

Original Article

# The social cognition of social foraging: partner selection by underlying valuation<sup>☆</sup>

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## Abstract

Humans and other animals have a variety of psychological abilities tailored to the demands of asocial foraging, that is, foraging without coordination or competition with other conspecifics. Human foraging, however, also includes a unique element: the creation of resource pooling systems. In this type of social foraging, people contribute when they have excess resources and receive provisioning when in need. Is this behavior produced by the same psychology as asocial foraging? If so, foraging partners should be judged by the same criteria used to judge asocial patches of resources: the net energetic benefits they provide. The logic of resource pooling speaks against this. Maintaining such a system requires the ability to judge others not on their short-term returns, but on the psychological variables that guide their behavior over the long term. We test this idea in a series of five studies using an implicit measure of categorization. Results showed that (a) others are judged by the costs they incur (a variable not relevant to asocial foraging), whereas (b) others are not judged by the benefits they provide when benefits provided are unrevealing of underlying psychological variables (despite this variable being relevant to asocial foraging). These results are suggestive of a complex psychology designed for both social and asocial foraging.

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## 1. Introduction

Survival and reproduction require energy. To extract this energy, natural selection has given animals exquisitely crafted psychological mechanisms for foraging (for reviews, see Gallistel, 1990; Stephens, Brown, & Ydenberg, 2007). Humans are no exception: Experimental and ethnographic evidence reveals that the human mind also contains foraging specializations (Hill, Kaplan, Hawkes, & Hurtado, 1987; Silverman & Eals, 1992; Winterhalder & Smith, 2000; New, Krasnow, Truxaw, & Gaulin, 2007; Hutchinson, Wilke, & Todd, 2008; Wilke & Barrett, 2009; Pacheco-Cobos, Rosetti, Cuatianquiz, & Hudson, 2010; Krasnow et al., 2011). Although much of the experimental work on humans has

addressed asocial, solitary foraging, an emerging literature has begun experimentally investigating human social foraging (e.g., Kameda, Takezawa, Tindale, & Smith, 2002; Kameda & Nakanishi, 2003; Kameda & Tamura, 2007; King et al., 2011; Hills & Pachur, 2012; Kaplan, Schniter, Smith, & Wilson, 2012). Although some aspects of human social foraging are similar to other animals', anthropological work shows that humans also have a unique style of social foraging: resource pooling (e.g., Kaplan & Hill, 1985; Cashdan, 1992; Fiske, 1992; Gurven, Allen-Arave, Hill, & Hurtado, 2000; Kaplan, Hill, Lancaster, & Hurtado, 2000; Gurven, 2004). Here, we use an experimental approach to study some of the cognitive mechanisms that give rise to this ability.

### 1.1. Foraging and social foraging

Successful foraging requires engaging with a complex world. Consider the psychological requirements of foraging in patchy environments. In such environments, prey items (e.g., fruit, insects, mammals) are distributed in patches—

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clumped together rather than randomly distributed. The marginal value theorem (Charnov, 1976) describes optimal foraging in these environments, predicting how long an animal should stay in a patch before leaving. Foraging mechanisms that embody the constraints of the marginal value theorem must estimate (a) the time to travel between patches, (b) the energy cost during travel, (c) the time to search for prey within a patch, (d) the energy cost of searching, (e) the number or amount of prey encountered over time in a patch (which is likely to change as the patch becomes depleted), and (f) the energetic return of consuming prey. Many of these variables will differ for different prey. More generally, optimal foraging requires estimating energetic return rates and implementing adaptive behavior in the face of changing external and internal environments (Gallistel, 1990; Stephens et al., 2007).

As with many foraging models, the marginal value theorem describes asocial foraging—foraging conducted without coordination or competition with other conspecifics. Other models have been developed that examine social aspects of foraging (for a review, see Giraldeau & Caraco, 2000). For instance, research has examined how animals in competition distribute themselves among foraging patches (e.g., Harper, 1982), how animals maintain collective vigilance for predators (e.g., Clutton-Brock et al., 1999), and how animals alert others to patches (e.g., Chapman & Lefebvre, 1990). This work reveals how sociality alters foraging dynamics in important ways.

Humans engage in a unique type of social foraging: multiple people forage and pool the resources they acquire. Co-foragers are not necessarily close kin and do not necessarily travel together during foraging trips. This type of foraging has variously been called resource pooling, communal sharing, social sharing, and risk reduction, among other terms (see above citations). The advantage of this system is that it buffers against shortfalls. Foraging is often high variance: On a given day, bad luck can prevent a forager from acquiring food. Even worse, injury and illness can prevent a person from foraging for extended periods—sometimes long enough that a forager would likely die without provisioning by others (Sugiyama, 2004). When foragers are successful, however, they may acquire more food than they can usefully consume before it spoils. They can share this excess with unsuccessful foragers, thereby providing a large benefit to others at a small personal cost. With frequent role reversals, most foragers will sometimes be successful and sometimes fail. Thus, resource pooling is not a unilateral flow of resources, but a type of social insurance that on average and over the long term can benefit those involved (Kameda, Takezawa, & Hastie, 2003). [Of course, in any given instance, a particular person or family might not earn a net benefit by participating. Moreover, exchanges do not need to be of equal magnitude: Highly productive people might give away more than they ever receive, but nonetheless benefit from provisioning in times of extreme need (Gurven et al., 2000).]

Could this system be implemented by the same variables that implement asocial foraging? This would be consistent with social exchange approaches to partner choice. These approaches hypothesize that the mind judges interaction partners by the rewards partners provide and the costs they inflict on the self (Homans, 1958, 1966; Thibaut & Kelley, 1959; Gouldner, 1960; Moreland, Levine, & Cini, 1993; Cropanzano & Mitchell, 2005). Although these are clearly important variables and this approach has generated an impressive body of supportive data, tracking only personally received benefits and personally incurred costs may not be sufficient to maintain resource pooling. Consider what would happen if humans judged foraging partners by the same metric used to judge a typical asocial foraging patch—return rate. If a foraging partner was unable to contribute due to bad luck, illness, or injury, then interacting with them would provide a low return rate. This, in turn, would lead to them being rejected as a foraging partner. Indeed, because almost everyone will be the victim of bad luck, illness, or injury, most people in one's social world would—by a return rate criterion—gradually be excluded as foraging partners. Ultimately, this causes the breakdown of a resource pooling system. To sustain such a sharing system, the mind must have a way to “see through” overt return rates and use other metrics (see also Delton, Cosmides, Guemo, Robertson, & Tooby, 2012). These other metrics must allow the mind to discover those individuals who will be valuable sharing partners over the long term, in the face of extensive variability.

In other words, this is a question of ecological rationality (Gigerenzer, Todd, & the ABC Research Group, 1999). What kinds of psychological variables and computations are necessary to behave adaptively in the context of resource pooling? In an ecological rationality approach, the computations performed and the information required depend critically on the problem being solved. Although personal benefits and personal costs might allow adaptive behavior in some contexts (e.g., asocial foraging), they are unlikely to support adaptive behavior in resource pooling; other variables are needed.

One possible solution is for the mind to estimate the underlying psychological variables that guide a foraging partner's behavior. These variables would more usefully predict behavior over the long term than overt return rate. Return rate, while useful for asocial resource patches, conflates several distinct causes of a person's contribution level, causes that may dissociate over the long term. Such causes include features of the person (such as willingness or ability to contribute) and features of the situation (such as injury or luck) that might hinder or enable successful contribution. Variables that conflate several distinct features of the world often make poor guides for behavior (Gallistel & King, 2009). Conversely and by definition, estimates of the psychological variables that underlie another person's behavior are estimates of a single, causal feature of the world. What might such internal variables look like?

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