Within the evolutionary sciences, the concept of adaptation plays an indispensable role not only in explaining and understanding how the properties of organisms came to be what they are, but also in predicting and discovering previously unknown characteristics in the brains and bodies of species.Evolutionary psychologists, for example, analyze the adaptive problems our ancestors were subjected to, predict the properties of previously unknown cognitive mechanisms that are expected to have evolved to solve these adaptive problems, and then conduct experimental studies to test for the existence of psychological adaptations with the predicted design (see EVOLUTIONARY PSYCHOLOGY). An understanding that organisms embody sets of adaptations rather than just being accidental agglomerations of random properties allows organisms to be properly studied as functional systems. If language is accepted as being the product of adaptations, then there is a scientific justification for studying the underlying components as part of a functional system.

The concept of adaptation became more contentious when human behavior and the human psychological architecture began to be studied from an adaptationist perspective. Critics have argued that not every characteristic is an adaptation – an error adaptationists also criticize. More substantively, critics have argued that it is impossible to know what the past was like well enough to recognize whether something is an adaptation. Adaptationists counter that we know many thousands of things about the past with precision and certainty, such as the three-dimensional nature of space and the properties of chemicals, the existence of predators, genetic relatives, eyes, infants, food and fertile matings, and the acoustical properties of the atmosphere, and that these can be used to gain an engineer's insight into why organisms (including humans) are designed as they are.

– Julian Lim, John Tooby and Leda Cosmides

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AD HOC CATEGORIES

An ad hoc category is a novel category constructed spontaneously to achieve a goal relevant in the current situation (e.g., constructing *tourist activities to perform in Beijing* while planning a vacation). These categories are novel because they typically have not been entertained previously. They are constructed spontaneously because they do not reside as knowledge structures in long-term memory waiting to be retrieved. They help achieve a relevant goal by organizing the current situation in a way that supports effective goal pursuit.

Ad hoc categories contrast with thousands of well-established categories associated with familiar words (e.g., *cat, eat, happy*). Extensive knowledge about these latter categories resides in memory and may often become active even when irrelevant to current goals. When ad hoc categories are used frequently, however, they, too, become highly familiar and well established in memory. The first time that someone packs a suitcase, the category *things to pack in a suitcase* is ad hoc. Following many trips, however, it becomes entrenched in memory.

Ad hoc categories constitute a subset of role categories, where roles provide arguments for verbs, relations, and **SCHEMATA**. Some role categories are so familiar that they become lexicalized (e.g., *seller, buyer, merchandise,* and *payment* name the agent, recipient, theme, and instrument roles of *buy*). When the conceptualization of a role is novel, however, an ad hoc category results (e.g., *potential sellers of gypsy jazz guitars*). Pursuing goals requires the constant specification and instantiation of roles necessary for achieving them. When a well-established category for a role doesn't exist, an ad hoc category is constructed to represent it.

Both conceptual and linguistic mechanisms appear central to forming ad hoc categories. Conceptually, people combine existing concepts for objects, events, settings, mental states, properties, and so on to form novel conceptual structures. Linguistically, people combine words in novel ways to index these concepts. Sometimes, novel concepts result from perceiving something novel and then describing it (e.g., seeing a traditional opera set in a modern context and describing this newly encountered genre as "modernized operas"). On other occasions, people combine words for conceptual elements before ever encountering an actual category instance (e.g., describing mezzo sopranos who have power, tone, and flexibility before experiencing one). The conceptual and linguistic mechanisms that formulate ad hoc categories are highly productive, given that components of these categories can be replaced systematically with alternative values from *semantic fields* (e.g., *tourist activities to perform in X,* where *X* could be *Rome, Florence, Venice,* etc.). Syntactic structures are also central for integrating the conceptual/linguistic components in these categories (e.g., the syntax and accompanying closed class words in *tourist activities to perform in Rome*).

Lawrence Barsalou (1983) introduced the construct of ad hoc categories in experiments showing that these categories are not well established in memory and do not become apparent without context. Once constructed, however, they function as coherent categories, exhibiting internal structures as indexed by typicality gradients. Barsalou (1985) showed that these gradients are organized around ideal values that support goal achievement and also around frequency of instantiation. He also showed (1987) that these internal structures are generally as stable and robust as those in familiar taxonomic categories.

Barsalou (1991) offered a theoretical framework for ad hoc categories (see also Barsalou 2003). Within this framework, ad hoc categories provide an interface between roles in knowledge structures (e.g., schemata) and the environment. When a role must be instantiated in order to pursue a goal but knowledge of possible instantiations does not exist, people construct

an ad hoc category of possible instantiations (e.g., when going camping for the first time, constructing and instantiating *activities to perform on a camping trip*). The particular instantiations selected reflect their fit with a) ideals that optimize goal achievement and b) constraints from the instantiations of other roles in the knowledge structure (e.g., *activities to perform on a camping trip* should, ideally, be enjoyable and safe and should depend on constraints such as the vacation location and time of year). Once established, the instantiations of an ad hoc category are encoded into memory and become increasingly well established through frequent use (e.g., establishing *touring back roads* and *socializing around the campground* as instances of *activities to perform on a camping trip*). Barsalou (1999) describes how this framework can be realized within a perceptual symbol system. Specifically, categories (including ad hoc categories) are sets of simulated instances that can instantiate the same space-time region of a larger mental simulation (where a simulation is the reenactment of modality-specific states, as in mental imagery).

Ad hoc categories have been studied in a variety of empirical contexts. S. Glucksberg and B. Keysar (1990) proposed that ad hoc categories underlie metaphor (e.g., the metaphor jobs are jails conceptualizes the category of *confining jobs*). C. J. Cech, E. J. Shoben, and M. Love (1990) found that ad hoc categories are constructed spontaneously during the magnitude comparison task (e.g., forming the ad hoc category of *small furniture*, such that its largest instances anchor the upper end of the size dimension). F. Vallee-Torangeau, S. H. Anthony, and N. G. Austin (1998) found that people situate taxonomic categories in background settings to form ad hoc categories (e.g., situating *fruit* to produce *fruit in the produce section of a grocery store*). E. G. Chrysikou (2006) found that people rapidly organize objects into ad hoc categories that support problem solving (e.g., *objects that serve as platforms*).

Research has also addressed ad hoc categories that become well established in memory, what Barsalou (1985, 1991) termed "goal-derived categories" (also called *script categories*, *slot filler categories*, and *thematic categories*). J. Luciarello and K. Nelson (1985) found that children acquire goal-derived categories associated with **SCRIPTS** before they acquire taxonomic categories (e.g., *places to eat*). B. H. Ross and G. L. Murphy (1999) examined how taxonomic and goal-derived concepts simultaneously organize *foods* (e.g., *apples* as belonging simultaneously to *fruit* and *snack foods*). D. L. Medin and colleagues (2006) found that goal-derived categories play central roles in cultural expertise (e.g., tree experts form categories relevant to their work, such as *junk trees*).

Although ad hoc and goal-derived categories are ubiquitous in everyday cognition, they have been the subject of relatively little research. Much further study is needed to understand their structure and role in cognition. Important issues include the following: How do productive conceptual and linguistic mechanisms produce ad hoc categories? How do these categories support goal pursuit during situated action? How do these categories become established in memory through frequent use? How does the acquisition of these categories contribute to expertise in a domain?

– Lawrence W. Barsalou

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ADJACENCY PAIR

CONVERSATION ANALYSIS, an inductive approach to the microanalysis of conversational data pioneered by Harvey Sacks (1992), attempts to describe the sequential organization of pieces of talk by examining the mechanics of the turn-taking system. Adjacency pairs reflect one of the basic rules for turn-taking (Sacks, Schegloff, and Jefferson 1974), in which a speaker allocates the conversational floor to another participant by uttering the first part of a paired sequence, prompting the latter to provide the second part. Examples are question-answer, greeting-greeting as in (1), and complaint-excuse:

(1) A: i there
B: Oh hi

The constitutive turns in adjacency pairs have the following structural characteristics:

(i) They are produced by two different speakers.

(ii) They are, as the term suggests, adjacent. This is not a strict requirement, as the two parts can be separated by a so-called *insertion sequence*, as in (2):