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The Comprehensive Infrequency/Frequency Item Repository (CIFR): An online database of items for detecting careless/insufficient-effort responders in survey data

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ABSTRACT

A promising method for detecting careless or insufficient effort (C/IE) responders is the infrequency/frequency-item method. Infrequency items are items that should be endorsed by almost no one (e.g., “I like being frustrated”) and frequency items are items that should be endorsed by almost everyone (e.g., “I keep some of my thoughts to myself”). Participants are flagged as C/IE responders if they tend to agree with the infrequency items and tend to disagree with the frequency items. Here, we introduce the *Comprehensive Infrequency/Frequency Item Repository* (CIFR)—an online database of 660 infrequency/frequency items. The purpose of CIFR is to provide researchers with a tool for selecting infrequency/frequency items that are not only valid but also match the content of the other items in their surveys. An initial validation effort based on 1166 participants indicated that most of the infrequency items in CIFR are, in fact, infrequent, and most of the frequency items in CIFR are, in fact, frequent. Although additional validation work is necessary, the present results indicate that CIFR can be a valuable tool for researchers who wish to ensure the quality of their data.

1. Introduction

A well-known adage in computer science—and increasingly psychology—is “garbage in, garbage out” (GIGO). Namely, if what you put into a program is garbage, what you get out of the program will also, invariably, be garbage. Among personality psychologists, this principle is often discussed in terms of the quality of one's items (Westen & Rosenthal, 2005) or the quality of one's models (Kline, 2016; Long, 1983), but an equally important consideration is the quality of one's data. The inclusion of low-quality responders in one's data can artificially increase observed effect sizes (Credé, 2010; Huang et al., 2015b), artificially decrease observed effect sizes (Hough et al., 1990; Oppenheimer et al., 2009), and create illusory factors in unidimensional data (Schmitt & Stults, 1985; Woods, 2006).

There are a number of methods that researchers can use to detect low-quality—or, as we will refer to them here, “careless or insufficient effort” (C/IE)—responders (see Curran, 2016). One promising (but often underutilized) approach is the use of infrequency/frequency scales. Infrequency/frequency scales include two types of items: *infrequency* items, which are meant to be endorsed by almost no one (e.g., “I have

never experienced jealousy”), and *frequency* items,¹ which are meant to be endorsed by almost everyone (e.g., “I like to spend my time doing things I enjoy”). Participants are flagged as C/IE responders if they tend to *agree* with the infrequency items and tend to *disagree* with the frequency items.

The present study introduces a new searchable online database of infrequency/frequency items: the *Comprehensive Infrequency/Frequency Item Repository* (CIFR; cifr-project.org). The purpose of CIFR is to provide researchers with a freely-accessible source of infrequency/frequency items that are not only valid but similar in content to the other items in their surveys.

All else being equal, infrequency/frequency items should be subtle (see Curran, 2016), so as not to be immediately identifiable as attention-check items to C/IE responders. One determinant of item subtlety is the content of the items. For example, items that include proper nouns (e.g., “I have sailed across the *Atlantic Ocean* in a hot air balloon”; Lynam et al., 2011), numbers (e.g., “I can speak 30 languages fluently”; Benning et al., 2018), unusual punctuation (e.g., “I lie 100 % of the time”; Dunn et al., 2018), and uncommon words (e.g., “I am interested in pursuing a degree in *parabanjology*”; Huang et al., 2015a) are, presumably, less

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¹ A discussion of the use of the phrase “frequency item” is provided in the Supplementary material.

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subtle than items that avoid these features. However, a second, often overlooked, determinant of item subtlety is the degree to which the infrequency/frequency items *fit* with the other items in a given survey. As an example, the item “I have never brushed my teeth” (Meade & Craig, 2012) may be subtle when included in a survey about personal hygiene but conspicuous when included in a survey about social media use. Therefore, if a researcher wants to maximize the subtlety of their infrequency/frequency items, they should ensure their chosen infrequency/frequency items thematically match the other items in their survey.

Unfortunately, for many survey topics, this is not currently possible. The extant pool of infrequency/frequency items only captures a relatively small portion of the possible content that can be assessed in the context of a survey. There are, for example, infrequency/frequency items related to dietary habits (e.g., “I try to eat something almost every day”; Lynam et al., 2011), zoology (e.g., “A dolphin is an animal”; Curran & Hauser, 2019), academic interests (e.g., “My favorite subject is agronomy”; Maniaci & Rogge, 2014), emotions (e.g., “I have never been mad before”; Dunn et al., 2018), and geography (e.g., “Mexico is our northern neighbor”; Beach, 1988), but few items related to politics, morality, art, religion, online behaviours, mental illness, creativity, and illicit drug use.

By expanding the number of currently available infrequency items from approximately 82 to approximately 328 and the number of currently available frequency items from approximately 42 to approximately 332, CIFR promises to drastically expand the breadth of content covered by infrequency/frequency items and, as a result, allow researchers to select infrequency/frequency items that thematically align with the content of the other items in their surveys. However, before researchers begin using these items, it is necessary to demonstrate that the infrequency items included in CIFR are, in fact, infrequent, and the frequency items included in CIFR are, in fact, frequent. That is what the present study aims to do.

2. Method

2.1. Participants and procedures

Nine hundred seventeen undergraduate students were administered 220 randomly selected items from CIFR. Given we were interested in the infrequencies and frequencies of these items among non-C/IE responders, we excluded participants who failed six or more of the 10 items from the *Instructed Response Item Set* (IRIS)² embedded in the survey (e.g., not selecting “agree” when instructed to respond “agree” to the item) ($n = 67$), as well as those who indicated that they were not paying attention (i.e., those who responded to a question asking if their data should be discarded by selecting “Yes—my survey SHOULD be thrown out”) ($n = 32$).³ After exclusions, the sample included 818 participants (65.65 % women; 29.34 % men; M age = 19.65; SD age = 2.56).

In order to increase our sample size and improve the generalizability of the dataset, we asked each participant to nominate three people whom they believed would be willing to complete an abridged version of the survey. The abridged version of the survey included a block of 22 infrequency/frequency items. After completing the block, nominees were asked whether they would be willing to complete an additional block of 22 items. This was repeated until the nominees indicated that they were not willing to complete any more items or until they had completed ten blocks of items.⁴

Four hundred ninety-six nominees responded to the survey. After excluding nominees who failed over half of the IRIS items they were presented with ($n = 122$) and those who indicated that they were not paying attention ($n = 26$), the sample included 348 nominees (60.06 % women; 36.49 % men; M age = 33.91; SD age = 17.09).⁵ We combined the data from the nominees with the data from the undergraduate students for all analyses reported here.⁶ On average, each item was rated by 305 participants.

2.2. Materials

CIFR (cifr-project.org) includes 124 items collated from Beach (1988, see also personal communication, May 6, 2021), Benning and colleagues (2018), Curran and Hauser (2019), Dunn and colleagues (2018), Fervaha and Remington (2013), Hargittai (2009; see also Curran & Hauser, 2019), Huang and colleagues (2015a), Kay (2021), Kay (2023), Lilienfeld and Widows (2005), Lynam and colleagues (2011), Maniaci and Rogge (2014), and Meade and Craig (2012); 5 items based on work from Forer (1949), Paulhus (1988), and Snyder (1974); and 531 bespoke items written by the authors.⁷ Most of the bespoke items were developed through personal brainstorming sessions conducted by the first author after reviewing popular measures from a variety of different fields. Participants responded to all items on a five-point Likert scale ($-2 =$ “Strongly disagree”; $2 =$ “Strongly agree”).

2.3. Results

The mean endorsement for all 660 items included in CIFR can be found on cifr-project.org. For the most part, participants were less likely to agree with the infrequency items ($M = -1.50$, $SD = 0.41$) than they were to agree with the frequency items ($M = 1.41$, $SD = 0.33$), $d = -7.89$, $t(628.48) = -101.05$, $p < .001$ (Fig. 1).⁸

Among the most infrequent infrequency items were “I can speak 30 languages fluently” ($M = -1.95$, $SD = 0.24$) (Benning et al., 2018), “I have been to the moon” ($M = -1.93$, $SD = 0.29$) (Dunn et al., 2018), and “I think it should be against the law to listen to music” ($M = -1.92$, $SD = 0.32$) (Kay, 2021) (Table 1). Some infrequency items did not perform as well, however. Participants tended, on average, to *agree* with the items “Sometimes I think people born in other countries like my country more than people born in my country” ($M = 0.43$, $SD = 1.19$) (New), “I appreciate it when people give me their divided attention” ($M = 0.35$, $SD = 1.47$) (Beach, 1988), “Nowadays, divorce is more common than marriage” ($M = 0.10$, $SD = 1.09$) (New), and “I am fluent in combinatorial English” ($M = 0.07$, $SD = 1.13$) (Curran & Hauser, 2019). The reason for the relative frequency of the first item is not entirely clear but may be due to dissatisfaction on the part of the participants with the direction the US is headed and a corresponding belief that people born outside of the US do not feel this same dissatisfaction. The relative frequency of the second item may be due to the use of the phrase “divided attention”; participants may have mistakenly read the item as “I appreciate it when people give me their *undivided* attention” because the phrase “undivided attention” is far more common than the phrase “divided attention”. The relative frequency of the third item may be due to the fact that divorce rates have increased over the last 60 years.

⁵ Additional demographic information about the nominees is provided in the Supplementary material.

⁶ A version of the CIFR portal that includes only data from the undergraduate students (cifr-project.org/portal_hsp.html) and a version of the CIFR portal that includes only data from the participants nominated by the undergraduate students (cifr-project.org/portal_nom.html) are available on the CIFR website.

⁷ A table detailing the number of infrequency and frequency items from each source is provided in the Supplementary material.

⁸ Reference values for infrequent and frequent items are provided in the Supplementary material.

² A description of the IRIS is provided in the Supplementary material.

³ The results were largely the same regardless of whether participants were excluded or not (see the Supplementary material).

⁴ Most of the participants elected to respond to 22 (20.69 %), 44 (35.63 %), or 66 (18.68 %) items ($M = 61.70$; $SD = 36.91$).

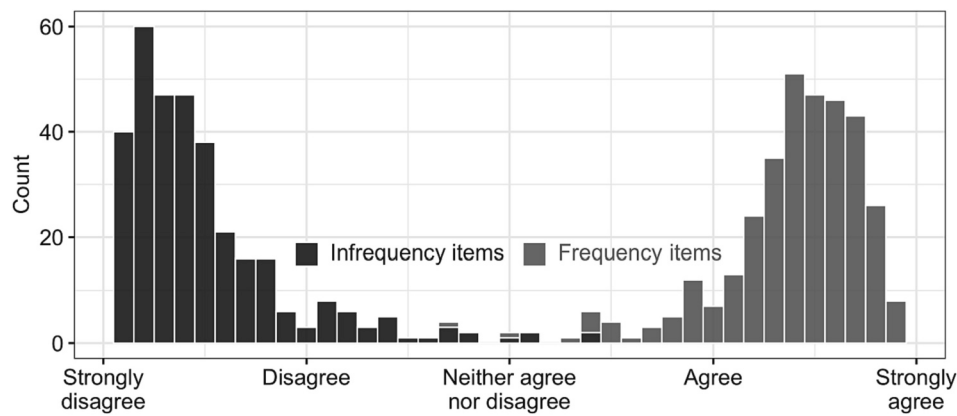


Fig. 1. Histogram of the average responses to the infrequency and frequency items in CIFR.

Table 1
The ten most infrequent infrequency items from CIFR.

Citation	Item	M	SD
Benning et al. (2018)	I can speak 30 languages fluently.	-1.95	0.24
Dunn et al. (2018)	I have been to the moon.	-1.93	0.29
Kay (2021)	I think it should be against the law to listen to music.	-1.92	0.32
Kay (2023)	I don't have a first name.	-1.92	0.27
Meade and Craig (2012)	I have never brushed my teeth.	-1.91	0.38
Dunn et al. (2018)	I am ninety-nine years old.	-1.91	0.31
Huang et al. (2015a)	I have never used a computer.	-1.91	0.38
Kay (2023)	Access to clean water should be restricted to certain classes of people.	-1.91	0.42
Kay (2023)	I have never cried.	-1.90	0.35
Huang et al. (2015a)	I eat cement occasionally.	-1.90	0.37

Participants may *feel* divorce is more common than marriage (while still knowing that marriage is more common than divorce). Finally, the relative frequency of the fourth item may be due to the fact that it is an “uncertain truth” (see Curran & Hauser, 2019)—an item that could be true depending on the meaning of some unknown word or concept. Participants may have simply ignored the word ‘combinatorial’ and agreed with the item because they are, in fact, “fluent in English.”

Among the most frequent frequency items were “Surgeons should be required to have a medical degree” ($M = 1.88, SD = 0.41$) (New), “I know the months of the year” ($M = 1.86, SD = 0.40$) (Dunn et al., 2018), and “Humans eat food” ($M = 1.86, SD = 0.35$) (Curran & Hauser, 2019)

Table 2
The ten most frequent frequency items from CIFR.

Citation	Item	M	SD
Kay (2023)	Surgeons should be required to have a medical degree.	1.88	0.41
Dunn et al. (2018)	I know the months of the year.	1.86	0.40
Curran and Hauser (2019)	Humans eat food.	1.86	0.35
Kay (2023)	I've graduated from high school.	1.86	0.42
Benning et al. (2018)	I know the name of my mother.	1.86	0.45
Kay (2023)	I breathe every day.	1.86	0.47
Dunn et al. (2018)	I know how to count to ten.	1.85	0.54
Dunn et al. (2018)	I eat food.	1.85	0.44
Dunn et al. (2018)	I know how to spell my name.	1.85	0.58
Kay (2023)	It would bother me if I knew a centipede was living in my ear.	1.85	0.59

(Table 2). As with the infrequency items, some of the frequency items did not perform as expected. On average, participants tended to *disagree* with the items “I like to eat dinner at the same every day” ($M = -0.31, SD = 1.08$) (New) and “I do not accept the statements of others without satisfactory proof” ($M = -0.04, SD = 1.00$) (Forer, 1949). The relative infrequency of the first item could be due to the fact that most people—especially undergraduate students—don't actually like to eat dinner at the same time every day. In other words, the authors may have mistakenly assumed that their preferences (i.e., liking to eat dinner at the same time every day) would be shared by the participants. A second possibility is that participants responded based on whether they actually eat dinner at the same time every day (rather than if they *prefer* to eat dinner at the same time every day). Potentially, some of the participants prefer to eat dinner at the same time every day but are unable to do so because of their other responsibilities. The relative infrequency of the second item is a bit harder to explain. It may be due to self-insight on the part of the participants—they may realize that people, including themselves, accept many statements without satisfactory proof—but it is also possible that some portion of the sample simply missed the word ‘not’ in the item and read it as “I *do* accept the statements of others without satisfactory proof’.

3. Discussion

The purpose of the present project was to introduce CIFR (cifr-project.org)—an online database containing 660 infrequency/frequency items. To provide initial estimates of the relative infrequencies and frequencies of those 660 items, we conducted an online survey that collected data from 1166 participants. Overall, the results demonstrated that the vast majority of items classified as infrequency items by CIFR are, in fact, infrequent (98.48 %) and the vast majority of items classified as frequency items by CIFR are, in fact, frequent (99.40 %). As such, CIFR appears to contain items that are not only suitable for including in surveys on a wide range of topics but also valid for detecting C/IE responders.

There does, however, remain three important questions that should be addressed. First, how many infrequency/frequency items should a researcher choose from CIFR? Second, how should researchers go about selecting items from CIFR? And, third, what cut-off score should researchers use to flag C/IE responders when using items from CIFR?

Turning to the first question, we recommend researchers include one infrequency item and one frequency item for every 40 non-infrequency/frequency items in their surveys. Moreover, for surveys shorter than 40 items, we recommend including at least two infrequency items and two frequency items.

The purpose of including this many items is to protect researchers from false positives resulting from participants who genuinely agree with some set of the infrequency items and/or genuinely disagree with

some set of the frequency items. For example, if 10 % of participants genuinely agree with the item “I have travelled around the world twenty three times” (Dunn et al., 2018) and 10 % of participants genuinely agree with the item “I sleep less than one hour per night” (Meade & Craig, 2012), including both of these items will effectively reduce the number of participants inaccurately flagged as C/IE responders to 1 % (assuming these items are orthogonal). Reducing the false positive rate benefits researchers, as it means less data will be thrown out unnecessarily, and it benefits participants, as it means less of a chance of being excluded (and, in some cases, less of a chance of not being paid).⁹

The reason for including equal numbers of infrequency and frequency items is to allow researchers to detect C/IE responders on both ends of the response scale. Like many participants (Cronbach, 1946), C/IE responders gravitate towards the right-hand side of response scales (e.g., “agree” on a five-point Likert scale from “strongly disagree” to “strongly agree”) (Johnson, 2005). Researchers may, therefore, conclude that they only need to include infrequency items in their scales (e.g., Huang et al., 2015a). However, just because C/IE responders tend to gravitate towards the right-hand side of response scales, does not mean they *only* respond using the right-hand side of response scales. As a case in point, of 980 participants who provided the same response to ten or more items in a row on the IPIP-version of the NEO-PI-R (see Goldberg et al., 2006), 30.71 % responded with “very inaccurate” or “moderately inaccurate” while 51.53 % responded with “very accurate” or “moderately accurate” (Johnson, 2005). Using only infrequency items would cause a researcher to miss that 30.71 % of responders.

In terms of the second question, we recommend researchers choose items that align with the content of the other scales in their surveys. For example, if a researcher is conducting a study on political ideology, they could use the item “I find that I have different political views than people who are on the opposite side of the political spectrum from me”; if they are conducting a study on personality, they could use the item “I’ve never disagreed with another person”; and, if they are conducting a study on generalized anxiety, they could use the item “I have never worried that I might be running late”. As noted in the introduction, matching the content of the infrequency/frequency items to the content of the other items in a survey should help make the infrequency/frequency items less easy to identify by C/IE responders.

We also recommend researchers choose infrequency items that are, on average, more infrequent and frequency items that are, on average, more frequent. For example, if a researcher is conducting a study assessing morality, we would recommend using the infrequency item “I would rather be known for killing a person than saving a person’s life” ($M = -1.83$, $SD = 0.48$) over the infrequency item “Surprise parties should be illegal because they involve deceiving innocent people” ($M = -1.54$, $SD = 0.80$) because the former is more infrequent than the latter. This helps ensure that participants who endorse the item are doing so because they are actually not paying attention rather than because they simply hold an uncommon belief.

Turning to the third question, an appropriate cut-off score depends on a number of factors, including the specifics of the population being examined and the design of the study. Our general recommendation would be to reverse score the frequency items and average them together with the infrequency items to produce an index of C/IE responding. From that point, researchers could produce a histogram of the C/IE responding scores. Ideally, there would be two modes: one to the left, representing careful and sufficient-effort responders, and one to the right, representing careless and insufficient-effort responders. In this case, the cut-off to use would be the value that best separates these two

groups.

We do, however, recognize that some researchers would prefer a general “rule-of-thumb” cut-off value. If we had to recommend one such value, we would suggest flagging participants with scores equal to or greater than zero. A score of zero is equivalent to incorrectly selecting “strongly agree” to all of the infrequency items and correctly selecting “strongly agree” to all of the frequency items (or, conversely, correctly selecting “strongly disagree” to all of the infrequency items and incorrectly selecting “strongly disagree” to all of the frequency items). As such, a cut-off value of equal to or greater than zero would, at the minimum, flag participants who selected the same response to every item on a survey and, at the maximum, flag participants who strongly agreed with all of the infrequency items and strongly disagreed with all of the frequency items. This will miss a number of C/IE responders, but we side with other researchers (e.g., Curran, 2016) who believe it is better to miss a C/IE responder or two than risk removing a valid responder.

3.1. Limitations and future directions

Despite the clear promise of CIFR, the present investigation did have several limitations that will need to be addressed in future work. First, the results of our study indicated that many of the infrequency items in CIFR are, indeed, infrequent and many of the frequency items in CIFR are, indeed, frequent. For many of these items, this has been the full extent of their validation. Future efforts should be undertaken to further establish the validity of these items, such as by examining them in relation to other indices of C/IE responding (see Curran, 2016).

Second (and relatedly), the validation work conducted here had participants respond to infrequency/frequency items intermixed with other infrequency/frequency items rather than with items drawn from content-matched scales. Although we believe administering the items together was appropriate for this initial validation effort, it may have, nevertheless, biased the results. For instance, after responding to multiple infrequency/frequency items in a row, some participants may have concluded that the present study was pointless and, consequently, decided to withhold further effort. Given that the majority of the infrequency and frequency items tested in the present study were endorsed infrequently and frequently, respectively, this doesn’t appear to have occurred at any large scale. Additionally, participants may have actually slowed down and responded to these items more carefully than they would have otherwise because they found the experience of responding to the items so unusual. Nonetheless, it is important to highlight that the estimates produced here may differ from those produced in a more naturalistic setting.

Third, all of the participants in the present sample are from a Western, Educated, Industrialized, Rich, and Democratic (WEIRD, Henrich et al., 2010) society, and the majority of the participants were undergraduate students. This is a problem, as the relative frequencies of many of these items may vary across countries, cultures, and groups. For example, the item “I’ve never met a person named Jennifer” may be an infrequency item for people from the US but a frequency item for people from China. Likewise, the item “I am a university student” would presumably be a frequency item for undergraduate students but an infrequency item for high school students. Future work will be needed to examine the cross-cultural, cross-national, and cross-group validity of the CIFR items.

Fourth, many of the items in CIFR are unlikely to be subtle except if used with a narrow set of scales. For example, the item “The graphite in pencils explains much of the declining fertility rates in our country” is unlikely to be subtle except if administered alongside a measure of conspiracist ideation (e.g., the *Belief in Conspiracy Theories Inventory*; Swami et al., 2011). We, therefore, strongly encourage authors to carefully consider the content of the items in their scales before incorporating any infrequency/frequency items from CIFR in their surveys.

Finally, despite drastically increasing the breadth of content covered

⁹ Although the decision to exclude or not exclude participants should never be taken lightly, this is especially true when compensation is involved. We believe researchers should default to compensating participants unless there is unambiguous and manifold evidence that the participant engaged in C/IE responding.

by infrequency/frequency items, there are still some subjects that are not represented in the CIFR item pool. For example, there are few items in the pool related to prejudice. Fortunately, CIFR is not intended to be a static database; it is intended to grow and evolve over time. Items related to prejudice (e.g., “Prejudiced people always seem to prejudge other people and groups”) and other underrepresented topics will be added to CIFR in the next stages of its development.

4. Conclusion

In the present study, we introduced and provided initial validation for CIFR—an online database containing 660 infrequency/frequency items. Although additional work will need to be done to further validate and expand CIFR, we believe that, even in its current form, it is a useful resource for any researcher who wishes to ensure the quality of their data.

CRedit authorship contribution statement

Cameron S. Kay: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Data curation, Writing – original draft, Writing – review & editing, Visualization, Project administration. **Gerard Saucier:** Writing – review & editing, Supervision.

Data availability

Data will be made available on request.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.paid.2022.112073>.

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