(1.52, 236.21) = 8.68$, *MSE* $= 0.04$, $p = .001$] (see Figure 4). Within the RFG condition, words ($M = 0.45$) resulted in more Familiarity hits than both drawings ($M = 0.28$) [$t(310) = 5.84$, $p < .001$] and photographs ($M = 0.17$) [$t(310) = 9.80$, $p < .001$]. Drawings ($M = 0.28$) also produced more Familiarity hits compared to photographs ($M = 0.17$) [$t(310) = 3.96, p = .001$].

Within the RFBG condition, words ($M = 0.54$) still produced more Familiarity hits than photographs ($M = 0.43$) [$t(310) = 3.61$, $p = .005$]. However, there was no difference in the number of Familiarity hits when comparing words ($M = 0.54$) to drawings ($M = 0.46$) [$t(310) = 2.53, p = .118$]. Another difference from the within-RFG findings is the number of Familiarity hits for drawings ($M = 0.46$) did not differ from photographs ($M = 0.43$) in the RFBG condition [$t(310) = 1.08, p = .890$].

Comparisons across response-option conditions showed that drawings produced significantly more Familiarity hits in the RFBG ($M = 0.46$) condition compared to RFG ($M = 0.28$) [$t(289.15) = -4.14$, $p = .001$]. A similar pattern was also evident for photographs (RFG: $M = 0.17$, RFBG: $M = 0.43$ [$t(289.15) = -6.00$, $p < .001$]). Words, however, showed no difference in the number of Familiarity hits between the RFG ($M = 0.45$) and RFBG ($M = 0.54$) conditions [$t(289.15) = -2.06$, $p = .314$].

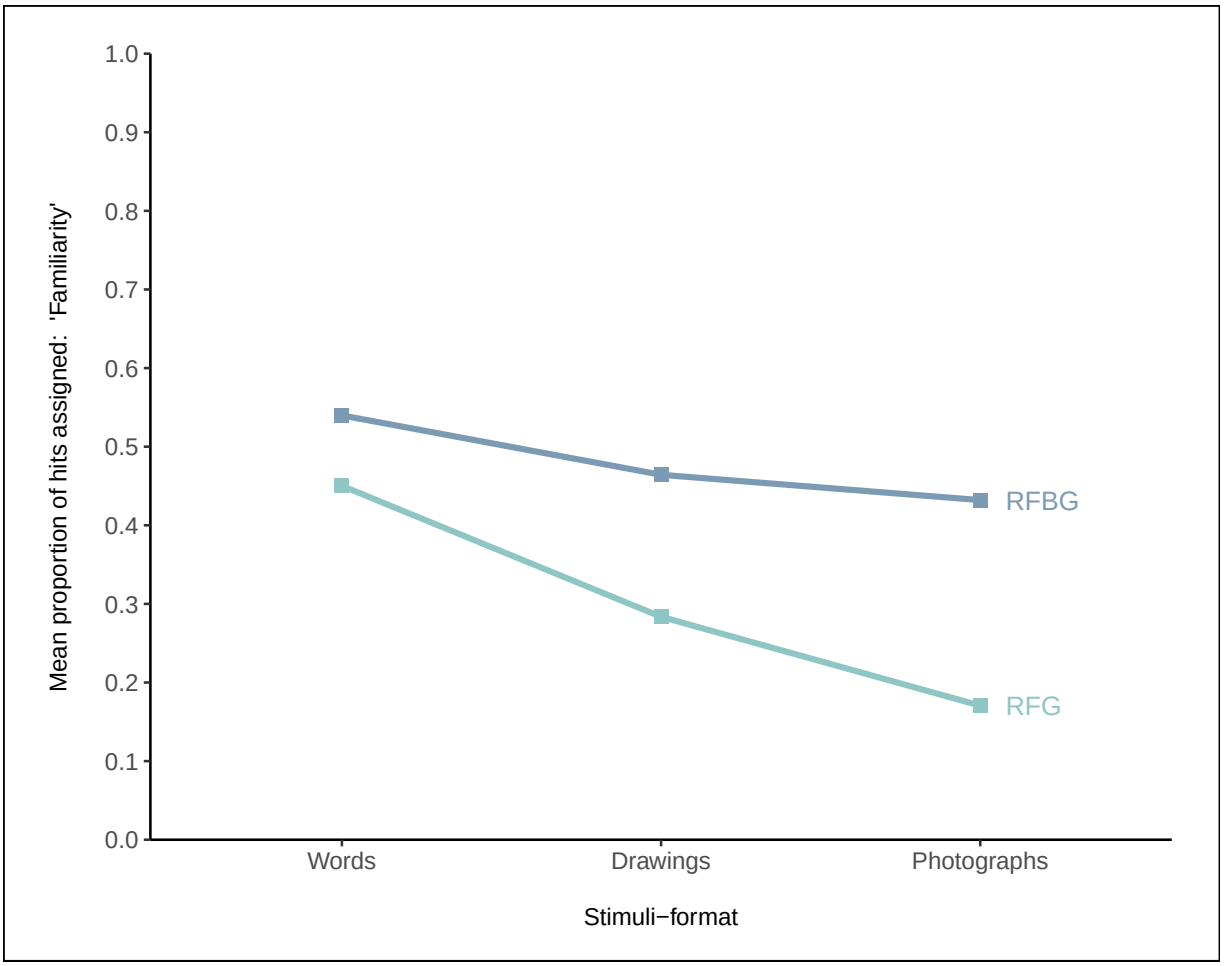

Figure 4: Interaction plot between stimuli format and response-option for the mean proportion of hits assigned 'Familiarity'.

Guessing (hits) For hits assigned Guessing, there was a significant main effect of stimuli format [$F(1.32, 204.20) = 71.22$, *MSE* $= 0.02$, $p < .001$]. The interaction effect was not significant [$F(1.32, 204.20) = 1.12$, *MSE* $= 0.02$, $p = .308$]. Post-hoc comparisons for the main effect of stimuli format showed that words ($M = 0.18$) produced significantly more Guessing hits than both drawings ($M = 0.08$) [$t(310) = 8.19$, $p < .001$] and photographs ($M = 0.03$) [$t(310) = 11.61$, $p < .001$]. Drawings ($M = 0.08$) also produced significantly more Guessing hits compared to photographs ($M = 0.03$) [$t(310) = 3.43$, $p = .002$].

FAs assigned Recollection, Familiarity, and Guessing

To determine the effects of stimuli format and response-option on false alarms, separate 3 (stimuli format: words, drawings, photographs) x 2 (response-option condition: RFG-judgments, RFBG-judgments) mixed ANOVAs were conducted on the mean proportion of FAs assigned Recollection, Familiarity, and Guessing (see Figure 5).

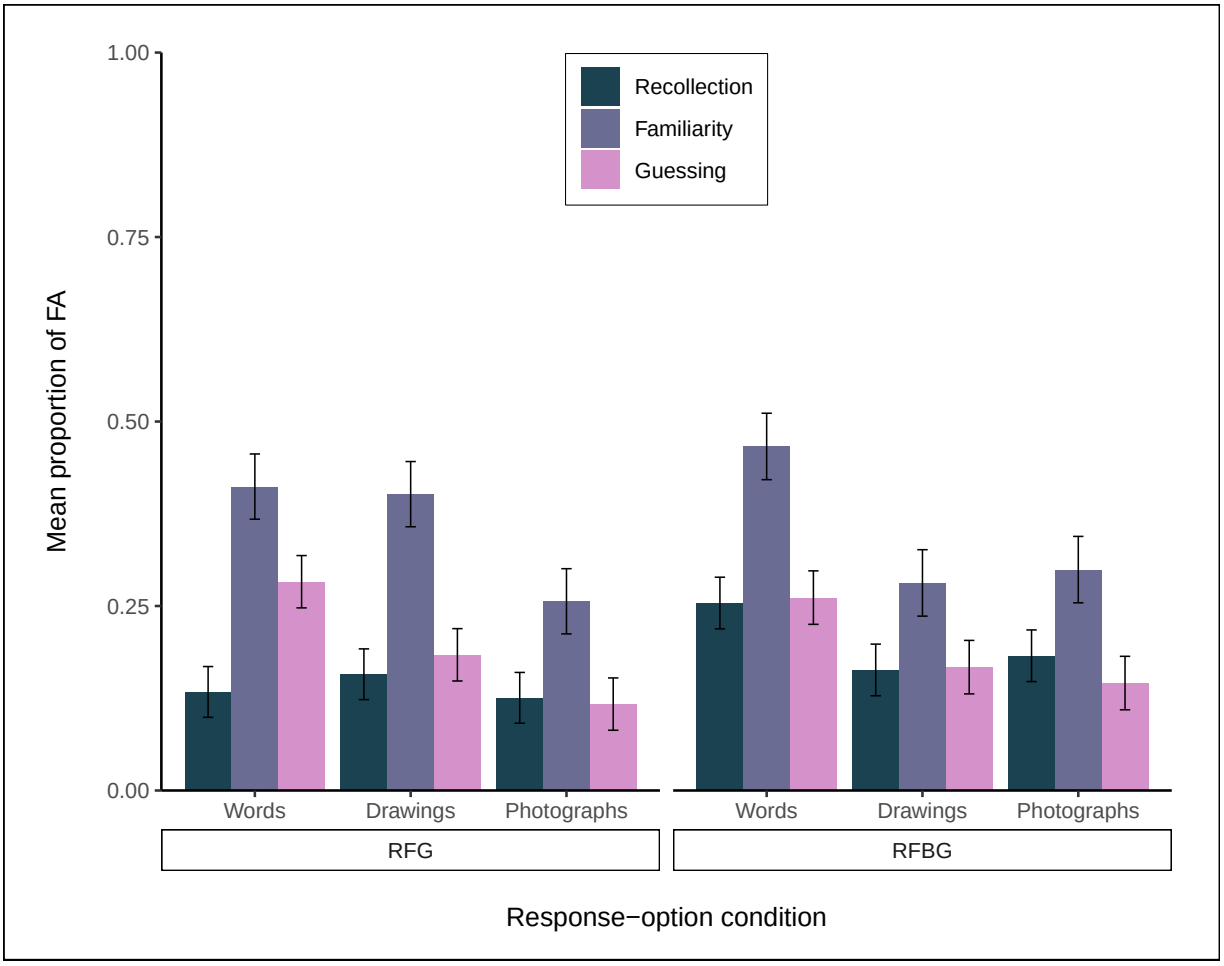

Figure 5: Proportion of FAs assigned Recollection, Familiarity, and Guessing, by stimuli format and response-option condition.

Recollection (FAs) For FAs assigned Recollection, there was no significant main effect of stimuli format [$F(1.94, 301.96) = 1.11$, *MSE* $= 0.07$, $p = .328$] or interaction [$F(1.94, 301.96) = 2.02$, *MSE* $= 0.07$, $p = .136$].

Familiarity (FAs) For FAs assigned Familiarity, there was a significant interaction between stimuli format and response-option [$F(1.98, 309.33) = 3.33$, *MSE* $= 0.11$, $p = .038$] (see Figure 6). Within the RFG condition, words ($M = 0.41$) resulted in more Familiarity FAs than photographs ($M = 0.26$) [$t(312) = 2.96$, $p = .039$], but not drawings ($M = 0.40$)

[$t(312) = 0.20$, $p > .999$]. The number of Familiarity FAs did not differ between drawings ($M = 0.40$) and photographs ($M = 0.26$) [$t(312) = 2.76$, $p = .066$] in the RFG condition.

Within the RFBG condition, words ($M = 0.47$) again produced more Familiarity FAs than photographs ($M = 0.30$) [$t(312) = 3.06$, $p = .029$]. However, words ($M = 0.47$) also produced more Familiarity FAs than drawings($M = 0.28$) [$t(312) = 3.39$, $p = .010$]. As before, the number of Familiarity FAs did not differ between drawings ($M = 0.28$) and photographs ($M = 0.30$) in the RFBG condition [$t(312) = -0.33$, $p = .999$].

Comparisons across response-option conditions showed no differences in the number of Familiarity FAs, for any stimuli format: words (RFG: $M = 0.41$, RFBG: $M = 0.47$ [$t(404.98) = -0.86$, $p = .955$]); drawings (RFG: $M = 0.40$, RFBG: $M = 0.28$ [$t(404.98) = 1.91$, $p = .400$]; photographs (RFG: $M = 0.26$, RFBG: $M = 0.30$ [$t(404.98) = -0.68$, $p = .984$]).

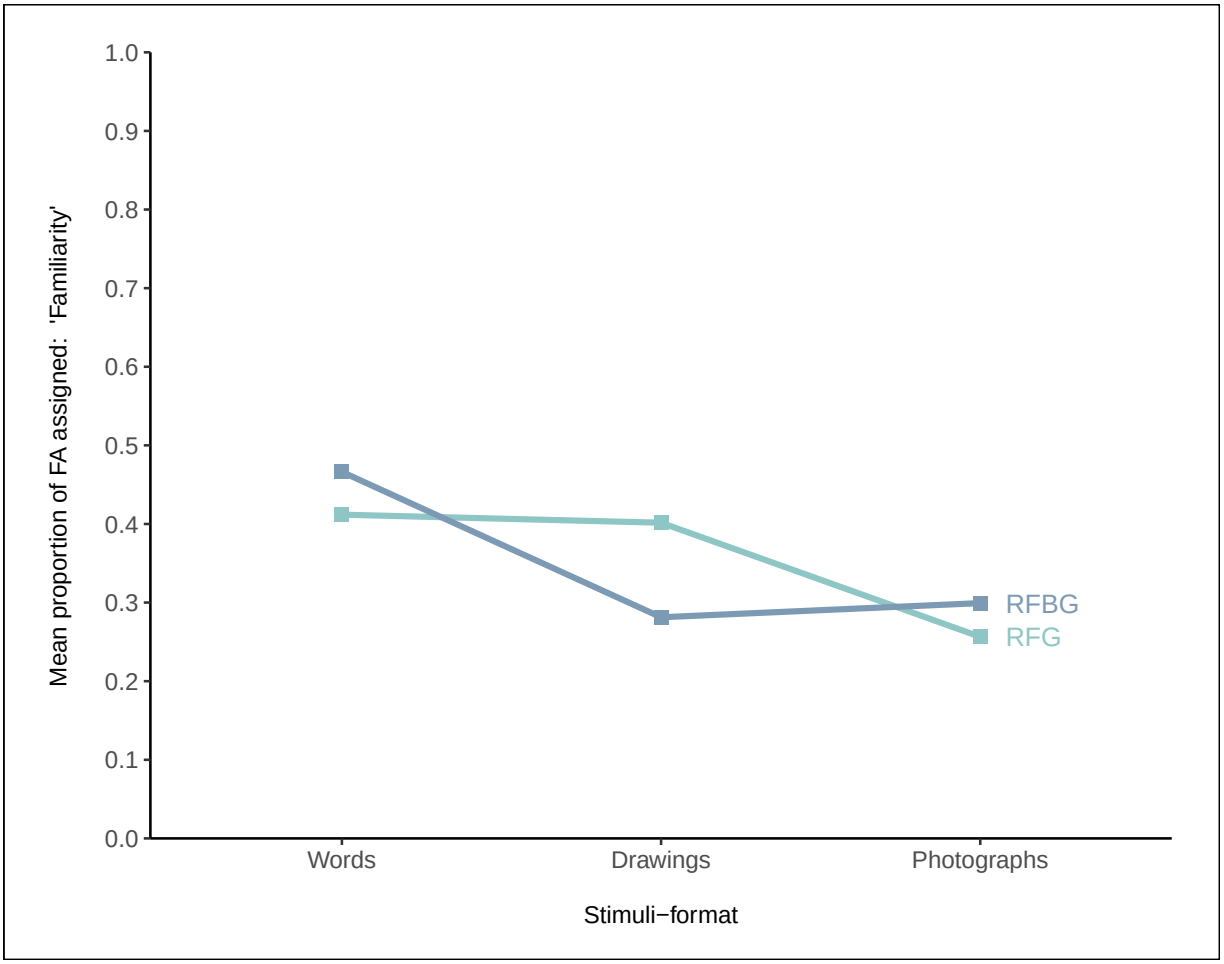

Figure 6: Interaction plot between stimuli format and response-option for the mean proportion of FAs assigned 'Familiarity'.

Guessing (FAs) For FAs assigned Guessing, there was a significant main effect of stimuli format [$F(1.93, 300.68) = 9.44$, *MSE* $= 0.09$, $p < .001$]. The interaction effect was not significant [$F(1.93, 300.68) = 0.35$, *MSE* $= 0.09$, $p = .699$]. Post-hoc comparisons for the main effect of stimuli format showed that words ($M = 0.27$) produced significantly more Guessing FAs than both drawings ($M = 0.18$) [$t(312) = 2.91$, $p = .011$] and photographs ($M = 0.13$) [$t(312) = 4.25$, $p < .001$]. There was no difference in the proportion of FAs assigned Guessing between drawings ($M = 0.18$) and photographs ($M = 0.13$) [$t(312.00) = 1.33$, $p = .378$].

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Appendices

Appendix A

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
anchor1-photo-colour	3.55	2.95	2.81	4.05
anchor1-photo-grey	2.97	2.81	NaN	3.95
anchor2-photo-colour	3.30	3.45	3.50	3.75
anchor2-photo-grey	2.81	3.00	NaN	3.52
anchor3-photo-colour	3.52	2.40	2.70	3.80
anchor3-photo-grey	3.10	2.35	NaN	4.25
apple1-photo-colour	4.79	3.10	3.43	4.15
apple1-photo-grey	4.85	2.19	NaN	3.05
apple2-photo-colour	4.95	3.00	3.50	3.76
apple2-photo-grey	4.40	2.40	NaN	2.75
apple3-photo-colour	4.75	3.05	3.75	4.25
apple3-photo-grey	4.71	2.25	NaN	3.35
ashtray1-photo-colour	3.62	3.05	2.71	3.90
ashtray1-photo-grey	4.15	2.90	NaN	3.50
ashtray2-photo-colour	3.90	3.00	2.25	4.10
ashtray2-photo-grey	3.50	3.00	NaN	3.50
ashtray3-photo-colour	3.55	3.55	3.10	3.40
ashtray3-photo-grey	4.10	3.15	NaN	3.80
balloon1-photo-colour	4.40	1.66	2.25	4.62
balloon1-photo-grey	4.15	1.80	NaN	3.48
balloon2-photo-colour	4.45	2.14	1.81	4.50
balloon2-photo-grey	4.35	1.85	NaN	4.05
balloon3-photo-colour	4.05	1.90	1.95	4.35
balloon3-photo-grey	4.20	1.67	NaN	3.55
banana1-photo-colour	4.65	2.55	4.55	4.48
banana1-photo-grey	4.80	2.10	2.36	3.76
banana2-photo-colour	4.80	2.10	3.95	4.85
banana2-photo-grey	4.90	2.24	NaN	3.30
banana3-photo-colour	4.30	2.00	4.67	4.65
banana3-photo-grey	4.85	2.00	NaN	3.35
barrel1-photo-colour	3.45	3.57	3.95	4.90
barrel1-photo-grey	3.90	2.95	NaN	4.05
barrel2-photo-colour	4.05	3.00	3.50	4.43
barrel2-photo-grey	3.90	2.95	NaN	4.15
barrel3-photo-colour	3.55	3.15	2.85	4.20
barrel3-photo-grey	3.57	2.85	NaN	3.95

(continued)

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
basket1-photo-colour	4.17	3.86	3.62	4.30
basket1-photo-grey	4.50	3.38	NaN	3.85
basket2-photo-colour	4.14	3.05	2.80	3.95
basket2-photo-grey	4.45	2.90	NaN	3.55
basket3-photo-colour	4.25	3.70	3.45	3.75
basket3-photo-grey	4.52	3.05	NaN	3.95
bear1-photo-colour	3.48	3.90	3.90	4.15
bear1-photo-grey	3.90	3.50	NaN	3.97
bear2-photo-colour	3.85	3.25	4.30	4.25
bear2-photo-grey	3.25	3.25	NaN	4.24
bear3-photo-colour	3.95	3.75	3.70	4.10
bear3-photo-grey	3.65	3.05	NaN	3.95
beetle1-photo-colour	3.10	4.07	3.25	2.95
beetle1-photo-grey	3.10	3.10	NaN	2.86
beetle2-photo-colour	3.20	3.81	3.05	2.95
beetle2-photo-grey	3.00	3.00	NaN	2.70
beetle3-photo-colour	2.65	3.40	3.00	2.95
beetle3-photo-grey	2.90	3.19	NaN	3.30
bell1-photo-colour	4.00	2.31	3.75	4.00
bell1-photo-grey	3.80	2.45	NaN	3.62
bell2-photo-colour	3.90	3.29	3.43	3.95
bell2-photo-grey	3.50	2.20	NaN	3.30
bell3-photo-colour	3.40	3.20	3.00	3.25
bell3-photo-grey	3.55	2.90	NaN	3.05
belt1-photo-colour	4.80	2.95	2.76	3.95
belt1-photo-grey	4.76	3.05	NaN	4.00
belt2-photo-colour	4.80	3.00	2.85	4.05
belt2-photo-grey	4.76	2.40	NaN	4.48
belt3-photo-colour	5.00	2.30	2.95	4.25
belt3-photo-grey	4.50	2.20	NaN	3.95
bicycle1-photo-colour	4.30	3.55	2.45	3.05
bicycle1-photo-grey	4.50	3.69	1.73	3.33
bicycle2-photo-colour	4.65	3.00	1.55	4.05
bicycle2-photo-grey	4.76	3.38	NaN	3.65
bicycle3-photo-colour	3.80	3.29	1.86	3.35
bicycle3-photo-grey	4.05	3.55	NaN	3.00
book1-photo-colour	4.85	3.15	2.40	3.67
book1-photo-grey	4.90	2.59	1.45	3.62
book2-photo-colour	4.75	3.20	1.55	3.65
book2-photo-grey	4.75	2.86	NaN	3.20
book3-photo-colour	4.30	3.00	2.19	3.05
book3-photo-grey	4.05	2.45	NaN	2.70

(continued)

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
boot1-photo-colour	4.15	2.95	2.50	3.33
boot1-photo-grey	4.70	2.79	2.82	2.76
boot2-photo-colour	4.60	2.95	2.05	4.25
boot2-photo-grey	4.70	3.48	NaN	3.75
boot3-photo-colour	4.25	2.86	2.33	4.05
boot3-photo-grey	4.45	2.90	NaN	3.70
bottle1-photo-colour	4.72	3.33	3.14	3.70
bottle1-photo-grey	4.85	2.33	NaN	3.15
bottle2-photo-colour	4.81	2.25	2.25	2.81
bottle2-photo-grey	4.65	1.85	NaN	3.20
bottle3-photo-colour	4.50	1.85	2.00	2.40
bottle3-photo-grey	4.67	1.40	NaN	3.30
bowl1-photo-colour	4.81	2.25	1.65	3.70
bowl1-photo-grey	4.81	2.00	NaN	3.10
bowl2-photo-colour	4.80	2.50	1.90	3.40
bowl2-photo-grey	4.75	1.90	NaN	4.10
bowl3-photo-colour	4.60	2.05	1.75	3.24
bowl3-photo-grey	4.55	1.80	NaN	3.15
bread1-photo-colour	4.95	3.45	3.85	3.80
bread1-photo-grey	4.52	2.80	NaN	3.10
bread2-photo-colour	5.00	3.20	3.75	3.85
bread2-photo-grey	4.90	2.35	NaN	3.29
bread3-photo-colour	4.80	3.45	3.25	3.48
bread3-photo-grey	4.70	2.75	NaN	3.10
broom1-photo-colour	4.14	2.30	2.55	3.35
broom1-photo-grey	4.29	2.55	NaN	3.34
broom2-photo-colour	4.20	2.85	3.30	3.20
broom2-photo-grey	4.05	2.10	NaN	3.33
broom3-photo-colour	4.00	2.35	2.65	3.86
broom3-photo-grey	4.10	2.40	NaN	3.30
brush1-photo-colour	4.33	3.00	2.15	2.21
brush1-photo-grey	4.52	2.80	NaN	2.85
brush2-photo-colour	4.10	3.50	3.65	2.24
brush2-photo-grey	4.00	3.20	NaN	2.15
brush3-photo-colour	4.25	3.05	2.95	2.50
brush3-photo-grey	4.05	3.10	NaN	2.43
button1-photo-colour	4.45	2.76	1.95	3.05
button1-photo-grey	4.69	2.33	NaN	4.05
button2-photo-colour	4.85	1.55	1.45	4.45
button2-photo-grey	4.90	1.50	NaN	4.24
button3-photo-colour	4.76	2.20	1.80	3.65
button3-photo-grey	4.60	2.00	NaN	3.45

(continued)

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
cake1-photo-colour	4.62	3.35	2.50	3.31
cake1-photo-grey	4.71	3.90	NaN	3.35
cake2-photo-colour	4.50	4.40	2.60	3.81
cake2-photo-grey	4.70	4.00	NaN	2.55
cake3-photo-colour	4.80	3.65	3.00	3.15
cake3-photo-grey	4.30	2.85	NaN	2.43
camel1-photo-colour	3.40	3.60	3.75	4.29
camel1-photo-grey	3.65	3.83	2.36	3.95
camel2-photo-colour	3.90	3.60	3.90	3.85
camel2-photo-grey	3.30	3.81	NaN	3.35
camel3-photo-colour	3.20	3.43	4.38	4.25
camel3-photo-grey	2.95	3.15	NaN	3.75
candle1-photo-colour	4.60	2.24	2.90	3.67
candle1-photo-grey	4.45	1.80	NaN	3.00
candle2-photo-colour	4.71	2.52	2.38	3.65
candle2-photo-grey	4.35	1.70	NaN	3.80
candle3-photo-colour	3.60	3.00	2.60	3.00
candle3-photo-grey	4.10	2.38	NaN	2.65
cannon1-photo-colour	3.20	3.43	3.43	3.70
cannon1-photo-grey	3.00	3.43	NaN	3.80
cannon2-photo-colour	3.85	3.30	3.75	3.95
cannon2-photo-grey	3.48	2.80	NaN	3.71
cannon3-photo-colour	3.43	3.50	2.95	3.05
cannon3-photo-grey	3.00	3.20	NaN	2.45
carrot1-photo-colour	4.90	3.00	4.15	4.25
carrot1-photo-grey	4.57	2.25	NaN	2.76
carrot2-photo-colour	4.90	3.10	4.60	4.25
carrot2-photo-grey	4.75	2.35	NaN	3.57
carrot3-photo-colour	4.70	3.55	4.20	3.95
carrot3-photo-grey	4.65	3.20	NaN	3.65
celery1-photo-colour	4.40	2.28	4.60	4.10
celery1-photo-grey	4.00	1.95	NaN	2.90
celery2-photo-colour	4.15	3.33	4.71	3.90
celery2-photo-grey	3.90	2.90	NaN	2.75
celery3-photo-colour	3.20	3.00	4.40	3.95
celery3-photo-grey	3.65	3.10	NaN	2.85
chain1-photo-colour	4.10	2.34	3.25	3.67
chain1-photo-grey	3.55	2.10	NaN	3.38
chain2-photo-colour	4.20	2.52	2.81	3.60
chain2-photo-grey	3.75	1.85	NaN	4.55
chain3-photo-colour	3.80	2.70	3.50	4.10
chain3-photo-grey	3.60	2.24	NaN	3.80

(continued)

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
chair1-photo-colour	4.76	3.15	2.90	3.45
chair1-photo-grey	4.71	3.10	NaN	3.40
chair2-photo-colour	4.60	3.10	3.00	3.71
chair2-photo-grey	4.95	2.70	NaN	3.45
chair3-photo-colour	5.00	2.15	3.05	4.35
chair3-photo-grey	4.80	2.50	NaN	3.48
cherry1-photo-colour	4.40	2.55	4.30	4.29
cherry1-photo-grey	4.20	2.14	1.73	3.48
cherry2-photo-colour	4.30	2.25	4.10	4.70
cherry2-photo-grey	4.45	2.38	NaN	3.25
cherry3-photo-colour	4.10	2.52	4.43	4.45
cherry3-photo-grey	3.95	2.20	NaN	3.55
chicken1-photo-colour	4.24	4.14	3.81	3.85
chicken1-photo-grey	4.25	3.52	NaN	2.90
chicken2-photo-colour	4.52	4.00	3.35	4.43
chicken2-photo-grey	4.40	3.40	NaN	3.70
chicken3-photo-colour	4.10	4.15	3.80	3.55
chicken3-photo-grey	4.05	3.50	NaN	3.25
chisel1-photo-colour	4.00	2.80	2.40	3.70
chisel1-photo-grey	3.86	2.45	NaN	3.34
chisel2-photo-colour	3.45	3.60	2.70	3.55
chisel2-photo-grey	2.60	2.50	NaN	3.86
chisel3-photo-colour	3.00	3.15	2.55	3.81
chisel3-photo-grey	2.35	2.40	NaN	3.80
clock1-photo-colour	5.00	3.24	2.86	3.55
clock1-photo-grey	4.90	3.24	NaN	4.20
clock2-photo-colour	4.80	3.15	3.20	2.90
clock2-photo-grey	4.81	2.60	NaN	2.90
clock3-photo-colour	4.86	3.25	2.35	3.25
clock3-photo-grey	4.40	3.35	NaN	2.50
cloud1-photo-colour	4.20	2.90	3.15	4.05
cloud1-photo-grey	4.75	2.69	3.64	4.00
cloud2-photo-colour	4.55	2.75	2.85	3.15
cloud2-photo-grey	4.20	2.29	NaN	2.55
cloud3-photo-colour	4.45	1.67	4.33	3.75
cloud3-photo-grey	4.05	2.10	NaN	3.55
comb1-photo-colour	4.57	2.45	2.25	3.45
comb1-photo-grey	4.67	2.05	NaN	3.72
comb2-photo-colour	4.50	2.85	1.80	3.95
comb2-photo-grey	4.60	1.85	NaN	3.95
comb3-photo-colour	4.60	2.30	1.70	3.86
comb3-photo-grey	4.60	2.00	NaN	4.25

(continued)

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
corn1-photo-colour	4.29	3.80	4.60	4.25
corn1-photo-grey	4.71	2.90	NaN	3.48
corn2-photo-colour	4.55	3.50	4.55	4.45
corn2-photo-grey	4.45	3.00	NaN	4.19
corn3-photo-colour	4.55	3.50	4.60	4.10
corn3-photo-grey	4.40	3.15	NaN	4.10
crown1-photo-colour	3.69	4.57	4.38	4.20
crown1-photo-grey	4.20	4.33	NaN	3.40
crown2-photo-colour	3.86	4.00	3.10	4.19
crown2-photo-grey	4.00	3.50	NaN	3.55
crown3-photo-colour	3.25	4.55	3.85	3.15
crown3-photo-grey	3.43	3.60	NaN	2.95
deer1-photo-colour	3.55	3.52	3.67	3.15
deer1-photo-grey	3.45	3.29	NaN	3.65
deer2-photo-colour	3.55	3.80	4.40	3.50
deer2-photo-grey	3.43	3.30	NaN	3.10
deer3-photo-colour	3.43	3.60	3.75	3.80
deer3-photo-grey	3.45	3.30	NaN	3.05
doll1-photo-colour	4.40	3.00	2.81	2.95
doll1-photo-grey	3.83	3.05	NaN	3.20
doll2-photo-colour	4.40	4.05	2.80	3.35
doll2-photo-grey	4.19	3.40	NaN	3.43
doll3-photo-colour	4.10	3.65	3.10	2.55
doll3-photo-grey	3.60	3.70	NaN	2.60
donkey1-photo-colour	3.81	3.55	4.05	4.45
donkey1-photo-grey	4.14	3.55	NaN	3.86
donkey2-photo-colour	4.15	3.70	3.60	4.50
donkey2-photo-grey	3.65	3.05	NaN	4.33
donkey3-photo-colour	4.10	3.60	3.20	4.33
donkey3-photo-grey	3.30	3.20	NaN	4.05
door1-photo-colour	4.95	2.34	2.80	3.43
door1-photo-grey	4.80	2.20	NaN	3.19
door2-photo-colour	4.80	3.71	1.90	2.90
door2-photo-grey	4.50	2.60	NaN	2.90
door3-photo-colour	4.80	2.35	1.85	3.80
door3-photo-grey	4.80	1.76	NaN	3.55
dress1-photo-colour	4.14	3.45	1.60	2.80
dress1-photo-grey	4.38	2.70	NaN	2.34
dress2-photo-colour	4.70	3.90	2.20	2.25
dress2-photo-grey	4.15	3.40	NaN	2.86
dress3-photo-colour	4.10	2.70	1.55	2.81
dress3-photo-grey	4.45	2.15	NaN	3.25

(continued)

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
dresser1-photo-colour	4.25	2.40	2.15	3.24
dresser1-photo-grey	4.80	2.21	2.27	3.10
dresser2-photo-colour	4.50	2.70	1.60	2.65
dresser2-photo-grey	4.60	2.76	NaN	2.90
dresser3-photo-colour	4.30	3.00	2.67	2.95
dresser3-photo-grey	4.50	2.95	NaN	3.40
drum1-photo-colour	3.90	3.52	2.81	3.60
drum1-photo-grey	4.14	3.48	NaN	3.95
drum2-photo-colour	3.90	3.50	2.45	3.55
drum2-photo-grey	4.10	3.45	NaN	4.10
drum3-photo-colour	3.95	3.20	2.70	3.85
drum3-photo-grey	4.00	3.15	NaN	3.20
duck1-photo-colour	4.71	3.75	3.85	4.00
duck1-photo-grey	4.19	3.90	NaN	3.55
duck2-photo-colour	4.35	4.65	3.75	4.29
duck2-photo-grey	4.40	4.10	NaN	3.75
duck3-photo-colour	3.95	3.30	3.70	3.70
duck3-photo-grey	4.60	3.40	NaN	3.10
eagle1-photo-colour	3.65	3.83	4.45	4.00
eagle1-photo-grey	3.15	2.95	NaN	3.29
eagle2-photo-colour	3.40	4.19	4.33	3.95
eagle2-photo-grey	3.40	3.70	NaN	3.75
eagle3-photo-colour	3.30	3.45	4.40	4.35
eagle3-photo-grey	3.05	3.76	NaN	3.60
fence1-photo-colour	4.57	2.25	2.60	3.50
fence1-photo-grey	4.57	1.95	NaN	3.21
fence2-photo-colour	4.75	3.10	2.75	3.35
fence2-photo-grey	4.50	2.90	NaN	2.90
fence3-photo-colour	4.70	3.00	2.45	3.86
fence3-photo-grey	4.45	2.35	NaN	3.40
fish1-photo-colour	4.62	3.60	3.00	3.66
fish1-photo-grey	4.10	3.05	NaN	3.30
fish2-photo-colour	4.20	4.05	2.90	3.29
fish2-photo-grey	4.40	4.00	NaN	3.00
fish3-photo-colour	4.40	3.40	3.10	3.55
fish3-photo-grey	4.10	3.30	NaN	3.95
flag1-photo-colour	4.62	2.40	2.10	2.86
flag1-photo-grey	3.81	2.15	NaN	3.30
flag2-photo-colour	4.05	2.85	4.25	3.05
flag2-photo-grey	4.60	2.25	NaN	2.40
flag3-photo-colour	4.25	2.60	2.20	3.20
flag3-photo-grey	3.95	2.25	NaN	2.81

(continued)

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
flower1-photo-colour	4.45	3.80	3.10	3.62
flower1-photo-grey	4.65	3.41	1.82	3.14
flower2-photo-colour	4.25	3.65	1.80	3.20
flower2-photo-grey	3.90	3.95	NaN	2.40
flower3-photo-colour	4.10	3.76	2.95	3.05
flower3-photo-grey	4.20	3.70	NaN	2.75
flute1-photo-colour	3.35	3.83	4.15	3.95
flute1-photo-grey	3.30	3.25	NaN	3.90
flute2-photo-colour	2.55	2.81	2.48	2.80
flute2-photo-grey	2.95	2.35	NaN	3.05
flute3-photo-colour	3.05	3.30	3.55	3.70
flute3-photo-grey	2.95	2.90	NaN	4.00
foot1-photo-colour	4.95	2.80	3.30	4.29
foot1-photo-grey	5.00	2.86	1.82	4.05
foot2-photo-colour	4.85	2.65	2.25	3.55
foot2-photo-grey	4.65	3.43	NaN	3.20
foot3-photo-colour	4.80	2.24	3.05	3.90
foot3-photo-grey	4.90	2.45	NaN	3.75
frog1-photo-colour	4.20	3.95	3.86	3.95
frog1-photo-grey	4.21	3.90	NaN	3.75
frog2-photo-colour	4.10	3.85	3.95	4.00
frog2-photo-grey	4.14	3.55	NaN	3.81
frog3-photo-colour	4.00	3.80	3.65	4.10
frog3-photo-grey	4.00	3.80	NaN	3.25
giraffe1-photo-colour	4.43	4.10	4.85	4.69
giraffe1-photo-grey	3.52	3.65	NaN	4.15
giraffe2-photo-colour	3.50	4.25	4.75	4.76
giraffe2-photo-grey	4.00	3.80	NaN	4.35
giraffe3-photo-colour	3.75	3.80	4.45	5.00
giraffe3-photo-grey	4.10	3.70	NaN	4.29
glasses1-photo-colour	4.57	2.60	1.95	3.93
glasses1-photo-grey	4.76	2.10	NaN	4.00
glasses2-photo-colour	4.80	2.35	2.35	4.19
glasses2-photo-grey	4.65	2.15	NaN	3.85
glasses3-photo-colour	4.90	2.65	2.30	3.05
glasses3-photo-grey	4.40	2.40	NaN	3.29
goat1-photo-colour	4.19	3.90	3.80	4.00
goat1-photo-grey	3.33	3.75	NaN	3.70
goat2-photo-colour	3.60	4.00	3.25	4.19
goat2-photo-grey	3.95	3.70	NaN	3.95
goat3-photo-colour	3.25	3.90	3.90	3.35
goat3-photo-grey	3.40	3.80	NaN	2.95

(continued)

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
grapes1-photo-colour	4.65	3.45	4.20	3.76
grapes1-photo-grey	4.70	2.85	NaN	3.10
grapes2-photo-colour	4.45	3.90	3.67	3.25
grapes2-photo-grey	4.20	3.40	NaN	3.00
grapes3-photo-colour	4.55	3.40	3.80	3.80
grapes3-photo-grey	4.40	3.48	NaN	3.10
guitar1-photo-colour	4.15	3.35	3.05	4.43
guitar1-photo-grey	4.35	3.24	2.00	3.90
guitar2-photo-colour	4.45	2.90	2.15	4.30
guitar2-photo-grey	4.25	3.57	NaN	3.85
guitar3-photo-colour	3.60	2.86	3.24	4.10
guitar3-photo-grey	4.35	3.05	NaN	4.00
hammer1-photo-colour	4.50	2.48	3.70	4.62
hammer1-photo-grey	4.50	2.10	NaN	3.62
hammer2-photo-colour	4.75	2.95	3.29	4.40
hammer2-photo-grey	4.55	2.45	NaN	4.55
hammer3-photo-colour	4.25	2.65	2.60	4.10
hammer3-photo-grey	4.25	2.33	NaN	3.80
hand1-photo-colour	4.97	3.33	3.14	4.60
hand1-photo-grey	5.00	3.14	NaN	4.20
hand2-photo-colour	4.90	3.40	3.15	4.62
hand2-photo-grey	5.00	3.05	NaN	3.90
hand3-photo-colour	5.00	3.35	2.90	2.60
hand3-photo-grey	4.95	3.25	NaN	3.40
harp1-photo-colour	3.25	3.69	3.50	3.81
harp1-photo-grey	2.75	3.15	NaN	3.67
harp2-photo-colour	3.15	4.19	2.95	4.15
harp2-photo-grey	3.40	3.20	NaN	4.25
harp3-photo-colour	2.65	3.50	2.95	4.35
harp3-photo-grey	2.90	3.10	NaN	3.75
horse1-photo-colour	4.24	3.45	2.45	4.30
horse1-photo-grey	4.48	3.35	NaN	3.83
horse2-photo-colour	4.40	3.75	3.55	3.85
horse2-photo-grey	3.90	3.55	NaN	3.71
horse3-photo-colour	4.25	3.55	3.10	4.10
horse3-photo-grey	3.95	3.25	NaN	3.75
house1-photo-colour	4.57	2.95	2.15	2.48
house1-photo-grey	4.48	2.45	NaN	2.80
house2-photo-colour	4.75	3.55	2.60	2.81
house2-photo-grey	4.75	3.35	NaN	2.35
house3-photo-colour	4.60	4.15	3.35	2.65
house3-photo-grey	4.35	4.00	NaN	2.05

(continued)

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
iron1-photo-colour	4.52	3.71	2.90	3.95
iron1-photo-grey	4.90	3.05	NaN	4.30
iron2-photo-colour	4.71	3.45	2.65	3.90
iron2-photo-grey	4.35	3.75	NaN	4.20
iron3-photo-colour	4.30	2.45	2.30	2.55
iron3-photo-grey	4.43	1.85	NaN	3.85
jacket1-photo-colour	4.50	3.15	2.95	2.43
jacket1-photo-grey	4.80	3.34	2.27	2.52
jacket2-photo-colour	4.55	2.70	2.70	3.00
jacket2-photo-grey	4.70	3.10	NaN	3.10
jacket3-photo-colour	4.40	2.48	1.71	2.60
jacket3-photo-grey	4.25	2.85	NaN	3.05
kettle1-photo-colour	4.55	3.05	2.81	3.30
kettle1-photo-grey	4.75	2.76	NaN	2.70
kettle2-photo-colour	4.52	2.85	2.60	3.10
kettle2-photo-grey	4.35	2.75	NaN	2.60
kettle3-photo-colour	4.30	2.50	2.10	2.05
kettle3-photo-grey	4.48	2.25	NaN	2.05
kite1-photo-colour	4.25	3.14	2.40	4.05
kite1-photo-grey	4.20	2.40	NaN	3.29
kite2-photo-colour	4.20	3.14	2.00	3.85
kite2-photo-grey	3.60	2.20	NaN	3.45
kite3-photo-colour	3.35	3.40	1.95	2.85
kite3-photo-grey	3.20	3.19	NaN	2.05
knife1-photo-colour	4.69	2.67	3.43	3.50
knife1-photo-grey	4.95	2.19	NaN	3.60
knife2-photo-colour	4.95	2.60	3.15	3.67
knife2-photo-grey	4.80	2.20	NaN	3.70
knife3-photo-colour	4.35	3.00	3.25	2.10
knife3-photo-grey	4.38	2.75	NaN	2.60
ladder1-photo-colour	4.75	1.86	2.86	3.10
ladder1-photo-grey	4.31	1.62	NaN	3.95
ladder2-photo-colour	4.55	1.95	1.80	4.10
ladder2-photo-grey	4.48	1.60	NaN	4.24
ladder3-photo-colour	4.62	2.35	2.85	3.15
ladder3-photo-grey	4.40	1.55	NaN	3.40
lamp1-photo-colour	4.62	2.76	2.90	3.55
lamp1-photo-grey	4.85	2.29	NaN	3.20
lamp2-photo-colour	4.81	3.35	2.55	4.05
lamp2-photo-grey	4.75	2.95	NaN	3.60
lamp3-photo-colour	4.45	3.70	2.55	2.85
lamp3-photo-grey	4.76	3.25	NaN	2.80

(continued)

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
leaf1-photo-colour	4.80	3.57	3.24	3.35
leaf1-photo-grey	4.83	3.43	NaN	3.40
leaf2-photo-colour	4.85	2.85	3.05	4.10
leaf2-photo-grey	5.00	2.90	NaN	3.48
leaf3-photo-colour	4.71	3.00	2.80	3.40
leaf3-photo-grey	4.70	2.60	NaN	2.65
lemon1-photo-colour	4.76	3.05	4.50	3.93
lemon1-photo-grey	4.29	2.45	NaN	3.35
lemon2-photo-colour	4.65	3.05	4.70	4.95
lemon2-photo-grey	4.50	2.95	NaN	3.90
lemon3-photo-colour	4.75	2.20	4.35	5.00
lemon3-photo-grey	3.95	2.60	NaN	3.38
lion1-photo-colour	4.10	3.62	4.33	4.70
lion1-photo-grey	4.17	3.33	NaN	4.35
lion2-photo-colour	4.10	3.75	4.65	4.65
lion2-photo-grey	4.10	3.40	NaN	4.29
lion3-photo-colour	3.95	3.95	4.30	4.65
lion3-photo-grey	3.35	3.65	NaN	3.35
lips1-photo-colour	4.80	3.19	3.14	3.80
lips1-photo-grey	4.90	3.29	NaN	3.80
lips2-photo-colour	5.00	2.15	3.25	4.55
lips2-photo-grey	5.00	2.15	NaN	4.14
lips3-photo-colour	4.95	2.30	3.30	4.00
lips3-photo-grey	4.80	1.75	NaN	3.25
lobster1-photo-colour	3.45	4.21	4.25	4.43
lobster1-photo-grey	3.50	3.65	NaN	3.38
lobster2-photo-colour	4.24	4.05	4.19	4.15
lobster2-photo-grey	3.75	3.05	NaN	3.35
lobster3-photo-colour	3.05	3.45	4.30	4.35
lobster3-photo-grey	2.85	3.19	NaN	3.25
lock1-photo-colour	4.31	3.81	4.05	4.15
lock1-photo-grey	4.50	3.29	NaN	3.45
lock2-photo-colour	4.29	3.40	2.70	3.48
lock2-photo-grey	4.40	2.60	NaN	4.10
lock3-photo-colour	4.05	3.30	3.70	3.80
lock3-photo-grey	4.38	2.85	NaN	3.55
mitten1-photo-colour	4.14	3.95	1.85	3.35
mitten1-photo-grey	4.48	3.20	NaN	3.62
mitten2-photo-colour	4.10	3.35	2.00	3.30
mitten2-photo-grey	3.75	2.30	NaN	3.76
mitten3-photo-colour	4.15	2.35	1.70	3.71
mitten3-photo-grey	4.40	1.95	NaN	3.80

(continued)

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
monkey1-photo-colour	3.62	3.95	3.85	3.41
monkey1-photo-grey	3.19	3.90	NaN	3.10
monkey2-photo-colour	3.10	4.15	4.15	3.52
monkey2-photo-grey	3.65	3.85	NaN	3.10
monkey3-photo-colour	3.75	3.40	3.75	3.55
monkey3-photo-grey	3.60	3.35	NaN	3.14
moon1-photo-colour	4.60	2.55	2.85	2.71
moon1-photo-grey	4.05	2.25	NaN	2.95
moon2-photo-colour	4.10	2.43	3.38	2.55
moon2-photo-grey	3.55	1.85	NaN	2.60
moon3-photo-colour	4.25	2.85	3.35	2.10
moon3-photo-grey	4.10	2.00	NaN	2.10
mouse1-photo-colour	3.76	3.75	3.60	3.75
mouse1-photo-grey	4.43	3.35	NaN	3.59
mouse2-photo-colour	4.15	3.90	3.70	3.85
mouse2-photo-grey	3.80	3.10	NaN	3.95
mouse3-photo-colour	3.85	3.85	3.25	3.48
mouse3-photo-grey	3.65	3.20	NaN	3.05
nail1-photo-colour	4.17	2.14	3.57	3.70
nail1-photo-grey	4.50	2.10	NaN	3.40
nail2-photo-colour	4.43	2.05	2.70	3.33
nail2-photo-grey	4.65	1.50	NaN	3.85
nail3-photo-colour	4.15	1.95	3.70	3.65
nail3-photo-grey	4.57	1.75	NaN	4.10
needle1-photo-colour	4.03	2.48	3.48	4.60
needle1-photo-grey	4.45	2.14	NaN	4.40
needle2-photo-colour	4.24	1.90	2.40	4.00
needle2-photo-grey	4.40	1.70	NaN	3.95
needle3-photo-colour	3.75	1.75	3.45	4.00
needle3-photo-grey	3.86	1.85	NaN	3.75
nose1-photo-colour	5.00	2.72	3.15	4.00
nose1-photo-grey	5.00	2.55	NaN	3.76
nose2-photo-colour	4.95	3.24	2.67	3.85
nose2-photo-grey	4.70	2.40	NaN	3.60
nose3-photo-colour	4.85	3.15	3.25	4.10
nose3-photo-grey	4.75	2.52	NaN	3.40
onion1-photo-colour	4.90	2.83	4.00	4.67
onion1-photo-grey	4.80	2.55	NaN	3.43
onion2-photo-colour	4.80	3.38	3.76	4.25
onion2-photo-grey	4.50	2.90	NaN	3.65
onion3-photo-colour	4.60	2.45	3.85	4.70
onion3-photo-grey	4.35	2.14	NaN	3.20

(continued)

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
orange1-photo-colour	4.67	2.30	4.70	4.75
orange1-photo-grey	4.48	2.35	NaN	2.79
orange2-photo-colour	4.90	3.25	4.85	4.80
orange2-photo-grey	4.25	1.90	NaN	3.76
orange3-photo-colour	4.85	3.55	4.70	4.62
orange3-photo-grey	4.45	2.30	NaN	3.10
ostrich1-photo-colour	3.48	3.81	4.19	4.70
ostrich1-photo-grey	3.40	3.10	NaN	4.30
ostrich2-photo-colour	3.33	3.85	3.55	4.52
ostrich2-photo-grey	3.30	3.50	NaN	3.90
ostrich3-photo-colour	3.10	3.60	3.95	3.75
ostrich3-photo-grey	3.00	3.25	NaN	3.35
peach1-photo-colour	4.45	3.19	4.00	3.95
peach1-photo-grey	4.31	2.95	NaN	2.95
peach2-photo-colour	4.35	3.20	4.20	4.45
peach2-photo-grey	4.33	2.20	NaN	2.90
peach3-photo-colour	4.10	2.20	3.95	4.00
peach3-photo-grey	3.75	1.90	NaN	1.75
peacock1-photo-colour	3.79	4.43	4.76	4.40
peacock1-photo-grey	3.70	3.62	NaN	3.10
peacock2-photo-colour	3.86	4.55	4.20	4.00
peacock2-photo-grey	3.60	3.85	NaN	2.55
peacock3-photo-colour	3.40	4.45	4.55	4.00
peacock3-photo-grey	3.43	3.90	NaN	3.20
peanut1-photo-colour	4.38	3.20	4.10	4.10
peanut1-photo-grey	3.95	2.75	NaN	3.35
peanut2-photo-colour	4.00	3.45	4.40	3.95
peanut2-photo-grey	4.20	3.45	NaN	4.00
peanut3-photo-colour	4.20	2.85	4.10	4.00
peanut3-photo-grey	4.00	3.05	NaN	4.14
pear1-photo-colour	4.59	3.14	4.48	5.00
pear1-photo-grey	4.80	2.48	NaN	3.55
pear2-photo-colour	4.67	2.80	3.60	4.33
pear2-photo-grey	4.40	2.45	NaN	3.55
pear3-photo-colour	4.25	2.90	4.00	4.10
pear3-photo-grey	4.43	2.35	NaN	3.10
pencil1-photo-colour	4.95	2.25	2.15	3.83
pencil1-photo-grey	4.57	1.75	NaN	3.85
pencil2-photo-colour	4.80	2.80	2.30	4.00
pencil2-photo-grey	4.90	2.60	NaN	3.75
pencil3-photo-colour	4.95	1.95	2.40	3.90
pencil3-photo-grey	4.60	1.80	NaN	2.57

(continued)

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
penguin1-photo-colour	4.00	3.55	4.65	4.62
penguin1-photo-grey	3.50	2.65	NaN	3.86
penguin2-photo-colour	3.85	3.76	4.52	4.65
penguin2-photo-grey	4.05	3.00	NaN	4.50
penguin3-photo-colour	3.60	3.45	4.20	4.40
penguin3-photo-grey	3.45	2.76	NaN	3.75
pepper1-photo-colour	4.76	2.20	2.95	3.10
pepper1-photo-grey	4.71	2.40	NaN	2.69
pepper2-photo-colour	4.65	3.10	3.50	2.50
pepper2-photo-grey	4.55	2.15	NaN	3.14
pepper3-photo-colour	4.45	3.30	2.95	2.76
pepper3-photo-grey	4.40	2.35	NaN	2.90
piano1-photo-colour	4.48	3.90	3.55	4.00
piano1-photo-grey	3.90	3.95	NaN	4.20
piano2-photo-colour	4.15	4.15	3.60	4.43
piano2-photo-grey	4.15	3.40	NaN	4.15
piano3-photo-colour	4.30	3.75	3.65	3.85
piano3-photo-grey	4.25	3.70	NaN	4.00
pipe1-photo-colour	3.43	4.10	3.20	2.79
pipe1-photo-grey	2.86	4.35	NaN	2.80
pipe2-photo-colour	3.00	2.75	3.55	2.76
pipe2-photo-grey	3.65	2.60	NaN	2.95
pipe3-photo-colour	2.80	2.40	3.35	2.90
pipe3-photo-grey	3.40	2.30	NaN	2.57
pitcher1-photo-colour	4.25	3.30	3.45	3.14
pitcher1-photo-grey	4.50	2.48	2.27	2.90
pitcher2-photo-colour	4.45	2.75	1.45	2.30
pitcher2-photo-grey	3.85	2.67	NaN	3.10
pitcher3-photo-colour	3.60	2.10	1.43	2.35
pitcher3-photo-grey	3.50	2.15	NaN	2.65
pliers1-photo-colour	4.05	3.00	2.40	3.90
pliers1-photo-grey	3.95	3.05	NaN	3.59
pliers2-photo-colour	4.25	2.75	2.90	4.15
pliers2-photo-grey	3.60	2.45	NaN	3.81
pliers3-photo-colour	4.10	2.60	2.30	3.86
pliers3-photo-grey	3.45	2.20	NaN	3.85
plug1-photo-colour	4.05	2.65	3.00	2.00
plug1-photo-grey	4.45	2.52	3.18	2.33
plug2-photo-colour	4.10	2.05	2.85	2.00
plug2-photo-grey	4.50	3.14	NaN	2.35
plug3-photo-colour	3.75	2.48	3.48	2.20
plug3-photo-grey	3.00	2.70	NaN	2.20

(continued)

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
potato1-photo-colour	4.90	2.71	4.00	5.00
potato1-photo-grey	4.85	2.38	NaN	4.00
potato2-photo-colour	4.90	2.75	3.70	4.52
potato2-photo-grey	4.45	2.45	NaN	3.50
potato3-photo-colour	5.00	2.30	3.95	4.55
potato3-photo-grey	4.90	2.45	NaN	3.80
pumpkin1-photo-colour	4.38	3.00	4.20	4.60
pumpkin1-photo-grey	4.10	2.55	NaN	3.28
pumpkin2-photo-colour	4.00	2.95	4.45	4.25
pumpkin2-photo-grey	3.50	2.25	NaN	3.29
pumpkin3-photo-colour	4.20	3.15	4.50	4.57
pumpkin3-photo-grey	3.85	2.50	NaN	3.65
rabbit1-photo-colour	4.35	3.52	3.71	3.90
rabbit1-photo-grey	4.41	3.38	NaN	4.05
rabbit2-photo-colour	4.20	3.20	3.60	3.70
rabbit2-photo-grey	4.10	3.10	NaN	3.43
rabbit3-photo-colour	4.29	3.90	3.75	3.85
rabbit3-photo-grey	4.20	3.75	NaN	3.70
raccoon1-photo-colour	3.45	3.52	4.25	4.33
raccoon1-photo-grey	3.45	3.25	NaN	3.95
raccoon2-photo-colour	3.60	4.14	4.62	3.95
raccoon2-photo-grey	3.65	3.60	NaN	4.30
raccoon3-photo-colour	2.90	3.60	4.35	4.35
raccoon3-photo-grey	2.80	3.29	NaN	3.60
ring1-photo-colour	4.62	2.35	2.90	3.31
ring1-photo-grey	4.38	2.70	NaN	3.40
ring2-photo-colour	2.55	3.45	3.20	2.05
ring2-photo-grey	2.75	2.85	NaN	1.85
ring3-photo-colour	4.20	1.85	2.25	3.35
ring3-photo-grey	4.15	1.90	NaN	2.67
ruler1-photo-colour	4.76	2.00	2.15	3.34
ruler1-photo-grey	4.57	2.05	NaN	3.30
ruler2-photo-colour	4.40	3.00	3.20	3.86
ruler2-photo-grey	4.55	2.65	NaN	4.05
ruler3-photo-colour	4.40	2.55	2.50	3.25
ruler3-photo-grey	4.15	2.65	NaN	3.62
screw1-photo-colour	4.80	3.10	3.29	4.60
screw1-photo-grey	4.48	3.38	NaN	4.90
screw2-photo-colour	4.75	3.10	3.40	4.45
screw2-photo-grey	4.76	2.60	NaN	4.38
screw3-photo-colour	4.52	3.05	3.25	4.45
screw3-photo-grey	4.20	2.55	NaN	4.40

(continued)

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
seal1-photo-colour	3.80	3.29	3.67	3.95
seal1-photo-grey	3.59	3.48	NaN	3.80
seal2-photo-colour	3.75	2.95	4.15	3.95
seal2-photo-grey	3.71	3.25	NaN	4.38
seal3-photo-colour	3.76	3.55	4.15	3.75
seal3-photo-grey	3.40	2.75	NaN	3.25
sheep1-photo-colour	4.30	3.71	3.71	3.95
sheep1-photo-grey	4.07	3.43	NaN	4.00
sheep2-photo-colour	4.05	3.75	4.30	3.85
sheep2-photo-grey	4.24	3.60	NaN	4.00
sheep3-photo-colour	3.95	3.55	4.10	3.95
sheep3-photo-grey	4.00	3.30	NaN	3.60
shirt1-photo-colour	4.60	3.35	2.25	3.38
shirt1-photo-grey	4.75	3.21	2.09	3.71
shirt2-photo-colour	4.45	2.50	2.30	3.10
shirt2-photo-grey	4.75	3.24	NaN	2.60
shirt3-photo-colour	4.55	3.00	1.67	3.40
shirt3-photo-grey	4.55	3.15	NaN	3.65
shoe1-photo-colour	4.90	3.19	2.67	4.05
shoe1-photo-grey	4.95	2.57	NaN	3.60
shoe2-photo-colour	4.90	3.55	2.95	3.52
shoe2-photo-grey	4.95	3.05	NaN	3.35
shoe3-photo-colour	4.70	3.45	2.85	3.30
shoe3-photo-grey	4.95	2.85	NaN	3.85
skirt1-photo-colour	4.15	3.24	2.15	2.81
skirt1-photo-grey	3.95	3.05	NaN	2.76
skirt2-photo-colour	4.15	3.33	1.71	2.60
skirt2-photo-grey	4.00	3.05	NaN	2.40
skirt3-photo-colour	3.50	3.00	1.80	3.00
skirt3-photo-grey	3.95	2.71	NaN	2.65
skunk1-photo-colour	3.19	3.65	4.40	4.28
skunk1-photo-grey	3.14	3.70	NaN	4.15
skunk2-photo-colour	2.85	3.65	4.35	3.95
skunk2-photo-grey	3.00	3.35	NaN	3.50
skunk3-photo-colour	2.35	3.50	3.60	3.30
skunk3-photo-grey	2.70	3.35	NaN	2.81
snail1-photo-colour	4.19	4.10	3.25	4.15
snail1-photo-grey	4.57	3.00	NaN	3.62
snail2-photo-colour	4.55	3.95	4.25	4.30
snail2-photo-grey	4.20	3.50	NaN	4.10
snail3-photo-colour	4.25	4.00	2.85	3.43
snail3-photo-grey	4.25	3.75	NaN	4.05

(continued)

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
snake1-photo-colour	4.10	2.95	2.71	3.65
snake1-photo-grey	3.93	3.10	NaN	3.55
snake2-photo-colour	4.35	2.95	2.60	3.45
snake2-photo-grey	3.90	2.65	NaN	3.86
snake3-photo-colour	3.62	3.05	2.70	3.60
snake3-photo-grey	3.50	3.10	NaN	3.40
snowman1-photo-colour	4.25	2.38	3.86	3.05
snowman1-photo-grey	4.17	2.33	NaN	3.60
snowman2-photo-colour	4.30	3.40	4.40	3.90
snowman2-photo-grey	4.10	2.60	NaN	4.10
snowman3-photo-colour	4.19	3.00	4.30	3.30
snowman3-photo-grey	3.75	2.80	NaN	2.65
socks1-photo-colour	4.90	2.14	1.90	2.90
socks1-photo-grey	5.00	1.81	NaN	4.05
socks2-photo-colour	5.00	2.05	1.65	3.55
socks2-photo-grey	5.00	2.00	NaN	3.29
socks3-photo-colour	5.00	2.55	1.75	3.10
socks3-photo-grey	4.90	2.00	NaN	2.90
spider1-photo-colour	4.52	4.00	3.38	3.30
spider1-photo-grey	4.35	3.62	NaN	3.15
spider2-photo-colour	4.71	4.25	3.20	3.33
spider2-photo-grey	4.50	3.95	NaN	2.85
spider3-photo-colour	4.05	4.45	3.45	2.05
spider3-photo-grey	4.33	3.95	NaN	3.15
spoon1-photo-colour	4.95	2.65	3.85	4.45
spoon1-photo-grey	4.90	2.50	NaN	4.35
spoon2-photo-colour	4.60	2.70	2.95	3.86
spoon2-photo-grey	4.90	2.55	NaN	3.80
spoon3-photo-colour	4.90	2.25	3.70	4.50
spoon3-photo-grey	4.85	2.55	NaN	4.52
stool1-photo-colour	3.48	2.85	2.85	2.45
stool1-photo-grey	3.52	2.35	NaN	1.86
stool2-photo-colour	4.30	3.10	2.80	3.65
stool2-photo-grey	4.30	2.55	NaN	3.33
stool3-photo-colour	4.25	2.75	2.10	3.14
stool3-photo-grey	4.40	2.40	NaN	3.55
swan1-photo-colour	4.62	3.45	4.40	4.38
swan1-photo-grey	4.05	3.20	NaN	3.65
swan2-photo-colour	3.90	4.15	4.45	4.67
swan2-photo-grey	4.30	3.90	NaN	3.90
swan3-photo-colour	4.05	2.60	4.20	4.65
swan3-photo-grey	4.45	2.55	NaN	4.10

(continued)

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
swing1-photo-colour	4.14	2.33	3.05	3.65
swing1-photo-grey	4.25	2.00	NaN	2.95
swing2-photo-colour	4.19	2.35	2.80	3.14
swing2-photo-grey	4.20	1.90	NaN	2.95
swing3-photo-colour	3.45	2.65	3.15	2.70
swing3-photo-grey	3.81	2.00	NaN	3.30
table1-photo-colour	5.00	2.15	2.80	3.95
table1-photo-grey	4.90	1.90	NaN	3.48
table2-photo-colour	4.95	1.95	1.80	3.65
table2-photo-grey	4.80	1.50	NaN	3.33
table3-photo-colour	4.10	3.45	2.10	2.24
table3-photo-grey	4.20	3.25	NaN	2.15
thimble1-photo-colour	3.40	2.83	3.45	3.95
thimble1-photo-grey	3.45	2.40	NaN	4.05
thimble2-photo-colour	3.25	3.81	2.67	3.70
thimble2-photo-grey	3.15	3.40	NaN	4.55
thimble3-photo-colour	2.85	3.10	3.40	3.90
thimble3-photo-grey	2.75	2.57	NaN	3.60
thumb1-photo-colour	4.90	2.95	3.20	3.81
thumb1-photo-grey	5.00	2.52	1.82	3.52
thumb2-photo-colour	4.55	2.50	2.85	4.15
thumb2-photo-grey	4.67	3.00	NaN	3.30
thumb3-photo-colour	4.65	3.33	2.81	3.45
thumb3-photo-grey	4.45	3.10	NaN	3.85
tiger1-photo-colour	3.52	4.10	4.45	4.55
tiger1-photo-grey	4.10	3.55	NaN	3.55
tiger2-photo-colour	4.15	4.05	4.65	4.65
tiger2-photo-grey	3.60	3.20	NaN	4.19
tiger3-photo-colour	4.10	4.00	4.10	4.62
tiger3-photo-grey	3.65	3.55	NaN	4.25
toaster1-photo-colour	4.70	2.90	2.60	3.33
toaster1-photo-grey	4.90	2.83	2.55	3.48
toaster2-photo-colour	4.75	3.15	1.95	3.95
toaster2-photo-grey	4.40	3.71	NaN	4.10
toaster3-photo-colour	4.55	3.38	1.67	3.15
toaster3-photo-grey	4.35	3.55	NaN	2.90
tomato1-photo-colour	4.85	2.41	4.45	4.67
tomato1-photo-grey	4.50	2.20	NaN	2.90
tomato2-photo-colour	4.76	3.48	4.24	4.30
tomato2-photo-grey	4.30	2.40	NaN	3.05
tomato3-photo-colour	4.40	2.20	4.40	4.90
tomato3-photo-grey	4.35	2.14	NaN	3.15

(continued)

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
train1-photo-colour	4.38	4.55	2.60	3.30
train1-photo-grey	4.05	4.10	NaN	2.55
train2-photo-colour	4.15	4.30	2.30	2.85
train2-photo-grey	3.85	3.50	NaN	3.00
train3-photo-colour	4.55	4.00	2.50	2.95
train3-photo-grey	4.35	3.95	NaN	3.20
tree1-photo-colour	4.90	4.05	3.70	3.90
tree1-photo-grey	4.76	4.20	NaN	3.55
tree2-photo-colour	4.90	4.10	4.05	4.57
tree2-photo-grey	4.90	3.40	NaN	3.80
tree3-photo-colour	4.85	3.60	4.25	4.25
tree3-photo-grey	4.55	3.30	NaN	3.24
trumpet1-photo-colour	3.30	3.60	3.50	3.81
trumpet1-photo-grey	3.55	3.52	2.82	3.81
trumpet2-photo-colour	3.80	2.95	4.45	4.90
trumpet2-photo-grey	3.50	3.52	NaN	4.05
trumpet3-photo-colour	3.30	3.43	4.10	4.20
trumpet3-photo-grey	2.80	3.30	NaN	3.95
turtle1-photo-colour	3.45	3.25	3.65	3.43
turtle1-photo-grey	3.65	3.52	2.00	3.24
turtle2-photo-colour	3.95	3.35	4.45	3.10
turtle2-photo-grey	3.35	3.81	NaN	2.55
turtle3-photo-colour	3.45	4.14	4.24	3.90
turtle3-photo-grey	3.35	3.30	NaN	3.45
vest1-photo-colour	4.05	1.81	1.71	1.85
vest1-photo-grey	3.66	2.00	NaN	2.70
vest2-photo-colour	4.10	2.05	2.05	2.20
vest2-photo-grey	4.10	2.10	NaN	2.76
vest3-photo-colour	3.76	3.10	2.10	2.35
vest3-photo-grey	3.25	2.75	NaN	1.90
violin1-photo-colour	4.00	3.70	4.20	4.69
violin1-photo-grey	3.33	3.10	NaN	4.00
violin2-photo-colour	3.60	3.40	4.05	4.62
violin2-photo-grey	3.70	3.25	NaN	4.20
violin3-photo-colour	2.90	3.40	3.95	4.05
violin3-photo-grey	3.70	3.45	NaN	3.43
watch1-photo-colour	4.60	3.05	2.85	3.52
watch1-photo-grey	4.80	2.90	2.45	3.19
watch2-photo-colour	4.85	3.30	1.80	3.80
watch2-photo-grey	4.70	3.48	NaN	3.15
watch3-photo-colour	4.40	3.05	2.05	3.40
watch3-photo-grey	4.40	3.15	NaN	3.65

(continued)

stim	familiarity	visualcomplexity	colourdiagnosticity	mentalimageryagreement
well1-photo-colour	3.71	3.90	3.45	4.38
well1-photo-grey	2.95	3.65	NaN	4.10
well2-photo-colour	3.25	3.65	3.00	4.14
well2-photo-grey	3.95	3.45	NaN	4.00
well3-photo-colour	2.70	3.95	3.10	3.95
well3-photo-grey	3.10	3.70	NaN	3.62
whistle1-photo-colour	4.05	2.75	2.90	4.29
whistle1-photo-grey	4.25	2.14	3.00	4.24
whistle2-photo-colour	4.30	2.00	3.00	4.35
whistle2-photo-grey	4.00	2.90	NaN	4.25
whistle3-photo-colour	3.35	2.19	3.33	4.30
whistle3-photo-grey	3.50	2.60	NaN	4.35
window1-photo-colour	4.70	2.75	2.30	2.71
window1-photo-grey	4.90	2.97	1.91	2.81
window2-photo-colour	4.75	3.65	1.95	4.00
window2-photo-grey	4.55	3.52	NaN	3.40
window3-photo-colour	4.55	2.62	2.24	3.15
window3-photo-grey	4.80	2.65	NaN	3.80
zebra1-photo-colour	3.38	3.80	4.75	4.60
zebra1-photo-grey	4.29	3.25	NaN	4.34
zebra2-photo-colour	3.90	3.80	4.55	4.55
zebra2-photo-grey	3.45	3.90	NaN	4.76
zebra3-photo-colour	4.15	3.60	4.80	4.38
zebra3-photo-grey	3.35	3.25	NaN	4.75

Appendix C

Table 3: Spelling corrections / manipulations to naming responses.

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

(continued)

Response	Correction	Response	Correction	Response	Correction
broon	broom	girafe	giraffe	pair	pear
brum	broom	giraff	giraffe	oencil	pencil
camal	camel	giaffee	giraffe	pengiuin	penguin
canddle	candle	girraffe	giraffe	pengiun	penguin
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		

(continued)

Response	Correction	Response	Correction	Response	Correction
rubarb	rhubarb	carrots	carrot		
thinbell	thimble	clouds	cloud		
thmble	thimble	draw	drawers		
timble	thimble	drawer	drawers		

Appendix D