

The Social Circle Heuristic: Fast and Frugal Decisions Based on Small Samples

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Abstract

Whereas reliance on information from one's proximal social environment for generalizing about the population has often been associated with erroneous judgments, this information is often valuable and can be exploited for making accurate inferences. The social circle heuristic is a judgment mechanism in which the content and structure of people's social networks are used for making inferences about frequencies in the population in a paired comparison task. Because the heuristic has a stopping rule, judgments generated by it will often be based on small samples sizes. In this paper we present experimental evidence that shows both that the social circle heuristic can compete with a more thorough strategy, and that people actually apply it.

Samples as Reflections of the Environment

Scarcity of information is one of the central properties of everyday decision making. For many judgment problems in the real world, neither direct knowledge of the to-be-judged values nor complete knowledge of all relevant facts that might help predict the correct value are available. Instead, inferences have to be made under uncertainty, based on information that is more or less predictive of the criterion. What processes underlie people's inferences in such situations? Recent approaches to judgment under uncertainty that acknowledge the bounded rationality of humans have advanced the notion of *fast and frugal decision making* (Gigerenzer, Todd, & The ABC Research Group, 1999). The heuristics proposed by this program are based on Brunswik's (1955) idea that judgments are made on the basis of cues that are probabilistically related to the target criterion. As Gigerenzer et al. (1999) have shown, such mechanisms can be astonishingly accurate despite using only a limited amount of information.

Typically, fast and frugal heuristics rely on cues that are qualitatively different from the criterion (e.g., considering whether or not there is rent control in a city to predict which of two cities has a higher homeless rate). In the case of frequency judgments, however, the target criterion can be inferred by sampling instances of it from a population. For example, which first name occurs more often in the

population: Martin or Simon? Or, does bladder cancer or renal cancer have a higher annual incidence rate? For these inference problems concerned with environmental frequencies, it is possible that—rather than accessing proximal cues—samples consisting of instances of the criterial event are drawn from the proximal environment. As such, samples can also serve as “keys to assessing the distal environment” (Fiedler, 2000, p. 661), and in the absence of direct knowledge about the environment, these “reflections” of the environment are used to infer its latent properties.

That humans use proximal samples when making inferences about the entire population has been argued in various forms. For instance, in one interpretation of the availability heuristic (Tversky & Kahneman, 1973; see also Sedlmeier, Hertwig, & Gigerenzer, 1998), frequencies in the environment are judged by accumulating easily accessible instances of the target event (e.g., Lichtenstein, Slovic, Fischhoff, Layman, & Combs, 1978). Judgment phenomena such as the false consensus effect (Ross, Green, & House, 1977) or the optimistic bias (Weinstein, 1980), have been attributed to the employment of the availability heuristic, and the use of such a small-sample-based heuristic has therefore been associated with the fallibility and irrationality of human decision making.

In contrast, we ask how humans can achieve fairly accurate judgments in spite of the scarcity and cognitive boundedness they have to face in the real world, and examine what processes contribute to this achievement (cf. Krueger & Funder, in press). Elaborating on the idea of sample-based judgments, we propose and test a simple heuristic for paired comparisons that exploits frequency information in one of people's most proximal environment: their social network.

The Social Environment as Sample Space

People's inferences have been shown to be strongly sensitive to information in their social environment. Prominent examples are attitude formation (e.g., Fishbein & Ajzen, 1975), conformity behavior (Hirshleifer, 1995; Latané, 1981) or risk frequency judgments (Benjamin, Dougan, & Buschena, 2001; Hertwig, Pachur, &

Kurzenhäuser, 2003). Furthermore, there is evidence that information obtained from individuals is accessed and used more readily than is the same information obtained in an abstract, statistical format when making judgments (Borgida & Nisbett, 1977)—even when it is pointed out that the concrete individual represents a highly unrepresentative instance (Hamill, Wilson, & Nisbett, 1980).

Apart from the well-known vividness argument, information obtained about concrete individuals could receive special prominence for several reasons: First, as no mediating factor can distort it, information directly obtained or observed about the members of one’s own social network is highly *reliable*. Second, the observations of instances of the target criterion are per se a *valid* indicator of the criterion. Further, the information is easily *accessible*, as information about social network members represents a constantly recurring and thus well-rehearsed event. Finally, observations of criterial events in one’s social environment are *naturally sampled*, that is, encountered sequentially and represented as natural frequencies. This format has been shown to foster probabilistic reasoning (Hoffrage, Lindsey, Hertwig, & Gigerenzer, 2000).

Based on these reasons, we propose that people use their social network as a sample space to search for information they use to draw numerous inferences. Specifically, we propose one heuristic, the social circle heuristic, which makes inferences about which of two events occurs more frequently in the entire population: With the heuristic, instances of the events in question are sampled from a person’s social network.

How Social Circles Guide Search and Stop Search

In light of the computational limitations of human cognition and the fact that inferences often have to be made without an exhaustive search of available information (Simon, 1956), the question of when to stop information search arises. In other words, when does one stop sampling from one’s social network?

An individual’s social network is no homogenous entity of identical types of relationships. Rather, one can argue that social networks have a hierarchical structure, with the relationships that a person has to the members of his or her social network differing in genetic relatedness, frequency of contact, emotional closeness, content of contact, and function (e.g., Milardo, 1992). Collapsing across these dimensions, we will differentiate among the following social circles: family, friends, and acquaintances.

A central idea of the social circle heuristic is that the structure of the social network is used during the sampling process, that is, the heuristic exploits the hierarchical structure of the social environment to guide and stop the sampling process. A popular notion in social network research has been to represent the hierarchical structure of a social network as concentric circles (Moreno, 1936; Kahn & Antonucci, 1980), with the person whose network is described in the focal circle, and persons of increasing “distance” to the person occupying increasingly peripheral

circles. For instance, one’s family might fall in the circle second closest to the middle, friends in the third circle, and one’s acquaintances in the outer circle. As described in the next section, the social circle heuristic works by sequentially sampling instances of the events in question from the different circles, starting with the focal circle. As soon as the search of a complete circle favors one of the two alternatives, the sampling process is terminated and no further circles are looked up. Note that moving outwards, the number of the circles’ members increases monotonically, and, as a consequence, so too does the sample size on which an inference can be based.

The Social Circle Heuristic

After defining the sample space and its structure, we are now in the position to describe the social circle heuristic in more detail. Consider the following inference problem: Which disease occurs more often in the population, hepatitis or tuberculosis? The social circle heuristic is a heuristic for such pair comparisons in which events (or characteristics) are judged according to their population frequency.

The heuristic consists of four building blocks and starts with the recognition heuristic (Goldstein & Gigerenzer, 2002).¹ The social circle heuristic has a search rule, which specifies where to search, a stopping rule, which specifies when to stop sampling, and a decision rule, which specifies how to make an inference based on the information gathered through sampling (for different building blocks of heuristics see Gigerenzer et al., 1999).

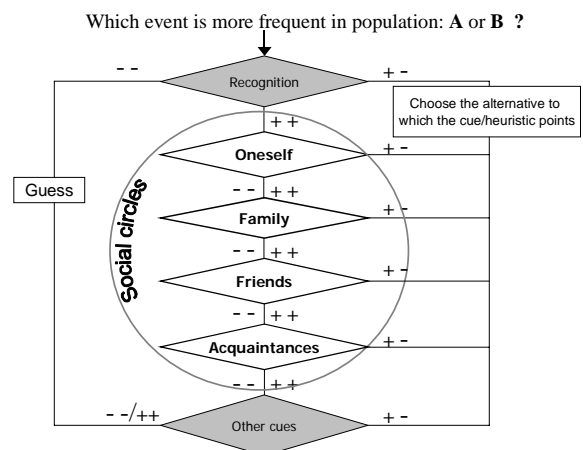


Figure 1: Flow chart of the social circle heuristic and the relationship of the sampling process to the recognition principle and inferences based on other cues (such as Take the Best; Gigerenzer & Goldstein, 1996).

It operates as follows:

Step 0 – Use the *recognition heuristic*. If the name of only one of the two events is recognized, then predict that the recognized one is more prevalent than the

¹ This latter point also illustrates how fast-and-frugal heuristics can be combined by nesting.

unrecognized one. If the names of both events are recognized, recruit the social circle heuristic.

Step 1 – *Search rule*: Search the social circle for instances of the events, running sequentially through the circles, starting with the focal circle.

Step 2 – *Stopping rule*: If search within a circle favors one event, stop search. If, within a circle; the same number of instances is found for both events, continue the search in the next circle.

Step 3 – *Decision rule*: Predict that the event for which a higher number of instances is found is the more prevalent in the population. If the sampled information does not discriminate between the alternatives (and no other information is known), then guess after the last circle is searched.

Due to the stopping rule, the search process will often be terminated early, and an inference based on information gathered with the social circle heuristic will be derived from samples of small sizes. Note that this also implies that as soon as search is stopped at a particular circle, information in more peripheral circles that might overturn the decision, is not considered. In this sense, the heuristic is non-compensatory. To rely on small samples has often been seen as unreasonable (“belief in the law of small numbers”; Tversky & Kahneman, 1971), and only recently a few authors have highlighted the possible value of such a strategy (e.g., Dawes, 1989; Fiedler & Kareev, 2004; Kareev, 2000).

How Accurate Is the Social Circle Heuristic?

In order to test the accuracy of the social circle heuristic, we conducted a computer simulation where the task of the heuristic was to judge which of two events, A or B, occurs more frequently in the entire population. For this task, the heuristic could search for instances of the events in its spatial vicinity. The population consisted of 2,500 agents, represented in a 50×50 matrix in which each cell represented one agent (see Figure 2, which shows the environment simplified to a population with 100 agents in a 10×10 matrix). We used the city block metric to define the distance between the agents. For instance, in Figure 2—which shows the social network of agent #45 in a population of 100—agent #44 is at a distance of 1 from agent #45, agent #34 is at a distance of 2 from agent #45, agent #33 is at a distance of 3 from agent #45 etc. It is assumed that each agent’s social network consists of 40 other agents that differ with regard to their distances to the agent. Thus, an agent could maximally sample information about 41 agents (including himself). This social network is divided into different social circles: Circle 1, that only includes the agent itself, Circle 2, including all neighboring agents with a distance of 1 (4 agents), Circle 3, including all neighboring agents with a distance of 2 (8 agents), and Circle 4,

including all neighboring agents with a distance of 3 or 4 (28 agents).²

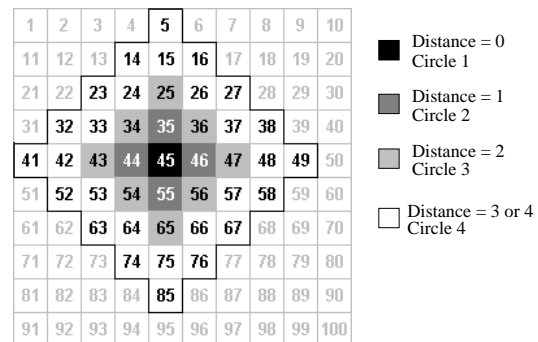


Figure 2: Environment in the computer simulation (here simplified as a 10×10 population).

Two environments were used to test the performance of the social circle heuristic. In the first environment, instances of 10 event categories were distributed randomly across the 2,500 agents (see Figure 3). The 10 events mimicked the frequency distribution of a real world environment used in the experiment (discussed further below): occurrences of infections in Germany. As can be seen from Figure 3, the distribution of the proportions of the infections is very skewed and falls into a J-shaped distribution, a pattern found in many real-world domains (Hertwig, Hoffrage, Martignon, 1999). The proportions of the 10 most frequent infections (from a set of 24) were chosen because their proportional distribution could be represented in a population of 2,500 agents. The most frequent event was set at a frequency of 2,000; the 9 other events were distributed according to this anchor and the proportions reported by the Robert Koch Institute (for details see Pachur, 2002).

Secondly, we constructed an environment in which the same overall number of instances in the population was distributed across the 10 event categories such that the frequency across the 10 events was linearly increasing. As a result, this linear environment and the skewed environment differed substantially with regard to the dispersion of the frequency distribution. We were interested in the effect of the frequency distribution of the events as this property can have an effect on the success of a strategy (Hertwig, Hoffrage, Martignon, 1999).

To make an inference, the social circle heuristic starts with Circle 1 and looks whether event A or B is present. If one is and the other not, no further circles will be looked up, irrespective of what information is present in the other circles, and it will be inferred that the sampled event is more frequent in the population. If neither of the events is present in Circle 1, the agents in Circle 2 will be looked up. If one

² The matrix was a wrapped environment, that is, the agents at the borders had neighbors at the opposite side. For instance, in Figure 2, the left-hand neighbor of agent #41 is agent #50.

event occurs more frequently in Circle 2, search is stopped and an inference is made after looking up only four agents. The same rule applies to Circle 3. Only if the number of instances in the first three circles does not discriminate, then Circle 4, and thus the maximum number of 41 agents will be looked up. If even circle 4 does not discriminate, one of the events is picked randomly.

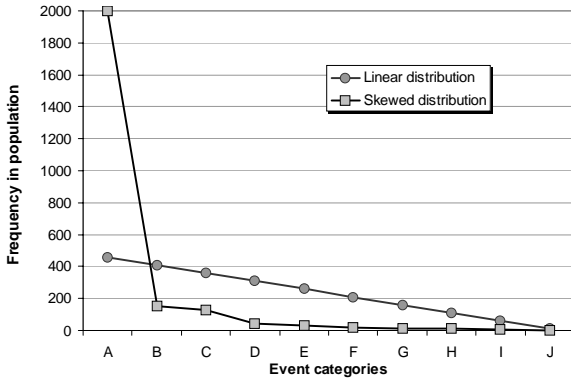


Figure 3: Distribution of the 10 events in the two environments used in the computer simulation.

As a benchmark for the social circle heuristic, its performance was compared with the performance of an exhaustive sampling strategy. For an inference of whether event A or event B occurs more often in the entire population, this strategy, normatively more appropriately, always looks up all 41 agents in the social network (that is, this strategy aggregates information across all circles). The event for which more instances can be sampled is inferred to be more frequent in the entire population. If an equal number of instances is sampled for both events, or if no instances can be sampled at all, one of the events is picked randomly.

For each of the two environments, the random distribution of the 10 events (totalling around 2,400 instances) was repeated 100 times, and each time 100 agents were picked randomly as starting points for the two strategies. At each run, the 10 events were combined in a pair comparison (yielding 45 pairs) and the task was to infer which event is more frequent in the entire population.

How well does the simple social circle heuristic perform compared to the exhaustive sampling strategy? In the skewed environment, derived from a real-world distribution, surprisingly, both strategies showed an identical proportion of correct inferences with a median of 77.8% (arithmetic means: social circle heuristic 76.3%, exhaustive sampling strategy 77.5%). Showing a similar level of performance, the social circle heuristic looked up, on average, only 24.7 agents, which is approximately 55% of the amount of information that the exhaustive sampling strategy used (which always looks up all 41 agents).

In the linear environment, the picture was different: here the exhaustive strategy clearly achieved a higher accuracy than the social circle heuristic. Whereas the social circle

heuristic a median of 75.6% correct choices (mean 75.2, $SD=8.9$), the exhaustive strategy 84.4% (mean 83.1, $SD=6.3$).

Table 1 shows the performance of the social circle heuristic in more detail. Because of the stopping rule, the social circle heuristic terminated for some inferences the search at Circle 1, for some at Circle 2, for some at Circle 3, for some at Circle 4, and for some a guess had to be made. The second column of Table 1 reports for each circle the percentage of choices for which search was stopped at the circle. The social circle heuristic had to guess in 31.6% of the cases (whereas the exhaustive sampling strategy had to guess in 33.6% of all choices). The rightmost columns shows the percentage of correct inferences for these choices. Note that in the skewed environment, contrary to normative expectations, the accuracy *decreases* from Circle 1 to Circle 3. In the linear environment, in contrast, the accuracy increased.

Table 1: Proportion and accuracy of choices after search was terminated for the SCH in the two environments. The ns in the first column refer to the number of agents looked up.

Circles	% of choices stopped at each circle		% of correct choices	
	Skewed	Linear	Skewed	Linear
	Circle 1 (n=1)	19.2	18.8	95.7
Circle 2 (n=5)	13.2	38.4	88.2	74.0
Circle 3 (n=13)	13.8	26.2	84.2	78.1
Circle 4 (n=41)	22.3	13.7	85.5	85.8
Guessing	31.6	3.0	50.0	50.0

Thus, we have accumulated a number of arguments for the usefulness of the social circle heuristic. First, it is a simple strategy that can be assumed to be easily performed by a boundedly rational agent. By restricting the search process and the amount of information on which an inference is based to a minimum, the social circle heuristic allows for very quick judgments. Second, as we have seen, it performs equally well as a more thorough strategy that takes much more information into account, and this performance seems to hinge on the statistical structure of the environment. Overall, the social circle heuristic achieves an astonishingly high proportion of correct inferences. But can we find evidence for people’s use of such a simple and efficient strategy for making inferences about event frequencies?

Do People Use the Social Circle Heuristic?

The 24 infectious diseases (the proportions of 10 of these were also used in the computer simulation) for which official records are kept by the Robert Koch Institute were combined in a complete paired comparison (yielding 276 pairs), and 40 participants were asked to choose the infectious disease that has a higher annual incidence rate in Germany. After this test, participants indicated for each infection and each of their circles (self, family, friends, and

acquaintances) how many, if any, people in their circles had been affected by the infection. They also indicated whether they recognized the name of the infection. From this information, we calculated how often participants had an opportunity to choose in accordance with the social circle heuristic and determined which prediction the social circle heuristic made in each of these cases (only pairs where both infections were recognized and the reported number of instances in the social network discriminated between the two infections were included). Overall, only relatively little occurrences of the infections were reported by the participants, which is not surprising given the rarity of infections. The social circle heuristic made predictions for 33 participants, and was applicable (i.e., discriminated between the infections), on average, with 11.1% of all choices. Figure 4 shows how often these 33 participants made a choice in accordance with the prediction of the social circle heuristic.

For each participant, the bar indicates the percentage of choices that were in line with the prediction of the social circle heuristic. Overall, the median proportion of inferences in accordance with the social circle heuristic was 79.5% (mean 77%, $SD=15.9$). It seems fair to conclude that the social circle heuristic did quite a good job in describing participants' judgments (focusing on those in which it was applicable).

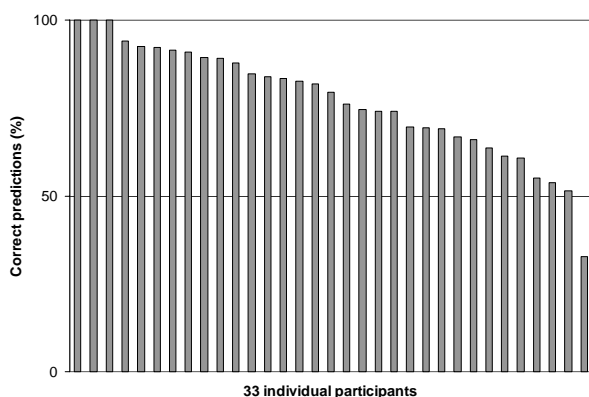


Figure 4: How often the 33 participants who reported instances of the infections in their social network made choices in accordance with the social circle heuristic.

How Ecologically Rational Is the Social Circle Heuristic?

The social circle heuristic is a psychologically plausible strategy: people appear to use it when trying to infer with of two risk events is more frequent. But how accurate a strategy is the heuristic when applied to the infections and based on the occurrences of the infections recalled by our participants? In other words, how ecologically rational are the inferences of the social circle heuristic in the task that our participants solved? In a second analysis, the predictions of the social circle heuristic for each individual were compared with the correct choices, that is, according to the

actual incidence rates (averaged values from a 5-year period were used to eliminate year-to-year fluctuations).

An index for the ecological validity was defined as the number of correct inferences made by the social circle heuristic divided by the number of pairs where it was applicable. This index was calculated separately for each participant. The median ecological validity was .83 (mean .78), indicating that, overall, strictly following the social circle heuristic when it was applicable would have led to an accuracy of over 80% correct choices.

In contrast, how did the non-adherence to the social circle heuristic affect participants' performance? As indicated by the ecological validity index, strictly following the social circle heuristic would have yielded over 80% correct choices (which is far above the performance the participants achieved overall). Analyzing the choices that were in line with the predictions of the social circle heuristic and those that were not in line with it, it turned out that when the participants could apply the heuristic and did, they achieved on average 83.4% ($SD=18.5$) correct choices, whereas when they could but did not apply the heuristic, they achieved on average only 45% ($SD=25.5$) correct choices.

To be able to evaluate the accuracy of the social circle heuristic for the domain of infections, we also tested the strategy that always takes all instances that our participants reported into account. The exhaustive strategy showed a very similar fit with our participants' choices (median 81.8% mean 77.6% of choices in line with the predictions of this strategy), but was applicable in slightly fewer cases. In terms of ecological validity, the predictions of this strategy achieved no higher accuracy than the social circle heuristic (median ecological validity of .83, mean .79), which is in line with the results of the computer simulation.

Discussion

In the real world, inferences from small samples need must not be less accurate than inferences from larger samples. In this paper we investigated, both in a computer simulation and in an empirical study, a simple decision mechanism that exploits a person's social network as an easily accessible sample space for judging event frequencies in paired comparisons. The results show that the social circle heuristic allows one to judge accurately, with simple search, stopping, and decision rules, the environmental frequencies of randomly distributed events in a paired comparison task. At the same time, this mechanism describes people's choices rather well. Thus, the performance of the social circle heuristic provides another instance for the argument that small samples can be an efficient basis for judgments in the real world (cf. Fiedler & Kareev, 2004; Kareev, 2000).

This paper was intended to explore the appropriateness of this heuristic in an environment that has a naturally occurring statistical structure, and it was shown that the heuristic works particularly well in such an environment. A question for future research is why the heuristic works so well under these conditions and how it performs in environments in which events occur in clusters.

By virtue of its reliance on the structure of social networks, the social circle heuristic represents another example of a judgment policy in which the mind is a mirror image of the environment. The social circle heuristic thus follows in the footsteps of the pioneering work by Egon Brunswik (1955), John Anderson (e.g., Anderson & Schooler, 1991), and Roger Shepard (e.g., 1994).

Acknowledgments

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