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Environmental Unpredictability

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Synonyms

Stochastic environment; Unpredictable environment

Definition

Uncertainty about future environmental outcomes.

Introduction

Choosing to stay at a party rather than leave depends on which people might still show up. Buying a house depends on future employment prospects. In making decisions, the best course of action often depends not only on current conditions but also on predictions about the future (Frankenhuis et al. 2016b).

Environments might be predictable for two reasons. First, environmental states might be autocorrelated across time (Nettle et al. 2013). If it rains today, it is likely to rain tomorrow. Second, even without such autocorrelation, *other* current cues might predict future conditions. For example, female parasitic wasps lay more eggs on low-quality hosts if conditions indicate an approaching thunderstorm (dropping barometric pressure) than if conditions indicate a fair summer day (steady barometric pressure). Thunderstorms might kill them, so rather than saving their eggs for a higher-quality host, the wasps deposit their eggs immediately (Roitberg et al. 1993).

Adaptation to Environmental Unpredictability

Natural selection favors different adaptations, depending on the degree of environmental predictability (Ellis et al. 2009; Frankenhuis et al. 2016a). If an environment is stable (and therefore predictable) generation after generation, natural selection might favor reliably developing phenotypes that are specialized for the prevailing conditions. If an environment is stable (and predictable) within a lifetime, but varies across lifetimes, natural selection might favor developmental plasticity – the ability to adjust development based on experience – if experience provides cues to the environmental state (Frankenhuis et al. 2013b). If an environment is variable across lifetimes and organisms cannot infer its state within lifetimes, natural selection might favor strategies that avoid extreme payoffs – either by producing generalist phenotypes, which do moderately well in all

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environmental conditions, or mixtures of specialists, each of which does very well in a subset of environmental conditions (Frankenhuis et al. 2016a).

Some evolutionary psychologists hypothesize that over the course of human evolution, the degree of environmental unpredictability might itself have been stable (and predictable) within a lifetime but variable across lifetimes (Ellis et al. 2009). If so, natural selection might have favored developmental plasticity for dealing with environmental unpredictability: organisms that infer the degree of environmental unpredictability during ontogeny and adapt accordingly (Frankenhuis et al. 2013a). Consistent with this idea, exposure to unpredictable childhood environments is associated with "fast" life histories, such as earlier age of first sex and first conception, higher rates of aggressive and delinquent behavior, and reduced health (Belsky et al. 2012; Brumbach et al. 2009; Nettle et al. 2011; Simpson et al. 2012). These associations remain after controlling for exposure to harshness, i.e., mean levels of morbidity and mortality.

Evolutionary developmental studies typically measure environmental unpredictability as residential changes, family disruptions, and parental job changes. An open and interesting question for future research remains whether these measures truly capture environmental unpredictability or different components of harshness (Nettle et al. 2012). A second challenge will be to empirically assess the idea that over the course of human evolution, the degree of environmental unpredictability was itself stable (and predictable) within a lifetime but variable across lifetimes (Nettle et al. 2013). A third challenge will be to determine how individuals might infer the degree of environmental unpredictability based on their experiences (Frankenhuis et al. 2013a).

Conclusion

In *Roadhouse Blues*, Jim Morrison sings: "The future's uncertain, and the end is always near" (The Doors, 1970). This sentence is contradictory. If the end is always near, then the future is certain: imminent death. The future is uncertain when it is not possible to predict it, that is, when current conditions are uncorrelated with future outcomes and there are no cues that predict future outcomes (Nettle et al. 2013).

Cross-References

- ▶ Brain Size-Environmental Change Hypothesis, The
- ▶ Dealing with Unknown Environments/Features
- ▶ Environmental Harshness
- ▶ Environmental Harshness/Mortality
- ▶ Environmental Risk
- ▶ Environmental Unpredictability and Bet-Hedging
- ▶ Environmental Unpredictability and Brain Complexity
- ▶ Harsh Environments

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