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ORIGINAL ARTICLE

The Role of Relational Contextual Cues versus Relational Coherence Indicators as Response Options on the Implicit Relational Assessment Procedure

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Abstract

Recent research has indicated that the results of the implicit relational assessment procedure (IRAP) may be affected by certain facets of the measure. The current research explores the use of response options in the IRAP and their potential influence on the responding of college students ($N = 40$) across two similar IRAPs. The IRAPs differed solely in the different types of response option used: contextually cued relational responses (C_{rels}) or relational coherence indicators (RCIs). The terms "same"/"opposite" served as C_{rel} response options whereas the RCI response options were "right"/"wrong." The expected IRAP effect was evident on *D*-scores from both IRAPs. This effect was shown to be stronger when C_{rel} response options were used (Wilk's Lambda = .86, F (1, 36) = 6.05, $p = .02$, $\eta_p^2 = .14$.), however, there was no statistically significant effect shown for the order of their presentation, nor were any other interaction effects detected. Potential implications and possible avenues for future research are discussed.

Keywords IRAP · Response options · RCIs · C_{rels}

The implicit relational assessment procedure (IRAP; Barnes-Holmes et al., 2006) is a computerized behavior-analytic measure of relational responding. The program presents participants with two stimuli (i.e., a label stimulus, for example, "pleasant," and a target stimulus, for example, "flower") and two potential response options (e.g., "same" and "different"). Participants are required to respond, under time pressure, alternately affirming or disconfirming the relations presented (e.g., pleasant–flower–same) for half of the trial-blocks and then affirming converse relations (e.g., pleasant–flower–different). In the seminal IRAP study, Barnes-Holmes et al. (2006) found that participants more rapidly affirmed relations that were deemed consistent with what was likely to be reinforced by the wider English-speaking community compared to relations that were not. That is, people responded on the IRAP with greater speed and accuracy (i.e., showed a response bias) when relations presented had been learned preexperimentally within the social/verbal community. This finding became known as the IRAP effect and has since been demonstrated in empirical research investigating response biases to myriad of social phenomena, for example, gender stereotypes (Fleming et al., 2020), smoking as a stigmatized behavior (Cagney et al., 2017), self-esteem (Remue et al., 2013), bias towards homo- and heterosexuality (Cullen & Barnes-Holmes, 2008), attractiveness bias (Rice et al., 2020), racial biases (Barnes-Holmes et al., 2010a, b), and national identity (Power et al., 2009).

Underlying the IRAP is a modern behavioral theory of human language and cognition that proposes that humans develop vast and diverse patterns of relational responding (i.e., relational frame theory (RFT); Hayes et al., 2001) with the aid of relational cues. In consequence, there are two key forms of relational cues, one of which are functional cues, or C_{funcs}, which denote the form of psychological properties that can be transformed across stimuli in a relational frame. For example, the recollection of what a lemon tastes like, evoked in an individual in the presence of the verbal stimulus "lemon," is controlled by C_{funcs} and is based upon the equivalence relation between the word "lemon" and the object "lemon," which evokes similar sensory stimulation.

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There are also contextual cues, or C_{rels}, which directly imply a relation between two stimuli or events. For example, the words "same" and "opposite" are C_{rels} denoting that relations between stimuli are equivalent or similar (same) or that relations between stimuli are bipolar (opposite, e.g., hot/cold). Terms such as "true" and "false" are considered as distinct from C_{rels} because they are evaluative terms used to indicate if a relational pattern is coherent (see Hayes & Barnes, 1997). For example, it is true to say that an elephant is bigger than a mouse. Here, "bigger than" is a C_{rel} indicating a contextual relation between two stimuli, whereas "true" is used to indicate that the relation is coherent. Thus, from an RFT perspective, "true" and "false" and their synonyms are known as relational coherence indicators (RCIs) rather than C_{rels}.

As IRAP research progresses, empirical studies have been dedicated to refining the IRAP as a measure, analyzing its features, and examining the characteristics of the data. For example, studies have examined how to fake responding on the IRAP (McKenna et al., 2007), the impact of rules or instructions (Finn et al., 2016), how the positioning of stimuli presented on-screen may affect responses (Campbell et al., 2011), and the properties of the stimulus categories employed (O'Shea et al., 2016). The differential arbitrarily applicable relational responding effects model (DAARRE; Finn et al., 2018) addressed the issue of C_{funcs} and C_{rels} and the single-trial-type-dominance-effect (STTDE). They suggest that faster responses are elicited on the IRAP in trial-types presenting a combination of stimuli that are highly coherent (Fig. 1). Finn et al. used the example of color–color relations versus shape–shape relations to illustrate the impact of stronger C_{rel} coherence. Citing Keuleers et al. (2010) on the more frequent use of "color" words compared to "shape" words in the English-speaking community, they suggest that the orientating function (C_{func}) between the label stimulus "color" and the target stimulus "color" may be stronger (i.e., greater coherence) that of the shape–shape relation.

In early IRAP studies response options were typically relational (e.g., "similar"/"opposite"; Hughes & Barnes-Holmes, 2011; Cullen et al., 2009), in accordance with the RFT perspective from which the program was derived. However, as IRAP research progressed there was some drift from the use of relational terms as response options and words like "true" and "false" or "yes" and "no" became popular choices (e.g., Hussey & Barnes-Holmes, 2012; McEnteggart et al., 2016; Rice et al., 2020). Thus, further research to empirically determine the potential impact of using such terms as IRAP response options may be timely. The rationale is supported because if the type of response options used (C_{rels} vs. RCIs) were found to enhance or diminish the IRAP effect, IRAP researchers in areas of social bias may be facilitated in avoidance of such confounding influences.

The theoretical distinction between C_{rels} and RCIs, and possible impact on participant responding in the IRAP were explored by Maloney and Barnes-Holmes (2016). In this study a sample of university students ($N = 52$) was required to complete two IRAPs in one sitting. One IRAP used the C_{rels} "similar" and "different" as response options (C_{rels}-IRAP) whereas the other used the RCIs "true" and "false" as response options (RCI-IRAP). Findings showed that when the C_{rels}-IRAP was completed first the IRAP effect was stronger for the C_{rels}-IRAP compared to the RCI-IRAP, but there was no discernible impact on the IRAP effect when the order of presentation was reversed. This was the first study to indicate that the type of response options used in the IRAP may not be irrelevant to IRAP results.

Maloney et al. (2020) continued this line of research. Participants ($N = 40$ adults) completed two consecutive IRAPs, the C_{rels}-IRAP used the relational terms "same" and "opposite," and the RCI-IRAP used the terms "accurate" and "inaccurate." The IRAP effect was shown to be stronger for the C_{rels}-IRAP compared to the RCI-IRAP. Unlike Maloney and Barnes-Holmes (2016), the order of IRAP completion (i.e., C_{rels}-IRAP first or RCI-IRAP first) did not have a significant impact on responding. However, a three-way interaction effect did emerge between the type of response option used, the order of completion and the order in which IRAP trial-blocks were presented (i.e., consistent or inconsistent relations first). This suggests that although the type of IRAP response options used in IRAP research may have an impact on the IRAP effects shown there may be multiple aspects of the IRAP methodology that are potentially relevant to participant performance.

The current research further examined the effects of C_{rels} versus RCIs as response options to add to the growing base of IRAP technological research literature and, it is hoped, provide greater clarity. Relational terms "same" and "opposite" were used as response options in the C_{rels}-IRAP and the RCI-IRAP used the terms "right" and "wrong." The C_{rels} were selected based on their frequent use in empirical IRAP literature, and to allow for a more direct comparison of results with Maloney et al. (2020). The RCI response options are comparable to the RCI terms previously used in this line of IRAP research and attempted to directly address a potential limitation in the similarity of the RCI terms used by Maloney et al. ("accurate"/"inaccurate") may have affected participant responding. Participants were required to complete a C_{rels}-IRAP and an RCI-IRAP in one sitting, with a view to ascertaining any effects shown for (1) the type of response options employed; (2) the order of presentation of IRAP type; (3) the order of presentation of trial-blocks; and (4) any interaction between any of the former.

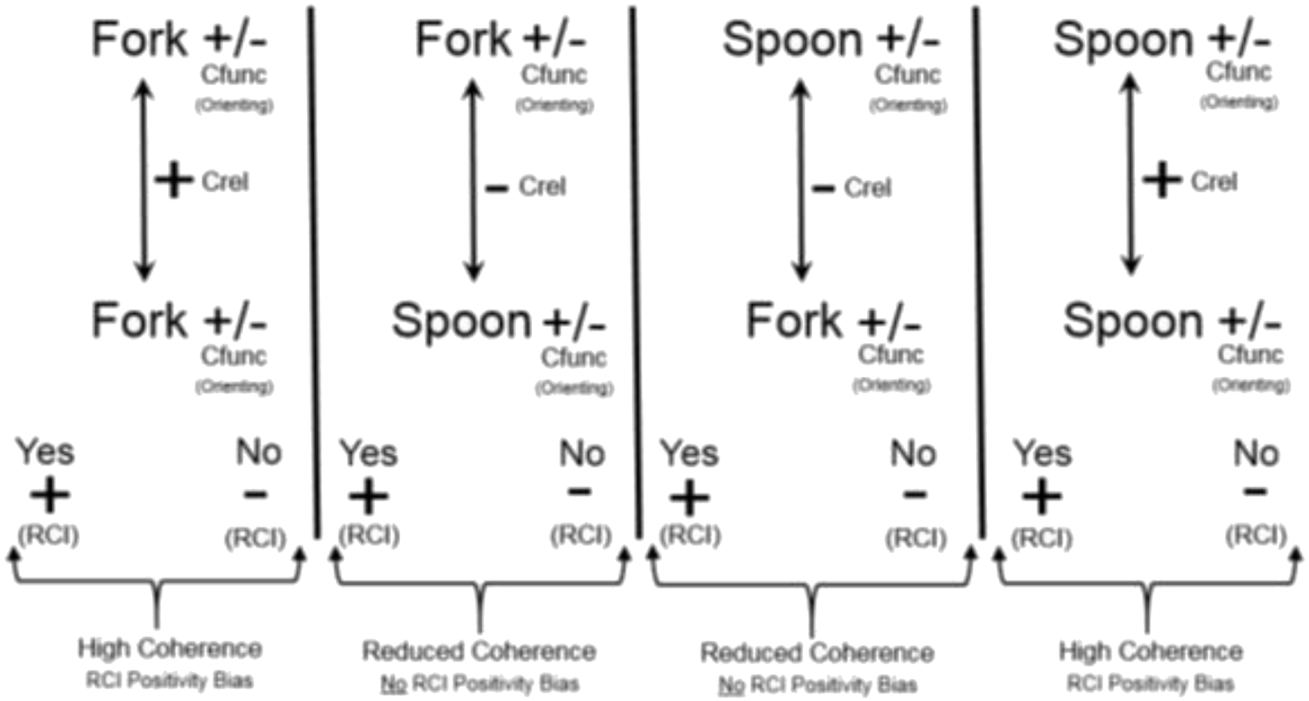

Fig. 1 Graphic representation of the DAARRE model suggesting coherence of stimulus relations. *Note.* Courtesy of Finn et al. (2016)

Method

Participants

Forty-nine participants were recruited from the student population of National University of Ireland Maynooth. Participants were welcomed from all disciplines and departments. Prior to participation, all were asked to confirm that they had normal or corrected to normal vision. If applicable, participants were advised to wear their prescribed glasses or contact lenses for the duration of the experiment. All participants reported to be native English speakers. Participants with a history of seizures in response to flashing images were asked to self-exclude from the study. Written informed consent was obtained prior to participation with no obligation to continue. No financial payment or other inducements were offered for participation in the study. Nine participants did not meet the predetermined accuracy and latency criteria required of the IRAP and their datasets were removed prior to data analysis. The remaining 40 participants ($N = 40$; 19 males, 21 females), aged between 18 and 24 years ($M = 20$), completed the study successfully.

Apparatus and Stimuli

All participants completed the study on laptop computer. Instructions, stimulus presentation, and data recording were controlled by the IRAP program (2014: written in Microsoft Visual Basic 6.0). On each trial of the procedure, one of two label stimuli ("pleasant" or "unpleasant") was presented on screen with a positively or negatively valenced target stimulus. The target stimuli consisted of six synonyms of the term "pleasant" ("good," "positive," "likeable," "lovely," "wonderful," and "nice") and six synonyms of the term "unpleasant" ("bad," "negative," "nasty," "awful," "unlikeable," and "horrible"). Two response options were presented in the lower left- and right-hand corners of the screen. For one IRAP the response options were C_{rels} ("same" and "opposite") and for the other IRAP the response options presented were RCIs ("right" and "wrong"); hereafter the former IRAP will be referred as the C_{rels}-IRAP and the latter will be referred to as the RCI-IRAP. Prior to the presentation of each block of trials a "rule" appeared on screen to instruct participant responding. For consistent blocks this rule read "Pleasant words are positive. Unpleasant words are negative"; for inconsistent blocks, the rule altered to "Pleasant words are negative. Unpleasant words are positive."

Procedure

In each trial of the IRAP, four words were presented simultaneously on-screen: one of two label stimuli ("pleasant" or "unpleasant") would appear at the top of the screen; a target word would be shown in the center of the screen (e.g., "wonderful") and a response option pair would appear in both lower corners of the screen (either "same"/"opposite" or "right"/"wrong"). The position of response options alternated quasi-randomly between trials with the constraint that they would not appear in the same position more than three times in succession. Participants were advised to choose one of the response options for each trial by pressing either "d" or "k" on the keyboard. All other keys were disabled during the experiment. To indicate which key corresponded to which response option on a given trial; the instruction "PRESS 'd' FOR" was shown above the response option on the left-hand side and the instruction "PRESS 'k' FOR" appeared directly above the response option on the right-hand side of the screen. The IRAP was programmed so that each label stimulus appeared once with each of the 12 target words across a block of 24 trials. This 2 × 2 cross-over of label with target stimuli resulted in four IRAP trial-types: pleasant–positive, pleasant–negative, unpleasant–positive, and unpleasant–negative (see Fig. 2). Each trial-type was presented six times per block with the constraint that none could appear twice in succession.

Participants completed a minimum of eight blocks of the same 24 trials: two practice blocks and six test blocks. The program allowed for up to four additional practice blocks if the participant was unable to meet the predetermined criteria required to procedure from practice to test blocks: accuracy exceeding 75% and median latency of no more than 2,100 ms (accuracy and latency amended to avoid high attrition rates as per Barnes-Holmes, Barnes-Holmes, et al., 2010a). These criteria are set to capture the IRAP effect that may be lost with less stringent conditions. Participants who were unable to achieve these criteria throughout practice blocks were thanked for their involvement, debriefed, and excused from further participation. Their data were subsequently discarded. Participants were provided with onscreen feedback reporting their accuracy and median latency upon completion of each block.

Brief on-screen instructions were presented by the IRAP program before a new block of trials began. These instructions informed the participant that the upcoming block of trials was either a practice or test block. For practice blocks, the instructions stated that participants were to "Try to avoid the red 'X' on every question." For test blocks, this was changed to "Please try to get as many right as possible." A "rule" relating to the subsequent block of trials was presented with these instructions. The

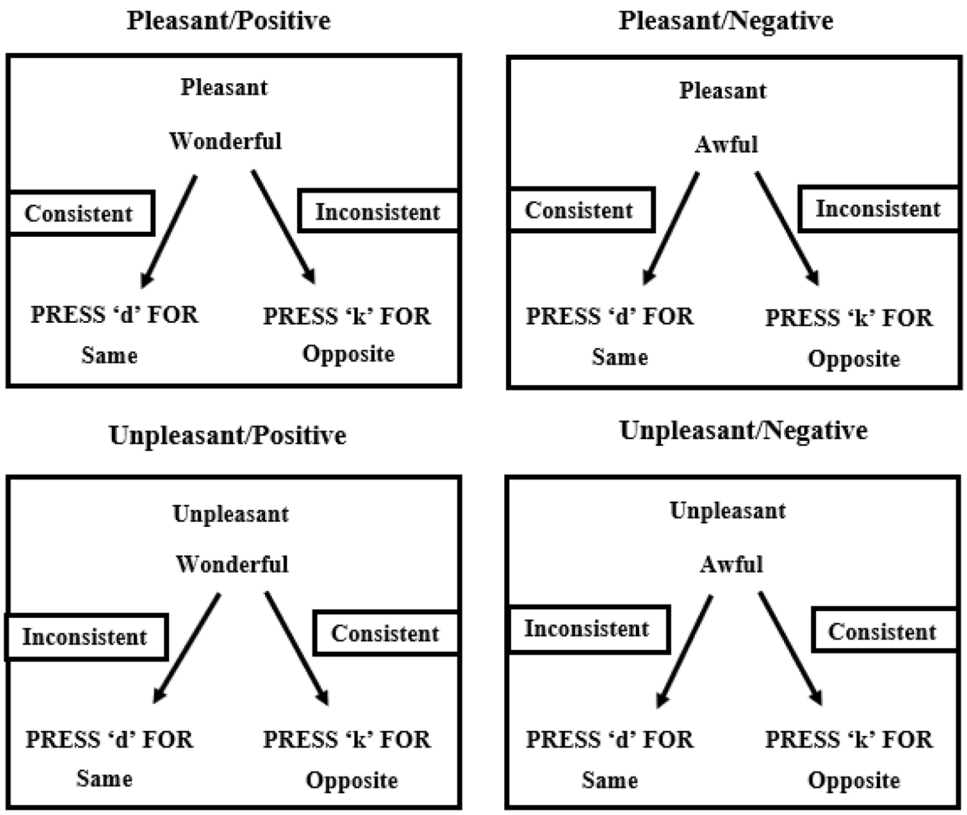

Fig. 2 Graphic representation of Four IRAP trial-types for the C_{rel} IRAP. *Note.* Similar format was used for the RCI-IRAP, except that the response options were different—see in text.)

two potential rules of the current study were as follows: "Pleasant is Positive. Unpleasant is Negative." or "Pleasant is Negative. Unpleasant is Positive." Participants were advised that depending on the rule presented, they were to respond in a manner either consistent with the English language (i.e., when the rule stated that "Pleasant is Positive. Unpleasant is Negative.," participants were to use the appropriate response option to affirm that relation) or inconsistent with the English language (i.e., when the rule stated that "Pleasant is Negative. Unpleasant is Positive.," participants were to affirm that relation with the appropriate response option). The presentation of the "rule" was alternated each block, creating "consistent" and "inconsistent" blocks.

It was emphasized to participants that they should aim to respond as quickly and as accurately (i.e., as designated by the rule) as possible throughout the experiment. The reasoning for this was explained to participants only after the experimental process was over. Participants were advised that only a response deemed to be in accordance with the rule would allow them to progress to the next trial. When a "correct" response was input there would be a 400-ms interval where no stimuli were presented onscreen before the new trial began. When an "incorrect" response (i.e., not in accordance with the rule) was entered a red "X" would appear onscreen and remain there until the designated response was entered. A red exclamation mark would appear onscreen if the participant failed to respond within 2,100 ms. This mark would remain onscreen until the participant responded. Once all 24 trials were completed, participants were asked to hit the space bar to continue to the next block of trials. Upon completion of all six test blocks, participants were notified to alert the researcher via an onscreen message.

The experimenter was present to provide initial instruction and describe the procedure and sat adjacent to participants during practice blocks. Participants completed test blocks alone in a private and quiet space. Each participant was required to complete two IRAPs in one sitting. The IRAPs differed only in the type of response option employed: one with "same"/"opposite" (C_{rels}-IRAP) as response options and another with "right"/"wrong" (RCI-IRAP) as response options. Participants were randomly allocated to one of four experimental groups, which determined the order in which the two IRAPs and the "rule" would be presented. All groups had 10 participants ($n = 10$). Group 1 completed the C_{rels}-IRAP first with the consistent relations "rule" first. Group 2 also completed the C_{rels}-IRAP first but with inconsistent relations "rule" first. Groups 3 and 4 completed the RCI-IRAP first, group 3 with consistent relations "rule" first and group 4 with inconsistent relations "rule" first (see Table 1 for tabular representation of experimental groups).

Table 1 A tabular representation of the four experimental groups

Group	Response Option Order	Block Order
1	C_{rels}-IRAP first	Consistent relations first
2	C_{rels}-IRAP first	Inconsistent relations first
3	RCI-IRAP first	Consistent relations first
4	RCI-IRAP first	Inconsistent relations first

Results

Data Preparation

The primary datum recorded by the IRAP was response latency. This is defined as the time in milliseconds that elapsed between the onset of a trial and the input of a correct response by a participant. In line with previous analyses of IRAP data, the response latency data for each participant were transformed into *D*-IRAP scores to control for the potential individual variations of responding, which may confound when analyzing between group differences (see Barnes-Holmes et al., 2010a, b, for a detailed description of this data transformation process). In cases where participants exceeded a response latency of 2,100 ms or who fell below 75% in accuracy on just one test block, analyses were conducted on the remaining two pairs of test blocks (as per Nicholson & Barnes-Holmes, 2012). That is, the *D*-IRAP score for that participant was recalculated following the removal of the test block pair that did not reach the required criteria. Ten sets of participant data in the current study underwent this treatment prior to analysis. If a participant failed to reach criteria across two or more test block pairs, her or his entire dataset was removed from analysis. Confidence intervals for all statistical analyses were set at 95%.

Data Analysis

The resulting overall *D*-IRAP scores for both IRAPs in this study indicated that participants more rapidly affirmed consistent relations (e.g., pleasant–positive) over inconsistent relations (e.g., pleasant–negative; see Fig. 3 for graphic representation). In particular, the overall mean *D*-IRAP score for the C_{rels}-IRAP was .24 ($SD = .27$) and for the RCI-IRAP was .11 ($SD = .24$). This suggests that participants responded with a bias favoring preexperimentally learned relations. Thus, the expected IRAP effect was detected in participant for both IRAPs. The mean overall *D*-IRAP scores for each response option type (C_{rels}-IRAP and RCI-IRAP) are presented in Fig. 3. This analysis revealed a significant main effect for response option type, which suggests that there was a difference between participant responding on the C_{rels}-IRAP and RCI-IRAP: Wilk's Lambda = .86, F (1, 36) = 6.05, $p = .02$, $\eta_p^2 = .14$.

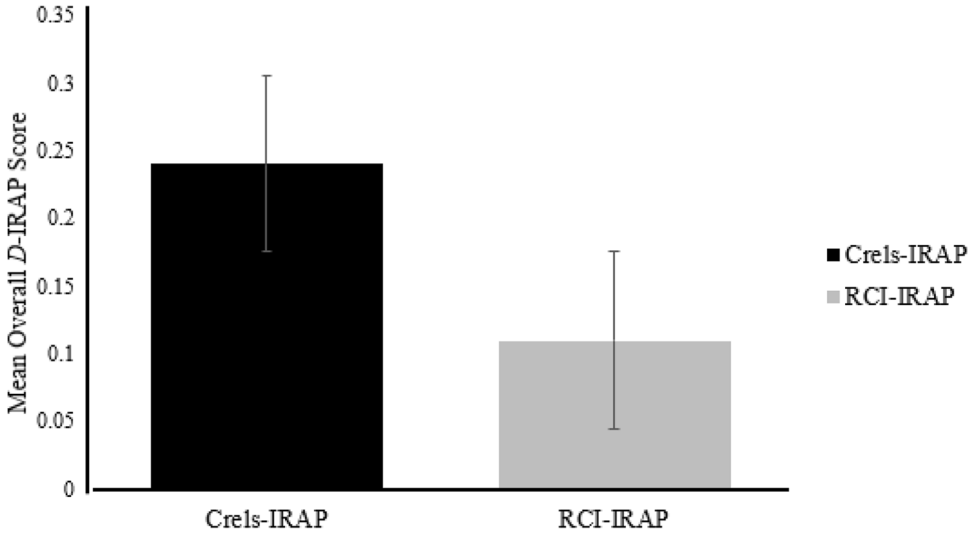

Fig. 3 Bar graph with error bars representing overall *D*-scores for both IRAPs

A mixed between within 2 × 2 × 2 × 4 analysis of variance (ANOVA) was conducted on participant *D*-IRAP scores to assess the impact of response option type and their order of presentation on participant performance across the four IRAP trial-types. The type of response options used (i.e., C_{rels}-IRAP or RCI-IRAP), the order in which the two different IRAPs were completed (i.e., C_{rels}-IRAP first or RCI-IRAP first), and the order of trial blocks (i.e., consistent or inconsistent trial-blocks first) served as the between-participants independent variables (IVs). The within-participants IV was IRAP trial-type (i.e., the four trial-types). The dependent variable (DV) was *D*-scores. No order effects in this analysis were statistically significant (all *p*'s >.16).

A significant main effect was detected for IRAP trial-type across both IRAPs: Wilk's Lambda = .37, F (3,34) = 19.68, p <.005, η_p^2 = .64. The mean *D*-IRAP scores for each of the four trial-type conditions across both IRAP types (C_{rels}-IRAP and RCI-IRAP) are presented in Tables 2 and 3.

Eight 1-sample *t*-tests were conducted to examine the strength of responding for each of the four trial-types for participants in both IRAP conditions. In both the C_{rels}-IRAP and RCI-IRAP conditions, *D*-IRAP scores were statistically significant relative to zero for the pleasant–positive and pleasant–negative trial-types. The unpleasant–positive trial-type in the C_{rels}-IRAP and the unpleasant–negative trial-type in the RCI-IRAP also produced statistically significant *D*-IRAP scores relevant to zero (see Tables 2 and 3). One sample *t*-test results for the C_{rels}-IRAP were as follows: pleasant–positive (M =.47, SD =.42 F (39) =7.19, p <.001); pleasant–negative (M = .19, SD = .39, F (39) = 3.1, p = .00); unpleasant–positive (M = .21, SD =.48, F (39) = 2.82, p =.01); unpleasant–negative (M =.08, SD = .36, F (39) = 1.38, p = .18). One sample *t*-test results for the RCI-IRAP were as follows: pleasant–positive (M = .31, SD = .30, F (39) = 6.64, p <.001); pleasant–negative (M =.13, SD = .36, F (39) = 2.2., p = .03); unpleasant–positive (M =.12, SD = .45, F (39) = 1.67, p = .104); unpleasant–negative (M = -.13, SD = .38, F (39) = -2.17, p = .04). A graphic representation of the differences in *D*-scores for the four IRAP trial-types on both IRAPs is shown in Fig. 4.

Table 2 Statistical significance (*p < .05) for the 4 IRAP trial-types in the C_{rels}-IRAP, with mean D-IRAP scores per trial-type, Standard Deviations (SD), F, and P Values Presented

	C_{rels}-IRAP			
Trial-Type	*Mean*	*SD*	*F*	*P* value
Pleasant–Positive	.47*	.42	F (39) = 7.19	< .001
Pleasant–Negative	.19*	.39	F (39) = 3.1	.004
Unpleasant–Positive	.21*	.48	F (39) = 2.82	.008
Unpleasant–Negative	.08	.36	F (39) = 1.38	.18

Table 3 Statistical significance (*p < .05) for the 4 IRAP trial-types in the RCI-IRAP, with mean D-IRAP scores per trial-type, Standard Deviations (SD), F, and P Values Presented

	RCI-IRAP			
Trial-Type	*Mean*	*SD*	*F*	*P* value
Pleasant–Positive	.31*	.30	F (39) = 6.64	< .001
Pleasant–Negative	.13*	.36	F (39) = 2.2	.03
Unpleasant–Positive	.12	.45	F (39) = 1.67	.104
Unpleasant–Negative	-.13*	.38	F (39) = -2.17	.04

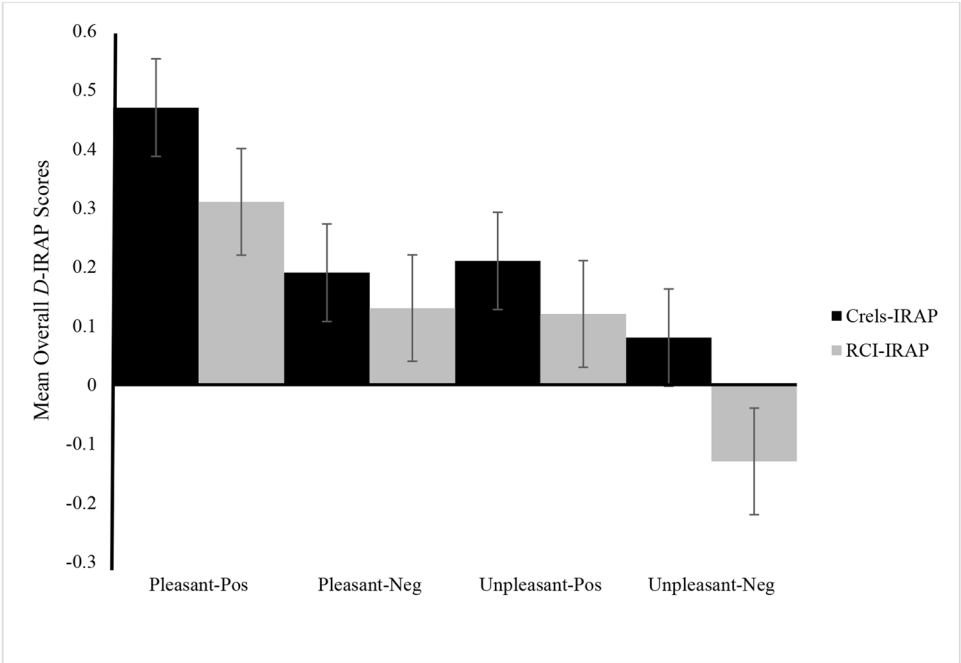

Fig. 4 *D*-scores (with error bars) for 4 individual trial-types on both IRAPs

Discussion

Results from $N = 40$ participants demonstrated that across both IRAPs participants responded faster, on average, when affirming relations consistent with those thought to be learned preexperimentally (e.g., pleasant–words–positive/unpleasant–words–negative) compared to relations inconsistent with prelearned relations (i.e., the IRAP effect was evident in responding on both IRAPs). There was a statistically significant difference between the strength of the IRAP effect across the two IRAPs. In particular, it was found that the IRAP effect was greater for the C_{rels}-IRAP compared to the RCI-IRAP.

A statistically significant main effect was also detected for IRAP trial-type, suggesting that participant responding differed across trial-types in both IRAPs.

Taken overall, the findings of the current research are in line with that of Maloney and Barnes-Holmes (2016) and Maloney et al. (2020). However, unlike results reported by those authors, there were no order or interaction effects detected in this study. The results presented here suggest that the type of response options used in IRAP research may have an impact on the strength of the IRAP effect produced. As such, the current findings are consistent with the theoretical distinction made between the function of C_{rels} and RCIs (Hayes & Barnes, 1997). Although not conclusive, the implications are that certain IRAP response options should not be assumed to be functionally equivalent with C_{rel} response options and that the use of RCIs in the IRAP may inadvertently affect participant responding. Future research is necessary to further explore such potential difference in function. For example, replication of this study, or of previous research in this line, may be warranted for extended systematic analysis and replication of effects, so that conclusive recommendations may be provided to IRAP researchers regarding the use of C_{rels} and RCIs as response options. Also, it remains unclear as to why there were no order effects found in this study, which was inconsistent with previous research (Maloney et al., 2020; Maloney & Barnes-Holmes, 2016). This is another matter that may benefit from further empirical investigations, to elucidate conditions under which order effects are found for type of response options used, or for trial-block presentation when C_{rels} or RCIs are employed as response options.

Findings for both IRAPs in the current research may be amenable to an interpretation using the DAARRE model (Finn et al., 2018) and with reference to the STTDE. The approach predicts that participants may respond faster on average to affirm the trial-type with greater coherence (i.e., in the current case, pleasant–positive) compared with the three remaining trial-types (i.e., pleasant–negative, unpleasant–positive, and unpleasant–negative), thus producing a statistically significant difference (the IRAP effect) for the dominant single trial-type (pleasant–positive) across both IRAPs. The positivity of the trial-type (i.e., requires affirmation, see "plus +" versus "negative –" signs in Fig. 1) may enhance coherence also (Finn et al., 2018). The DAARRE model may further suggest that the IRAP trials presenting pleasant–positive–same (i.e., the C_{rels}-IRAP) had greater coherence than the pleasant–positive–right trial-type (i.e., the RCI-IRAP), and this could have influenced the difference in IRAP effect between

the two IRAPs. In particular, the C_{rels}-IRAP may have a greater IRAP effect because it presented relational patterns (e.g., coordination relations) that were readily coherent to participants, whereas, for example, pleasant–positive–right (RCI-IRAP) may have had less coherence.

At this point it may be germane to note that equivalence coordination relations have been researched in multiple studies using the terms "same"/"different," whereas RCI terms ("true"/"false," "accurate"/"inaccurate," "right"/"wrong") derived from natural language may appear plausibly similar in function, yet under closer research scrutiny may not cohere relationally with other IRAP stimuli in the manner that the IRAP was designed to examine. In actuality, the terms "true"/"false" have been more commonly used in IRAP research examining IRAP effects in socially sensitive domains, compared to "accurate"/"inaccurate," "right"/"wrong"; nonetheless, the latter terms have served to highlight the potential importance of terms used as response options in IRAP research applications. The terms "right"/"wrong" used in the current research were selected to address a limitation in previous research (Maloney et al., 2020), in which the similarity of the terms "accurate"/"inaccurate" in rapidly presented IRAP trials, could have exerted unwarranted influence.

To conclude, the current study has added to the growing base of empirical investigations examining the functionality of C_{rels} versus RCIs and their use as response options in the IRAP. Consistent with previous research (Maloney et al., 2020; Maloney & Barnes-Holmes, 2016), and supporting theoretical distinctions proposed by RFT (Hayes et al., 2001), the results presented here indicate that the type of response options employed in the IRAP may affect participant responding. These and other technical aspects of the IRAP will require further and ongoing investigations to increase the precision of the program for use in assessment and applications involving relational responding. Further, it is suggested that C_{rels} and RCIs may have different functions and, thus, produce different patterns of responding in certain contexts. For IRAP researchers examining participants' relational response bias, the implications are that careful consideration should be given to selection of stimuli to use for IRAP response options.

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Data Availability All data generated or analyzed during this study are included in this article and its supplementary information files.

Declarations

Conflict of Interest There was no conflict of interest for any of the authors.

Consent to Participate The study was approved by the Research Ethics Committee at National University of Ireland Maynooth. Informed consent was obtained for all participants. The study was performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments.

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