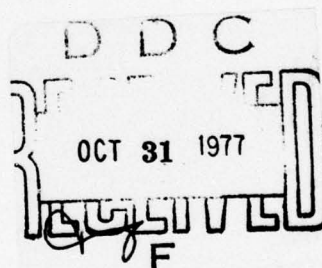# DIRECT MEASURES OF AVAILABILITY AND JUDGMENTS OF CATEGORY FREQUENCY

DECISION RESEARCH • A BRANCH OF PERCEPTRONICS

Ruth Beyth-Marom
Baruch Fischhoff

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DIRECT MEASURES OF AVAILABILITY AND JUDGMENTS OF CATEGORY FREQUENCY

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March 1977

See 1413

SUMMARY

Background

        For many types of decisions, it is important to know
how many people or objects there are in a particular category
(e.g., the number of possible candidates for a particular
position, or the number of options at an opponent's disposal).
In the absence of accurate statistical data, the decision
maker must rely on his or her own judgment for these estimates.
In earlier ARPA-sponsored work, Tversky and Kahneman proposed
that people make such estimates with the aid of the
"availability heuristic;" a category is judged to be large to
the extent that category members are easy to imagine or recall.

        In a series of experiments, Tversky and Kahneman showed
that although availability of examples is often a valid
indicator of true category size, it can lead to predictable
errors when factors like vividness affect availability. In
none of their experiments, however, was availability measured
directly. The present studies attempted to fill that gap.

Findings

        Although the availability hypothesis was supported by
some of our results, it was also found to be an
oversimplification of the process of estimating category size.
Specifically, for a situation in which category instances were
easily retrieved, availability was a better predictor of
category size estimates than was actual category size. In
that situation, exhaustively listing instances in memory led
to improved estimation. For a second task, however,
availability did not predict subjective estimates.

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Implications

Several theoretical and applied conclusions may be drawn from this study.

1. Availability is an important factor in category size estimation.

2. Research is needed on other factors that supplement or supplant availability in some situations. (Some speculations about these factors are advanced in the paper.)

3. If one is going to use the availability heuristic, it is best to use it intensively, that is, to work hard to exhaust one's memory for instances before making an estimate.

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TABLES

ACKNOWLEDGMENT

1. INTRODUCTION

Tversky and Kahneman (1973) have proposed that people evaluate "the frequency of classes or the probability of events by availability, i.e., by the ease with which relevant instances come to mind" (p. 207). In a series of nine studies they showed that although availability is correlated with ecological frequency, it is also affected by other factors and can, therefore, lead to systematic biases.

In only two of their nine studies, however, was availability measured. Experiments 1 and 2 gave subjects 7 seconds to estimate the total number of instances they would be able to produce from a particular category and then had them actually produce instances for a period of two minutes. Subjects' short-term estimates proved to be good predictors of their long-term production. In the remaining studies, plausible arguments were advanced for why particular manipulations should affect availability which should, in turn, produce biased estimates. Although the predicted biases were observed, availability was not directly measured.

The present investigation explores the use of a number of direct measures of availability in hope of attaining a better understanding of how the availability heuristic works.

2. METHOD

Thirty-six first-year Hebrew-speaking psychology majors participated in the present study as partial fulfillment of course requirements. The entire experiment was conducted in Hebrew. Each subject was tested individually in a soundproof room seated at a table beside the experimenter. A cassette tape recorder rested on the table with the attached microphone 20-30 cm away from the subject and recorded subjects' responses. The following instructions were read by the experimenter who throughout the experiment remained impassive:

> "In the present experiment we are interested in people's ability to retrieve items from their memory. In some of the questions you will be asked to retrieve and list various items; the more you retrieve, the better."

> "In the remainder of the questions you will be asked to give a numerical answer to questions whose precise answer you probably do not know. Therefore, we will ask you to give the numerical answer which seems to you most likely to be correct."

In the first part of the experiment, each subject performed two retrieval tasks, one dealing with names of countries and one with names of kibbutzim (communal settlements in Israel). The order of the two tasks was randomized over subjects. Instructions for those tasks were as follows:

> "There are some 140 countries in the world (240 kibbutzim in Israel), we will concentrate on countries (kibbutzim) whose names begin with one particular letter. We will give you one letter and you will be asked to list and simultaneously say aloud all the countries (kibbutzim) which you can recall whose names begin with that letter. When you feel that you can remember no more, tell me. Is everything clear?"

"Try to list all the names of the countries
(kibbutzim) whose names begin with the letter __.
START."

Subjects generally devoted about two or three minutes
to each retrieval task. After giving up, they were asked
whether they had remembered all of the possible instances.
After replying "No" (as all subjects did), each was asked,
"Of the 140 or so countries (240 or so kibbutzim) how many
do you think begin with this same letter?"

Three initial letters for countries and three for
kibbutzim were used. Letters were chosen so that the true
number of members in the categories varied fairly widely.
The letters used and the true number of members were, for
countries, "Aleph" (19), "Kuf" (12), and "Yud" (5); and for
kibbutzim, "Mem" (31), "Beit" (15), and "Hei" (8). One-third
of the subjects (12) produced instances and such "aided"
estimates for each of these categories. Following the two
retrieval and aided (after-production) estimation tasks, the
recorder was turned off and subjects were instructed in the
second, "unaided estimation" task.

"I will now allow you only 5 seconds to
estimate the number of countries or kibbutzim
whose names begin with a certain letter. I will
state the letter. Five seconds later, I will
point to you indicating that your time is up and
you will give me your estimate."

Each subject made unaided estimates for the two
country and two kibbutz letters for which he or she did not
produce instances. Thus, 12 subjects made unaided estimates
and the remaining 24 made aided estimates for each letter.

3.   RESULTS

The following information was derived from each subject's responses: (a) unaided (five-second) estimates of category size; (b) the time between the word "START" and production of the first instance; (c) the number of instances produced in the first five seconds (the period allotted for the unaided estimation task); (d) the number of instances produced overall; and (e) post-production (aided) estimates of category size. Summaries of these data appear in Table 3-1.

3.1   Countries

Comparing the top row of the table and row a reveals a substantial bias in unaided estimates of the relative sizes of the categories. In particular, the "Yud" category is judged to be considerably larger than "Kuf" ($Z = 2.72$, Mann-Whitney U Test), even though it is actually less than half the size. This reversal is, however, predicted by either measure of short-term availability (rows b and c). Subjects take half as long to produce the first instance of a "Yud" country and produce twice as many instances in the first five seconds. The availability explanation of the bias in estimates seems even more plausible when the instances included in the two categories are considered. The five "Yud" instances (Israel, Jordan, Japan, Greece, Yugoslavia -- all written in Hebrew with the same first letter) are much more familiar than the 12 "Kuf" instances (Cambodia, Cameroun, Canada, Columbia, Congo-Brazzaville, Congo-Kinshasa, Costa Rica, Cyprus, Cuba, Kenya, Korea, Qatar). However, although "Aleph" instances are less available than "Yud," by both short-term measures (rows b and c), "Aleph" is judged to be a more numerous

TABLE 3-1

PRODUCTION AND ESTIMATION DATA
COUNTRY AND KIBBUTZ CATEGORIES

Letter	Countries			Kibbutzim		
	Aleph	Kuf	Yud	Mem	Beit	Hei
Actual number in category	19	12	5	31	15	8
a. Median unaided (5-second) estimate of category size	15	7	11.7	29	23	10
b. Median time to produce first instance (in sec.)	1.9	2.9	1.5	4.5	5.7	5.8
c. Mean number of instances produced in first five seconds	1.5	1.1	2.0	0.5	0.4	0.6
d. Median number of instances produced	9.5	3.3	5	3.8	4	3
e. Median aided (after production) estimate	16	10	6.5	15	20	10

category (row <u>a</u>). Clearly, availability is not the only
determinant of judged numerosity.

After exhausting their memories for category instances,
subjects produced considerably more accurate estimates of
category size (row <u>e</u> vs. row <u>a</u>). This superior performance
suggests that at least some of the bias induced by relying
on the availability heuristic can be eliminated by using that
heuristic properly, i.e., by working hard to see how many
instances are in memory. Note, however, that the order of the
final estimates (row <u>e</u>) is not the order of the number of
instances produced (row <u>d</u>). Again factors other than
availability (at least as measured here) are at work.

3.2   <u>Kibbutzim</u>

Subjects' unaided estimates (row <u>a</u>) were generally
quite good. Differences in category availability (rows <u>b</u> and
<u>c</u>) were, however, so small here (none being statistically
significant) that it is hard to imagine them serving as the
basis of the discrimination shown in the estimates. In
contrast with the country task, exhaustive listing of
instances produced poorer estimates of category size (row <u>e</u>),
suggesting that hard work alone is not sufficient for accurate
estimation. Although the order of these final estimates was
the same as that of the number of instances produced (row <u>d</u>),
production differences were quite small.

4. DISCUSSION

The results indicate that where instances were easily available, with the country task, unaided estimates of category size were uncorrelated with actual size, but were correlated with two direct measures of availability: time to produce first instance and number of instances in the first five seconds. In this situation, exhaustively listing instances in memory lead to improved estimation. In fact that aided estimates of country category size do not correlate completely with total production (rows d and e) indicates that there must be other factors influencing frequency judgments.

For the kibbutz task, instances were not easily available; half our subjects were unable to produce any examples at all within five seconds. Here, short-term measures of availability (rows b and c) did not correlate with unaided estimates. The correlation between unaided estimates and actual category size in this situation must be taken as further evidence for the influence of factors other than ease of instance production on frequency estimates.

Further research is needed to identify these factors. We suspect that they will prove to be highly situation specific. Tversky and Kahneman suggested that direct knowledge of category size (or item frequency) may be stored in memory, a proposal also advanced by Underwood (1969). This seems unlikely with the unnatural categories used in this experiment. A more likely factor is knowledge of the

lexicographic structure of the language. For example,
subjects may have known that "Aleph" is a much more popular
initial letter than "Yud", a factor which could have
tempered their reliance on availability information in the
unaided task (rows a, b and c). Similar use of analytical
information might also explain the accuracy of the unaided
estimates in the kibbutz task, for there are more Hebrew
words beginning with "Mem" than with "Beit," and more with
"Beit" than with "Hei".

        Even unsuccessful attempts to produce instances may
be informative. Some kibbutz-task subjects reported that the
search process reminded them that there are many kibbutzim
with names of the form "Beit_____" ("House of _____,"
"Beit" being both the name of the letter and the word for
"house") or of the form "Ha ____" ("Ha" being the Hebrew
word for "the"), even though they were not able to produce
any specific instances. Quite possibly "Kuf" subjects in
the country task increased their frequency estimates
following the production of relatively few instances
because of a feeling that there were quite a few obscure
countries "in there" but unretrievable; "Yud" subjects in
the country task may have lowered their unaided estimates
because of the opposite feeling. Such information is
reminiscent of that reported in "tip of the tongue"
experiments (Brown & McNeill, 1966). If this sort of
information is to be considered an aspect of availability,
then that term should be expanded to include the "ease with
which instances almost come to mind."

        One subject for whom the instance-producing strategy
of availability estimation did seem relevant asked for an
extension of the five-second estimation period, begging,
"Just wait until I can think of at least one."

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7. AUTHOR(s) Ruth Beyth-Marom, Hebrew University, Jerusalem Baruch Fischhoff, Decision Research		8. CONTRACT OR GRANT NUMBER(s) N00014-76-C-0074,
9. PERFORMING ORGANIZATION NAME AND ADDRESS Decision Research A Branch of Perceptronics 1201 Oak Street, Eugene, Oregon 97401		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS ARPA Order No. 3052
11. CONTROLLING OFFICE NAME AND ADDRESS Defense Advanced Research Projects Agency 1400 Wilson Blvd. Arlington, Virginia 22217		REPORT DATE March 1977
		NUMBER OF PAGES 22
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) Office of Naval Research, Code 455 800 No. Quincy Street Arlington, Virginia 22217		15. SECURITY CLASS. (of this report) Unclassified
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18. SUPPLEMENTARY NOTES

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19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Estimation
Probability
Memory
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Tversky and Kahneman (1973) have proposed that people judge the numerosity of categories by the availability of category instances. The present study tests this hypothesis using several direct measures of availability for lexicographically defined categories (e.g., "How many countries are there beginning with the letter __?"). Although these availability measures were successful in predicting some estimates, including several judgment errors, the role of availability in frequency estimation appeared to be quite complex.

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20. (Continued)

A number of possible confounding factors are discussed.