# Theoretical and empirical framework

## The natural setting for food-seeking behavior

Foraging comprises the complete set of activities and behaviors related to obtaining food in a wild environment. Food-seeking behavior is a particular element of such set, which includes all re-orientation and locomotion activity related to the obtention of food. Thus, food-seeking behavior stops when a given food-resource is found, whereas foraging behavior is still present in future utilization of acquired energy, including feeding or possibly hoarding [@V3Z2UVAU#Kramer\_2001].

The food-seeking phase of foraging must ensure an optimal way to aquire food using the least amount of resource and reducing exposure to potential predators. If food-resources location where to be static, food-seeking behavior only necesary input would be an initial sampling of the environment, and then matching landscape cues, this is not the case. Animals do not necessarily follow landscape cue [@9XCDNBAM#Bartumeus\_Etal\_2016], or even develop search strategies based on them [@BWKDXXFW#Kölzsch\_Etal\_2015]. Moreover, animals are subject to incomplete knowledge about resources location, quality and probability of obtention [@ZD73QGIR#Pyke\_1984 ]. Thus a foraging animal must determine its food-seeking behavior considering an inherently stochastic environment with only partial knowledge.

In a stochastic environment, in order to to establish optimal food-seeking strategies, animals should consider the overall statistical properties of the environment, otherwise, local environment volatility could lead to the misguided preference for lower mean quality food resources with high variability, which could lead to starvation in the long run. Empirical evidence has shown that multiple animal species, including humans, perform search in a Lévy-walk fashion [@7YQKP7Z2#Garg\_Kello\_2021; @I2BS842S#Reynolds\_Etal\_2018; @TPRPLPEC#Viswanathan\_Etal\_1996; @BWKDXXFW#Kölzsch\_Etal\_2015]. Lévy-walks are random walks with a Lévy which produces heavy-tails, and describes multiple concentrated movements with sharp turning angles, followed by few ballistic displacements, such pattern produces optimal searches in a wide variety of environments were resources are dispersed in a patchy-fashion [@97UESCC6#Wosniack\_Etal\_2017], although its generative mechanism is not clear [@I2BS842S#Reynolds\_Etal\_2018] there is evidence that this mechanism is partially independent of sensory information [@M5RXPXSZ#Humphries\_Sims\_2014; @5WUMQR2H#Sims\_Etal\_2019], probably selected through evolution as it optimizes food searching with partial or complete lack of knowledge [@97UESCC6#Wosniack\_Etal\_2017].

Given that this food-seeking strategies are present without sensory information, and are ubiquitous in animals, food-seeking behavior probably evolved to deal with partial knowledge in uncertain environment. While, Lévy-walks provide a ‘basal’ strategy when there is partial or no knowledge, it is known that upon food encounter or sensing search strategy switches to a more focused one similar to brownian-motion [@5KMWW8NS#Reynolds\_Frye\_2007; @F9HICU4A#Nauta\_Khaluf\_Simoens\_2020]. Furthermore, computational modeling points how this switch between informed (brownian-like) and random search might be dependent on food encounter uncertainty [@3YWCKUUK#Anselme\_Otto\_Güntürkün\_2017]. Together this data suggests that animals food-seeking behavior evolved to deal with uncertain environments and partial knowledge. Moreover environment uncertainty itself modulates the baseline strategy, thus allowing to optimally search for food even when knowledge is not complete.