Hunting experience and prey predictability jointly shape individual foraging specialisation in a predator-prey videogame

# Abstract

Keywords: foraging behaviour, individual specialization, experience, learning, prey predictability, online videogames

# Introduction

Individual variation in predator foraging behaviour is increasingly recognized as a major driver of trophic interactions and community dynamics (Lima 2002; Schreiber et al. 2011; Pettorelli et al. 2015; Michalko and Pekár 2016). Indeed, predator populations are often composed of an assemblage of individuals that specialize in different foraging strategies or resources (**phillipsCausesConsequencesIndividual2017?**). It is now well established that individual foraging specialization cannot be attributed exclusively to instrinsic factors such as sexual, morphological, or age-related differences (Bolnick et al. 2003; Estes et al. 2003; Woo et al. 2008; Bolnick et al. 2011). A growing body of evidence suggests that ecological interactions, such as predator-prey interactions, may instead act as the major drivers of individual foraging specialization (Araújo et al. 2011; Toscano et al. 2016). Yet, we have very limited knowledge on how intrinsic factors and interactions with prey reciprocally affect predator foraging specialization, and the underlying ecological and fitness consequences of such among-individual differences (**phillipsCausesConsequencesIndividual2017?**).

sexual, morphological, or age-related differences, while environmental heterogeneity is a prevailing external factor Patrick et al. (2021).

*Ideas* : - \* we now have metrics that enable the quantification of individual specialization (cleasby)\*

A potential consequence of among-individual differences in foraging behavior is that they can lead to individual differences in the type of prey captured (i.e. individual niche specialization) [Woo et al., 2008, sources]. There may thus exist a functional relationship linking individual foraging specialisation to specialisation in resource consumption [sources: Toscano et al. 2016, etc, michalko et gibbons, Kerr, Tinker, Bowen]. This would imply that predators need to develop foraging tactics that are fine tuned to specific prey attributes or prey types [sources: Phillips, Woo, etc.]. *ICI GARDER LES IDÉES MAIS METTRE L’ACCENT SUR LE FAIT QUE C’EST LES PROIES DISPONIBLES AU LIEU DES PROIES MANGÉES*

For instance, predators species often use stereotyped hunting techniques required to capture the type of prey they encounter, such as (dauphins, orcas, etc) [sources : Woo, Estes, tinker, etc]. However, it remains largely unclear how extrinsinc and intrinsinct factors interact to shape these individual differences. Therefore, we still have limited knowledge on how individual foraging specialisation arises, and its ecological and community consequences.

Hunting experience has been proposed as a potential major driver of the relationship between foraging specialisation and resource use [sources]. Learning how to hunt is crucial for young predators to reach adulthood and survive. (check Urszan et al) (learning optimises return rates or foraging success) (apprentissage, search images, prior information) (par contre, décomposer l’âge de l’expérience est difficile, et particulièrement chez des espèces sur le terrain puisque ça peut impliquer des techniques invasives) (parler des études qui ont montré que certains spécialistes étaient meilleurs, mais que c’était confondu par l’âge)

A number of long-term studies observed that generalist and specialist individuals can achieve similar fitness [sources: à partir de Woo]. An emerging explanation is that temporal fluctuations in the predictability of resources (abundance, availability, behaviour) may favor one or the other strategy depending on time scales [sources : Woo, Phillips, Ceia, etc, Courbin, Chang]. The resource-predictability hypothesis advances that when resources are predictable, particularly on short time-scales, individual specialists should benefit from higher fitness returns. The rationale is that individuals should have higher prey delivery rates when they repeatedly employ the same foraging technique, as it is easier to assess prey predictability over shorter time-scales. In contrast, individual generalists should be advantaged over longer time scales, as resource parameters are expected to fluctuate. [revoir ceia et ramos pour les sources]

(travailler ceci) An important question that remains unanswered is how can generalist and specialist individuals coexist within predator populations. If foraging and resource specialisation can help maintain community stability by promoting species coexistence [sources: bolnick, araujo, wolf, etc], it is crucial that we develop studies that integrate the causes and consequences of these two individual components.

Several studies have shown that individual specialists can outperform

* Paragraphe 1 : Importance of among-individual variation in foraging behaviour
* Paragraphe 2 : Factors shaping individual variation in foraging behaviour - the role of experience (sources Weimerskirch, 2005, 2007) (explain mechanisms). Explain how it may unravel why foraging specialists are often thought to be more succesful.
* Paragraphe 3: (Linking prey variability to experience (woo et al.)) how trophic interactions are probably the main driver of learning and experience
* Paragraphe 4 (système qu’on utilise) (jeux vidéo : paragraphe le + court possible)
* Paragraphe 5 (objectifs et hypotèses)

*Idéé* : - Est-ce que ça se pourrait que les proies déterminent si les prédateurs se spécialize avec l’expérience ou plutôt deviennent flexible? Dans ce cas, j’utiliserais pas la covariance mais le comportement des proies en effet fixe sur la variance? ou il faudrait que je change les covariances?

# Dernier paragraphe intro (Thèsez-vous)

Here, we collected individual behavioural data from players in *Dead by Daylight* to investigate how hunting experience and the behavioural variation in prey encountered shaped predator foraging specialization. This enabled us to have a high degree of precision on the interaction as both the behaviour of the predator and the four prey were measured simultaneously in each trial. First, we hypothesize that individual predator behaviour will change with hunting experience. If experience reduces the costs of switching between hunting tactics, then predators should become more flexible through time. Alternatively, if experience enables the refinement of the hunting tactics, then individuals may instead specialize through time. Second, we hypothesize that prey behaviour will shape the developmental trajectories of the predator hunting tactics. Whether predators specialize or not with experience may depend on the behaviour of their prey, for instance, as it may be harder to specialize on prey that are more variable. Third, if individuals differ in their degree of foraging specialization, then we expect that the success of foraging specialists and generalists will be equal. Specialist hunters should fare better when prey variability is lower, while flexible hunters should fare better when prey variability is higher.

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