# Recognizing National Hockey League Greatness With an Ignorance-Based Heuristic

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**Abstract** This study examined whether people adhered to the *recognition heuristic* (i.e., inferred that a recognized hockey player had more total career points than an unrecognized player) and whether using this heuristic could yield accurate decisions. On paired comparisons, having participants report whether they recognized each player plus any knowledge they had about each player permitted players to be classified as either unrecognized (UR), merely recognized (MR), or recognized with additional knowledge (RK), thus producing six possible trial types. Participants adhered to the recognition heuristic on 95% of MR-UR trials and were accurate on 81% of those trials. They chose the recognized player on 98% of RK-UR trials, yielding 94% accuracy. Women had less knowledge and recognized fewer players than men, yet they were nearly as accurate as men. Future research should examine the conditions under which the recognition heuristic is an adaptive strategy.

It is widely accepted that human rational behaviour is constrained by mental and environmental factors. When proposing plausible models of human decision-making, research paradigms must take these constraints into consideration. One such paradigm, bounded rationality, proposes that effective decision-making strategies have evolved from mind-environment interactions. In particular, bounded rationality research involves the analysis of the heuristics that people with limited resources use to make decisions, the structure of the environments in which they make decisions, and the match between the two (Todd & Gigerenzer, 2001, 2003). Bounded rationality is typically equated with Herbert Simon's (1955, 1956) notion of *satisficing,* which involves the mental search across alternatives until an alternative that meets a certain aspiration level is found. Gigerenzer and his colleagues (e.g., Gigerenzer, 2001; Gigerenzer & Selten, 2001; Gigerenzer, Todd, & the ABC Research Group, 1999) have extended the bounded rationality framework to incorporate Simon's model and additional decision-making strategies that people use to search across attributes, stop that search, and make a decision. They have proposed a metaphor of the mind as an *adaptive toolbox* that contains a repertoire of simple heuristics for making decisions in real world environments. When applied in appropriate situations, these "fast and frugal" decision strategies yield effective choices while sparing time and mental resources. From this toolbox perspective, human decision-making is adaptive because people can select heuristics that meet the demands of particular decision tasks, as well as identify patterns in which heuristics do or do not work and consequently alter existing strategies or adopt new ones based on their experiences. The fastest and most frugal of the various heuristics is based on ignorance and recognition – the *recognition heuristic* (Goldstein & Gigerenzer, 1999, 2002).

Consider this question: Which of these two National Hockey League players has achieved the highest total career points – Wayne Gretzky or Eric Carnes? If you recognize one player and not the other, Goldstein and Gigerenzer (1999) claim that you will use the recognition heuristic, or decide that the player you recognize has the most career points without ever searching for any task-relevant information. Given their relative popularity, you probably recognized Wayne Gretzky but not Eric Carnes, thus you could have made a correct inference by using the recognition heuristic. Specifically, the recognition heuristic states that: *If one of two objects is recognized and the other is not, then infer that the recognized object has a higher value with respect to the criterion* (Goldstein & Gigerenzer, 2002, p. 76). The heuristic is therefore "ignorance-based" – it can only be used in situations where the decision maker is ignorant about one of the objects. The condition that one object is recognized and the other is not acts as a stopping rule – individuals do not search for any additional information about the recognized object – thus making the recognition heuristic noncompensatory. Goldstein and Gigerenzer (1999) argued that this was the case by showing that participants inferred that recognized objects were higher on the criterion even when they were provided with information that contradicted that inference.

Lack of recognition, or ignorance, about one object

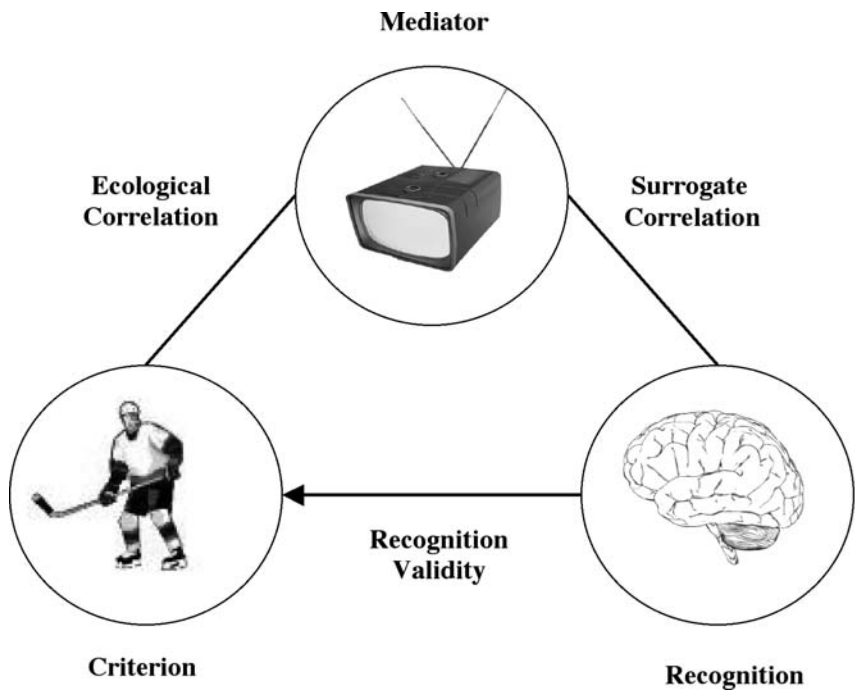


*Figure 1.* The ecological rationality of the recognition heuristic.

can lead to a correct inference because recognition in memory exploits the structure of the information in natural environments (i.e., is ecologically rational). Figure 1 depicts the ecological rationality of the recognition heuristic. Three variables describe the relationship between the unknown criterion being judged, accessible environmental mediators, and the mind – *ecological correlation*, *surrogate correlation*, and *recognition validity* (Goldstein & Gigerenzer, 1999). The ecological correlation refers to the relationship between the mediator and the criterion. In the aforementioned hockey player example, a player's total career points is the criterion and the mediator variable is the number of times a player is mentioned in the media. The surrogate correlation is the relationship between the mediator and the contents of memory, which could be measured by correlating the number of times that players' names are mentioned in the media with recognition of those names. The recognition validity refers to the strength of the relationship between recognition and the criterion, or the proportion of times that choosing a recognized object over an unrecognized one would yield an accurate inference. The recognition validity must be significant in order for the recognition heuristic to work in a particular domain. In such domains, an unknown and inaccessible criterion can be inferred from accessible environmental mediators that reflect it. Essentially, people are able to capitalize on the fact that media exposure is a reflection of hockey greatness because the best players receive relatively more media exposure, and thus have a greater likelihood of being recognized.

Several studies have examined whether the recognition heuristic can be used to make accurate decisions and whether people actually use it. In one of the earliest studies, Ayton and Önkal (1997) demonstrated that Turkish students who were unfamiliar with English soccer were almost as accurate as more knowledgeable British students when they predicted the outcomes of English soccer games (Turkish, 63% vs. British, 66%). Gigerenzer and colleagues have more directly tested whether the recognition heuristic could produce accurate inferences. For instance, Goldstein and Gigerenzer (2002) asked groups of American students to choose the larger city out of random pairs of the 22 largest American cities and random pairs of the 22 largest German cities. The participants were, on average, 71% accurate on both American and German cities. The relatively more knowledge the participants had about American cities, and thus the presumably higher number of recognized American cities (although participants were not directly asked to indicate which cities they recognized), did not produce more correct inferences. Borges, Goldstein, Ortmann, and Gigerenzer (1999) evaluated the recognition heuristic in a different domain. They wanted to determine whether stock portfolios created on the basis of company recognition could be profitable. This study involved a generalization of the recognition heuristic to large sets of objects (rather than just two objects) where the heuristic denotes choosing the subset of recognized objects. Borges et al. (1999) asked several hundred experts and laypeople in Chicago and Munich to indicate American and German companies that they recognized. A stock portfolio was created for each of the eight groups of participants (i.e., experts from Chicago judging American companies, experts from Munich judging American companies, laypeople from Munich judging German companies, and so on) from the top 10 most recognized companies and the rate of return from each portfolio was calculated after a six month period in 1996-1997. Six of the eight portfolios outperformed portfolios created from stocks of unrecognized companies, market indices, mutual funds, and randomly selected stocks. The other two portfolios outperformed portfolios of randomly selected companies and unrecognized companies.

Other studies have asked people to identify objects they recognized and then proceeded to calculate the accuracy they would have achieved if they adhered to the recognition heuristic in a task (i.e., the recognition validity). For instance, in a study that asked American and German college students to choose the best college among pairs of American colleges, Hertwig and Todd (2003) found that the German and American students recognized one-fifth and three-quarters of the colleges, respectively. Nonetheless, the recognition validity was actually higher for the German students (.74) than the American students (.62), thus demonstrating that recognizing fewer objects in a particular domain may theoretically lead to more accurate decisions than recognizing relatively more objects – the *less-is-more effect*. According to Gigerenzer (2002), this by-product of the recognition heuristic occurs when those who recognize fewer objects in a particular domain exhibit higher inferential accuracy than those who recognize relatively more objects. A graphical representation (i.e., number of objects recognized vs. percentage of correct inferences) of the less-is-more effect follows an inverted-U pattern. That is, when no objects are recognized, people achieve chance level accuracy; accuracy increases until approximately half of the objects are recognized; and accuracy subsequently decreases.

The studies mentioned thus far demonstrate that choosing recognized objects over unrecognized ones can yield accurate inferences. But do people actually use the recognition heuristic? Goldstein and Gigerenzer (1999) examined this question by having participants report whether they recognized each city used in their task. This allowed the researchers to determine how many opportunities each participant had to use the recognition heuristic (i.e., whenever an unrecognized city was paired with a recognized city) and on how many occasions they adhered. On average, the participants chose a recognized city over an unrecognized city 90% of the time, indicating that their choices were consistent with the use of the recognition heuristic. The recognition heuristic has also been expanded to group settings, where it was demonstrated that groups made more accurate inferences when the majority of members used the recognition heuristic as opposed to task-relevant knowledge, and that group members who used the recognition heuristic were more influential in the process of reaching a consensus (Reimer & Katskiopoulos, 2004).

A recent study by Oppenheimer (2003) questioned Gigerenzer et al.'s (1999) evidence for the recognition heuristic by arguing that they confounded recognition and knowledge. Gigerenzer et al. (1999; also Gigerenzer & Goldstein, 1999; Hertwig & Todd, 2003; Marsh, Todd, & Gigerenzer, 2004; Todd & Gigerenzer, 2003) did not distinguish between trials on which participants' inferences were based on recognition alone and where they may have used additional knowledge about recognized objects; thus they are unable to provide compelling evidence that recognition alone is used as a rule to stop searching for information. Oppenheimer specifically argued that, in inferences about the larger of two cities, the high accuracy reported was due to task-relevant knowledge that the recognized cities were large and not simply recognizing the city's name. He conducted an experiment that paired local cities, which it was assumed were known to be small, with fictional ones. According to the recognition heuristic, participants should have chosen the local cities more than one would expect by chance. However, he found that the fictional city names, which he assumed provided no size-related cues, were selected as the larger city in a pair in 63% of trials. In a second experiment, he paired fictional cities with cities that he assumed participants would recognize (e.g., Chernobyl because of the nuclear disaster) but which they would have no size-related knowledge about, and similarly found that the fictional cities were judged to be larger on slightly less than 60% of the trials. Because the participants avoided the cities that Oppenheimer assumed should be recognized, he concluded that people use knowledge beyond recognition to make paired comparisons of city size when they are ignorant about one of the cities. The inherent implication of Oppenheimer's findings is that recognition heuristic experiments should aim to separate when people are using recognition alone from when they may be using additional information.

Other researchers have challenged Gigerenzer and colleagues' intended interpretation of the recognition heuristic as a noncompensatory decision strategy (Ayton & Önkal, 2005; Newell & Shanks, 2004), whereby "no other information can reverse the choice determined by recognition" (Goldstein & Gigerenzer, 2002, p. 82). According to that interpretation, even if there is information available that suggests to an individual that the recognized object has a low criterion, that object should still be inferred to have a higher criterion than the unrecognized object. Some researchers maintain that further knowledge about a recognized object can cause an individual to choose the unrecognized object in a pair. Newell and Shanks, for example, argue that an alternate and more plausible interpretation of the recognition heuristic is that people use recognition to make decisions only when there is no additional information available and no opportunity to search for additional information about the alternatives. Newell and Shanks found that participants searched for and used other cues to make inferences when recognition of an object had low predictive validity, and therefore maintain that Gigerenzer and colleagues have exaggerated the role of recognition in decision-making. Consequently, Newell and Shanks concluded that the recognition heuristic is a compensatory rather than a noncompensatory strategy and that recognition may be just one cue among many that people use when making decisions.

The current study attempts primarily to address Oppenheimer's (2003) concern that Gigerenzer and colleagues have confounded recognition and knowledge. We designed our task to isolate instances where recognition was not confounded with knowledge. Unlike Oppenheimer's participants, those in the current study will indicate which objects in each pair they recognize and, unlike and previous experiments that we know of, any knowledge they can recall about each object. This will allow us to separate those inferences based on mere recognition and those where additional knowledge may have been used. For the purposes of evaluating the accuracy that recognition alone could achieve, in the current experiment we consider inferences based on mere recognition to be synonymous with inferences where recognition was used as a stopping rule. Adherence to and accuracy of the recognition heuristic are assessed in a novel domain – inferring which of two hockey players has the highest total career points. This domain is less "friendly" (Shanteau & Thomas, 2001) than the city size domain because many of the reasons why hockey players are recognized (e.g., victims of a highly publicized brutality or accident, physical enforcers, relatively older, play an important team position or role) may not predict their career points. Studying NHL players also allows a comparison of more and less knowledgeable groups, which allows a test of the prediction that people who know less about a particular domain should exhibit equal inferential accuracy as those who know more. The six possible trial types that result from paired combinations of hockey players that are i) *unrecognized*, ii) *merely recognized*, and iii) *recognized with additional knowledge* are independently evaluated. We suspect that in the hockey player domain, inferences based on mere recognition will be highly accurate.

## Method

### Participants

Participants were 20 men and 25 women enrolled as undergraduate students at Memorial University of Newfoundland. The average age of both the men and women was 21 years ($SD$ = 3.2 and 4.4 years, respectively). Overall self-reported knowledge about the National Hockey League (NHL) was 3.5 ($SD$ = 2.7) on a scale from 1 (*not knowledgeable*) to 10 (*very knowledgeable*). Women's knowledge about the NHL ($M$ = 2.1, $SD$ = 1.3) was significantly lower than men's knowledge ($M$ = 5.1, $SD$ = 3.0), $t(40) = 4.33$, $p < .001$.

### Materials

In a pilot study, 150 Memorial University of Newfoundland undergraduates indicated which NHL hockey players they recognized among a random list of 400 player names (acquired from the NHL Website, 2005). One hundred of those players who were unrecognized by all of the students comprised half of the players used for the current study. Player Stats Search was used to retrieve career point totals for these players. The remaining 300 were discarded. Another 100 players were then chosen because they had the highest total career points in the NHL (according to the NHL Website). From the final list of 200 players, four questionnaires were compiled. Each questionnaire consisted of 100 randomly generated pairs of players. Including the top 100 players, presumably highly recognizable, and 100 unrecognized players increased the likelihood that the three categories of players – unrecognized (UR), merely recognized (MR), and recognized with knowledge (RK) – would occur frequently enough to allow meaningful analyses.

### Procedure

Participants were randomly assigned one of the four questionnaires. For each pair of player names, they were asked to indicate which player had the highest career point total, whether they recognized either or

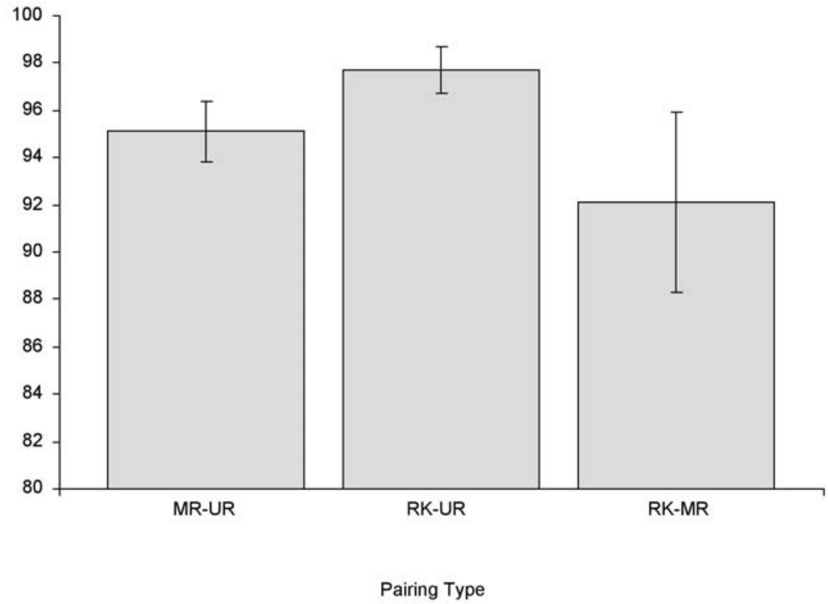


*Figure 2.* Percentage of MR-UR, RK-UR, and RK-MR trials on which participants inferred that the MR, RK, or RK player, respectively, had the highest total career points, plotted with 95% confidence intervals.

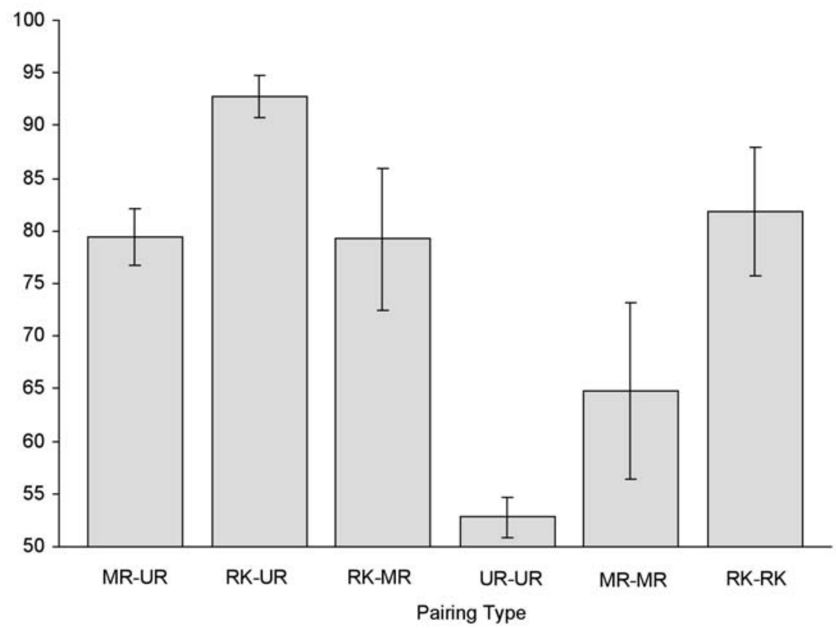


*Figure 3.* Percentage of correct inferences for each of the six pairing types, plotted with 95% confidence intervals.

both of the players, and whether they had any additional knowledge about the players, and then to list the additional knowledge that they possessed, in that order. Participants were given 30 minutes to complete the study. Additional time was allotted if required. All questionnaires were completed in the researcher's presence and returned immediately upon completion. Each of the completed questionnaire items was categorized as one of six possible pairing types, as indicated by participant responses. For instance, if a participant recognized Wayne Gretzky, but did not report any additional knowledge about him, and did not recognize Eric Carnes, an item featuring these two players would be classified as an MR-UR pairing type. Accuracy was

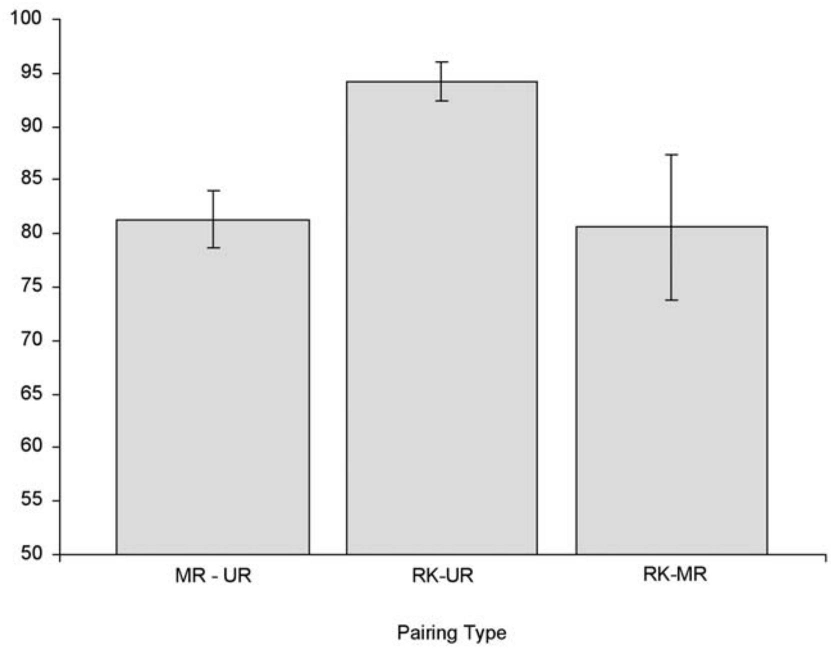


*Figure 4.* Percentage of correct inferences on MR-UR, RK-UR, and RK-MR trials when the MR, RK, or RK player, respectively, was chosen as having the highest total career points. Percentages are plotted with 95% confidence intervals.

measured as the percentage of inferences where the player with the most career points was selected (i.e., a correct inference) among all occurrences of a particular pairing type across all participants.

## Results

Figure 2 shows the overall percentage of inferences where a MR or a RK NHL player was inferred to have more total career points than an UR player (i.e., adherence to the recognition heuristic), and where a RK player was chosen over a MR player. The effect of gender was assessed using $\chi^2$ tests for independence (two-tailed, $\alpha = .05$). Participants chose the MR player in 95% of the 732 instances where a questionnaire item produced a MR-UR pairing. This was consistent for men (94%; $n = 354$) and women (96%; $n = 378$), $\chi^2 = 1.508$, $df = 1$, *ns*. Participants chose the RK player in 98% of the RK-UR pairings ($n = 479$), with men ($n = 385$, 99%) selecting the RK player more often than women ($n = 94$, 94%), $\chi^2 = 8.705$, $df = 1$, $p = .003$. When the MR-UR and RK-UR pairing types were collapsed, overall adherence was 96%. These results indicate that in the vast majority of instances where participants were ignorant about one player and recognized the other player, they inferred that the recognized player had the most career points. The RK player was selected on 92% of the RK-MR pairings ($n = 101$). Men ($n = 93$) chose the RK player 93% of the time and women ($n = 8$) similarly chose the RK option on 88% of trials, $\chi^2 = .250$, $df = 1$, *ns*. Thus, participants largely inferred that a hockey player who they had knowledge about had more total career points than a player who they merely recognized. Based on the nonoverlapping 95% confidence intervals (*CI*s) shown in Figure 2, it appears that adherence was significantly higher on the RK-UR than on MR-UR and RK-MR pairing types, whereas the latter two did not differ, $\chi^2 = 1.600$, $df = 1$, *ns*.

Figure 3 shows the percentage of trials on which participants accurately chose the player with the highest total career points on each of the six possible types of trials. Correct inferences were made on 79% of the MR-UR pairings, whereas accuracy reached 93% on RK-UR trials. There was no overlap of the 95% *CI*s for the MR-UR and the RK-UR data; thus inferences where additional knowledge was accessible yielded higher overall accuracy than those based upon mere recognition. This finding was supported by an individual-level analysis, which showed a stronger relationship between each participant's achieved accuracy and the number of RK players ($r = .79$, $p < .001$, $CI = .65$ to $.88$) than the number of MR players ($r = .57$, $p < .001$, $CI = .33$ to $.74$). Inferences were accurate on 53%, 79%, 65%, and 82% of all UR-UR ($n = 2{,}811$), RK-MR ($n = 101$), MR-MR ($n = 105$), and RK-RK ($n = 110$) pairings, respectively.

Figure 4 shows participant accuracy when they inferred that the recognized player had the highest career points on MR-UR and RK-UR pairings, and that the RK player had more career points on RK-MR pairings.

TABLE 1
Gender Comparisons of the Percentage of Correct Inferences Across all Participants on Each Pairing Type

| | Women | | | Men | | | |
|---|---|---|---|---|---|---|---|
| Pairing Type | *n* | % Correct | 95% CI | *n* | % Correct | 95% CI | $\chi^2$ value |
| Figure 3 data | | | | | | | |
| MR-UR | 378 | 77 | 73 to 81 | 354 | 82 | 78 to 86 | 2.721 |
| RK-UR | 94 | 89 | 82 to 94 | 385 | 94 | 91 to 96 | 1.916 |
| RK-MR | 8 | 63 | 31 to 86 | 93 | 81 | 72 to 87 | 1.473 |
| UR-UR | 1,925 | 52 | 50 to 54 | 886 | 55 | 52 to 58 | 2.630 |
| MR-MR | 25 | 68 | 48 to 83 | 80 | 64 | 53 to 73 | 0.151 |
| RK-RK | 2 | 100 | 34 to 100 | 108 | 82 | 73 to 88 | 0.453 |
| Figure 4 data | | | | | | | |
| MR-UR | 363 | 78 | 74 to 82 | 333 | 85 | 80 to 88 | 4.754* |
| RK-UR | 88 | 94 | 87 to 98 | 380 | 94 | 91 to 96 | 0.002 |
| RK-MR | 7 | 57 | 25 to 84 | 86 | 83 | 73 to 89 | 2.679 |

* $p < .05$.

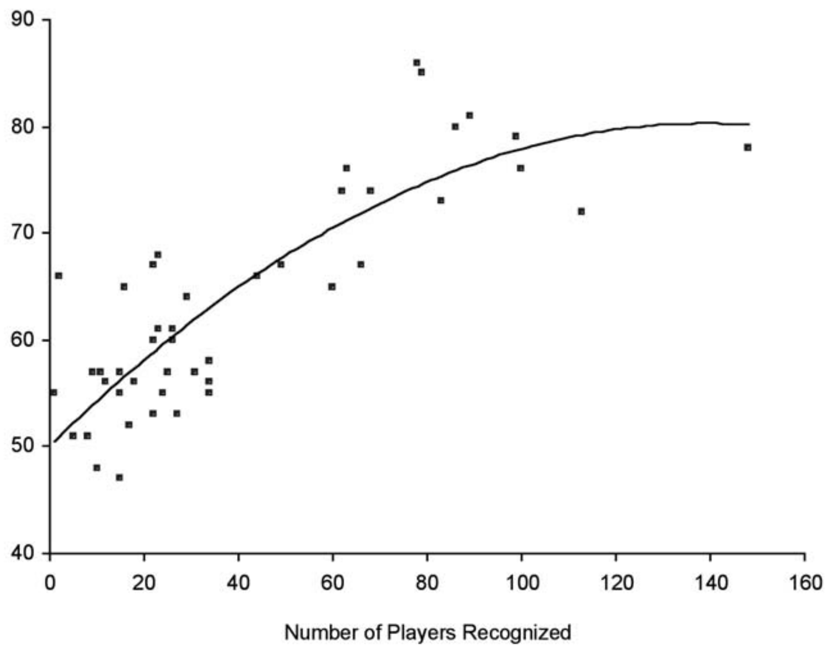


*Figure 5*. Percentage of correct inferences as a function of the number of players recognized. Each data point represents the total number of recognized players and the combined accuracy on MR-UR and RK-UR trials for one participant.

Correct inferences were made on 81% of MR-UR pairings ($n$ = 696) when the MR player was chosen. Choosing the RK player on RK-UR pairings ($n$ = 468) yielded 94% correct inferences. There was a 13% difference in accuracy, with no overlap of the 95% *CI*s, between these two types of trials. When a RK player was inferred to have the highest total career points in RK-MR pairs, the inference was accurate 81% of the time; thus participants tended to choose players they knew something about over those they merely recognized.

In order to compare the results with previous research that did not un-confound judgments based on mere recognition from those where additional information may have been used, accuracy was also measured with MR-UR and RK-UR pairings collapsed; correct inferences were made on 87% of those pairings where a participant was ignorant about one player and recognized the other. The reported accuracy of inferences made by choosing a recognized player over an unrecognized player could have been inflated in this study if those based on mere recognition and those where knowledge was accessible were not considered separately.

Men and women achieved similar levels of accuracy on the hockey player inference task; 2 x 2 $\chi^2$ tests for independence (two-tailed) revealed no effect of gender for any of the pairing types. Moreover, as can be seen in the top panel of Table 1, which is based on the same data used to produce Figure 3, the *CI*s around the percentages of correct inferences for men and women overlap for each pairing type. As shown in the bottom panel of Table 1, men were more accurate than women when they selected a MR player who was paired with a UR player ($p$ = .029); however, men and women were equally accurate when they chose a RK player who was paired with an UR player or a MR player.

As the total number of players who participants recognized (i.e., MR and RK) increased, there was a corresponding increase in accuracy, $r$ = .82, $p$ < .001. The associated 95% *CI* was .69 to .90. It appears in Figure 5, in which each data point indicates the total number of recognized players and the overall accuracy for each individual participant, that this trend was maintained until approximately half of the 200 players were recognized. When the recognition rate was above approximately half of the players, accuracy leveled off. High self-reported knowledge was also strongly correlated with participant accuracy, $r$ = .83, $p$ < .001, *CI* = .71 to .90. It follows from these two correlations that self-reported knowledge should have also been a strong predictor of the number of recognized players, which in fact it was, $r$ = .91, $p$ < .001, *CI* = .84 to .95. This latter correlation also supports the validity of the knowledge-scale used to assess participants' general knowledge level about the NHL, which further supports the finding that the number of players recognized is a predictor of accuracy.

## Discussion

Over all trials on which one player was recognized and the other was unrecognized, participants behaved in a way consistent with the recognition heuristic by inferring that the recognized player had the most career points on 96% of trials and they were accurate on 87% of those trials. In previous studies by Gigerenzer and colleagues (e.g., Gigerenzer et al., 1999), these percentages would have been reported as those which reflected adherence to and accuracy of the recognition heuristic, and they are indeed very similar to their findings. We, however, separated these trials in order to determine how accurate inferences would be if participants based their decisions on recognition alone (i.e., mere recognition). On both MR-UR and RK-UR trials, participants largely inferred the recognized player had the most career points. The accuracy results show that inferences based on recognition alone can be highly accurate in the hockey player domain. In other words, if recognition was used as a stopping rule when inferring which of two NHL players has the most career points, decision-makers would be reasonably accurate. But having knowledge about a recognized player who was paired with an unrecognized player yielded 13% more correct inferences, suggesting that at least some participants did not use recognition as a stopping rule, probably proceeding instead to search for task-relevant knowledge in memory. Because we did not use a process tracing technique, however, we cannot identify the process that participants employed on the RK-UR trials but propose that the elevated accuracy indicates that knowledge may have been incorporated into the strategy of some participants.

In order to demonstrate that a situation where one object is recognized and the other is not does not constitute a stopping rule, Ayton and Önkal (2005) provided participants with information that conflicted a recognition-based inference, and found that people chose the unrecognized object more in that situation. We did not control the additional information that participants had in the present study, instead permitting them to search their own memory. It is likely that they acquired most of their knowledge about the hockey players via the media and that possessing any information confirmed their recognition-based inferences. The media tend to highlight the best sports players – all stars, award winners, record breakers, etc. Furthermore, because people are presumably aware that skilled players generally get more media attention than unskilled players, they infer that a player they know anything about has more career points than a player they do not recognize. Indeed, the knowledge that participants reported was sometimes task-*ir*relevant (e.g., player hair length) or inaccurate (e.g., player's position). Yet choosing players they reported having knowledge about over unrecognized players yielded more correct inferences overall than choosing merely recognized players over unrecognized players. Furthermore, participants chose a player they had knowledge about over a merely recognized player in 92% of instances. When both players were recognized, participants apparently searched their memory for additional knowledge about them and selected the player that they knew something about. These results suggest that the predictive validity of knowledge is higher than the predictive validity of recognition in the hockey player domain.

The current study provides some evidence to support arguments that people sometimes consider more than just recognition when making inferences between a recognized and an unrecognized object (Ayton & Önkal, 2005; Newell & Shanks, 2004) and that people use recognition to make decisions only when there is no other information available and no opportunity to search for additional information (Newell & Shanks, 2004). As mentioned, however, we did not directly assess whether a recognition-based decision could be altered by further knowledge about the recognized object; thus we cannot conclude whether the recognition heuristic is in fact compensatory or noncompensatory. Experimentally determining this facet of the recognition heuristic is actually rather difficult. By making further information accessible to participants, Newell and Shanks gave them an opportunity whereby increasing effort would increase their likelihood of making an accurate decision. Ayton and Önkal not only made information accessible, but provided it directly to their participants so that there was no need to search for it. In both menu-based studies, participants used the available information and it was therefore concluded that recognizing one object and being ignorant about the other did not constitute a stopping rule. But the participants probably incorporated the provided information into their decision-making strategy because they felt it might enhance their accuracy and because they were not limited by time or cognitive constraints. These participants arguably had no reason to rely on the fastest and most frugal heuristic in the adaptive toolbox.

In the current memory-based study, participants relied on recognition to make inferences when it was the only cue available but probably did not base their inferences on recognition when there were other cues available. People under strict time or load pressures would probably also stop search after simply assessing whether they recognize two objects, and may be highly accurate by choosing the recognized objects in certain domains. Recognition can certainly be a highly predictive inferential cue. But Gigerenzer et al. (1999) do not argue that the search for information is unnecessary, but that a search is never performed when one object is recognized and the other is unrecognized. In order to support this claim, research would have to demonstrate that people, with task-relevant information already available in memory and under no strict time or load pressure, stop their search after assessing recognition of the two objects. We speculate that making recognition-based inferences in a manner that is consistent with adherence to the recognition heuristic is only an adaptive strategy in highly constrained situations, and only in these situations is it likely that people will use it to make accurate decisions.

The power of recognition-based inferences was strengthened by the finding that women were as accurate as men on MR-UR trials, despite being more ignorant about the NHL and recognizing fewer players. This finding is in line with the less-is-more effect (e.g., Goldstein & Gigerenzer, 1999), which states that those who know more exhibit lower inferential accuracy than those who know less. Because none of our participants recognized all 200 players and we did not employ exhaustive pairings of players, we could not truly test the less-is-more effect as outlined by Goldstein and Gigerenzer. However, based on a limited individual-level analysis, it appears that participants who recognized very few players performed near chance levels, accuracy increased as the number of recognized players increased up to nearly 100, and then leveled off beyond this point. Although the rightmost portion of the curve represents few participants, it appears to be following the inverted-U pattern that less-is-more effect data typically follow. In short, this trend occurs because increasing the number of recognized players beyond half results in fewer instances in which the recognition heuristic can be applied. Our curve integrates both merely recognized players and those who participants recognized and had additional knowledge about, however. Because we cannot be certain that recognition was used as a stopping rule when additional information about a recognized player was accessible to participants, the recognition heuristic cannot account for this finding, yet it is somewhat consistent with Gigerenzer and colleagues' findings.

In sum, this study showed that when people could not use knowledge to infer the better of two hockey players, they were still able to make accurate decisions. Thus, in this sports domain, and probably many others, when choosing between two alternatives, people could be highly accurate if they stopped search and made a decision after determining that they recognized one object and did not recognize the other. People appear to have the ability to exploit the way information is structured in the environment to be effective decision-makers even in the face of ignorance. However, people probably do not stop search and make an inference between two objects every time they recognize one and not the other. The question about the noncompensatory nature of the recognition heuristic could be resolved by considering the situations in which it is an adaptive strategy. When recognition is the only cue an individual has in memory about an object that is being compared to an unrecognized object, inferences will obviously be based on that cue. Future research should examine whether there are real-world situations in which individuals have access to additional information about a recognized object but adhere to the recognition heuristic by stopping search after assessing recognition for the two objects.

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## Sommaire

This paper addressed an issue concerning the influence of task-relevant knowledge when using the *recognition heuristic* (RH) (Gigerenzer, Todd, & the ABC Research Group, 1999) to make paired comparisons. Gigerenzer et al. (1999) claimed that inferring that a recognized object is higher on some criterion than an unrecognized object is a default decision making strategy that is not influenced by additional information and yields highly accurate decisions. Oppenheimer (2004) criticized Gigernezer et al.'s experiments by arguing that they confounded recognition with task-relevant knowledge and that it is difficult to disengage the effects of each on the basis of recognized vs. unrecognized ratings of objects. Specifically, Gigerenzer et al.

did not distinguish between trials on which participants' inferences were based on recognition alone and where they may have used additional knowledge about recognized objects, thus they were unable to provide compelling evidence that recognition alone can yield accurate inferences when it is used as a rule to stop searching for information.

The current study attempted to separate judgments made using recognition alone from those made by also using additional information when using the RH. On 100 paired comparison trials, 45 undergraduate participants inferred which of two NHL hockey players had the highest total career points. After each trial, participants reported whether they recognized each player and specified any additional knowledge they possessed about each player, permitting players to be classified as unrecognized (UR), merely recognized (MR), or recognized-with-knowledge (RK) and producing six possible trial types. Accuracy was measured as the percentage of inferences where the player with the most career points was selected (i.e., a correct inference) among all occurrences of a particular pairing type across all participants.

When participants had no knowledge about a player they recognized that was paired with a player they did not recognize (i.e., on MR-UR trials), they inferred that the recognized player had the most career points on 95% of those trials and achieved 81% correct inferences. Thus, using recognition alone as a stopping rule can produce high levels of accuracy in the hockey player domain. However, adherence to and accuracy of the RH elevated to 98% and 94%, respectively, on RK-UR trials. Although we did not employ a process tracing method, this finding suggests that at least some participants did not use recognition as a stopping rule, probably proceeding instead to search for task-relevant knowledge in memory. Gender comparisons revealed furthermore that women, who reported having less general knowledge about the NHL than men, were statistically as accurate as men on the inference task.

The study provides some evidence to support arguments that people sometimes consider more than just recognition when making inferences between a recognized and an unrecognized object (Ayton & Önkal, 2005; Newell & Shanks, 2004) and that people use recognition to make decisions only when there is no other information available and no opportunity to search for additional information (Newell & Shanks, 2004). We argue that in other highly constrained situations (e.g., when time or cognitive resources, rather than knowledge, are very limited), the RH may also be a likely decision making strategy and consequently call for future research to specify whether there are situations where using the RH may be adaptive.