

# A Checklist to Define the Psychological Processes\*

*Una Lista de Control Para Definir los Procesos Psicológicos*

*Um Check-list para Definir os Processos Psicológicos*

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## Abstract

This essay explores a conceptual definition of *psychological processes*. Previous researchers from the fields of psychology and neuroscience have noted that improving the definition of psychological processes may be extremely useful to help current efforts to map the neurobiological basis of psychological phenomena. In this essay I suggest a conceptual path in which psychological processes might be characterized by their material, efficient, formal, and final causes. I briefly explore the potential use of this way of defining psychological processes for neuroscience and psychology, and also comment on the effect it may have for the traditional distinction between basic and higher-order processes.

**Keywords:** Aristotle, psychological processes, definition, material cause, efficient cause, formal cause, final cause, neuroscience.

## Resumen

El ensayo tiene como objetivo explorar una definición conceptual de los *procesos psicológicos*. Investigadores contemporáneos en psicología y neurociencia han observado que mejorar la definición de los procesos psicológicos puede ser extremadamente útil para contribuir a los intentos actuales de localizar las bases neurobiológicas de los fenómenos psicológicos. En este ensayo sugiero una alternativa conceptual en la que los procesos psicológicos podrían ser caracterizados por sus causas materiales, formales, eficientes y finales. Brevemente exploro el potencial de esta forma de definir los procesos psicológicos en neurociencias y en psicología, así como sus posibles implicaciones en la distinción tradicional entre procesos básicos y procesos superiores.

**Palabras clave:** Aristóteles, procesos psicológicos, definición, causa material, causa eficiente, causa formal, causa final, neurociencia.

## Resumo

Neste ensaio exploro uma definição conceitual de *processos psicológicos*. Pesquisadores precedentes da psicologia e neurociência notaram que melhorando a definição de processos psicológicos poderia ser extremamente útil para contribuir com os esforços atuais para mapear a base neurobiológica do fenômeno psicológico. Sugiro uma via conceitual na qual os processos psicológicos possam ser caracterizados pelas suas causas materiais, causas eficazes, causas formais e causas finais. Brevemente exploro o uso potencial deste modo de definir os processos psicológicos para a neurociência e psicologia, e suas possíveis implicações para a distinção tradicional entre processos básicos e processos superiores.

**Palavras-chave:** Aristóteles, processos psicológicos, definição, causa material, causa eficaz, causa formal, causa final, neurociência.

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### **Psychological Processes**

Do you believe that you react similarly to equivalent situations? Despite the fact that there are outstanding variations in human behavior, this is of course, a fundamental point of departure for psychological science: the assumption that there are recurring patterns in behavior and its concomitant emotions and thoughts. Normally, psychologists refer to these behavioral patterns and their underlying mechanisms as *psychological processes*.

In a previous short essay, targeted at a broader audience (Tamayo, 2010), I was interested in exploring the way in which psychologists customarily define psychological processes. For instance, most text-books in psychology distinguish between basic (perception, attention, emotion, etc.) and higher-order psychological processes (abstraction, thinking, language, etc.). Similar classifications are implicitly assumed in bachelor programs of psychology at universities and in research journals. What distinguishes basic from higher-order processes? Is this only a methodological distinction brought out to organize different fields of research? Or are there actually reasons suggesting that our current taxonomy corresponds to an ontological distinction among psychological processes? In the present essay, I address the definition of psychological processes, and I will try to identify some of the critical questions that may help characterize our current taxonomy of basic and higher-order psychological processes.

### **Neuroscience and Psychology**

One of the initial key reasons I had for addressing this topic is related to the current developments in behavioral and cognitive neuroscience. Seventy years ago, it seemed to be an open question whether or not the neural substrates of psychological processes were susceptible of direct observation (e.g., Lashley, 1930). Research was mainly constrained by severe limitations in observation techniques, on the one

hand, and by the nature of hypothetical psychological processes, on the other. Today, many influential psychologists and neuroscientists claim that contemporary progress in the available observation techniques will lead to an imminent integration between the neurosciences and psychological sciences (Poldrack, 2006; Posner & Rothbart, 2007). The high number of publications in the domain of cognitive neuroscience and behavioral neuroscience clearly support this claim. Psychological research has provided us with a great deal of empirical characterizations, detailed models, and clever research techniques to tackle the study of basic and higher-order psychological processes. Unfortunately, it is not equally clear whether psychological science has contributed significantly to the improvement of its conceptual elements, especially, to defining and organizing the taxonomy of hypothetical psychological process under study. Maybe for this reason there are still hotly debated questions regarding the future of psychology. For example, is it possible to reduce all psychological principles to neurobiological characterizations? Or might psychology and neurosciences coexist as independent sciences?

I believe that the picture of the relationship between psychology and neuroscience that has emerged in recent years requires additional work to conceptually characterize psychological processes. For me, it has become increasingly difficult to make sense of some approaches adopted in neuroscience. For instance Cacioppo and Decety (2009) recently stated “that the human brain is the organ of the mind is not in dispute” (p. 10). They later suggested that “the identification of the brain mechanisms underlying specific psychological processes requires the accurate specification of psychological processes” (p. 12). I actually believe that many important reasons and empirical research indeed dispute the assumption that “the brain is the organ of the mind”. A strong argument, for instance, was developed by Putnam (1973), who stated that

“from the fact that the behavior of a system can be *deduced* from its description as a system of elementary particles it does not follow that it can be *explained* from that description” (p. 131). In consequence, Putnam’s analysis would invalidate Cacioppo and Decety’s assumption that the brain is the organ of the mind without one having to accept Putnam’s thesis of multiple realizability. Similarly, Killeen and Glenberg (2010) have recently reviewed empirical evidence showing that an extended notion of cognition -in which not only the brain but also the whole nervous system is taken into account- might do a better job than traditional reductionist approaches in integrating a broad range of empirical findings (ranging, for instance, from change blindness to the Simon effect) that would seem otherwise scattered, as if they were fundamentally different phenomena (for more detail see Killeen & Glenberg, 2010).

However, noticing some shortcomings of this received brain-centered approach does not mean in any way that neurobiology and brain imaging techniques are irrelevant for understanding psychological processes; it simply emphasizes the idea that psychological processes may not exclusively be accounted for by reducing them to an inferior (brain-based) level of explanation. In this precise sense, I strongly agree with Cacioppo and Decety’s claim that psychology needs to specify in more detail the psychological processes it studies, which, of course, have to be consistent with neurobiological findings. This would not only help neuroscience increase the battery of paradigms and concepts needed to study the biological mechanisms of cognitive and emotional processes, but also acknowledge the genuine role that psychology plays in formulating and identifying its own object of study.

### **Characterizing Psychological Processes**

A psychological process is a series of steps or mechanisms that occur in a regular way

-not necessarily a deterministic one- to attain changes in behavior, emotion, or thought. Psychological processes are a way to explain changes in the behavior of individual organisms and are formulated as a series of organized changes in the “state” of that organism and its environment. In traditional functionalist terms, the *state* of an organism refers to a description of the configuration of the internal components of the organism in relation to the role they play in the system of which the organism is a part, this is, its environment. Moreover, I suggest that psychological processes should also be characterized by (a) their biological substrates, (b) the adaptive function they fulfill, and (c) a formalized description of the changes in the states of the organism and the environment. The first part of the above definition is relatively standard. It understands a process as a series of changes in the states of an organism, and the environmental conditions triggering those changes. In this sense, the environment is considered the *efficient cause* for the psychological processes. The second part, however, adds to the standard definition the Aristotelian idea that an explanation also requires consideration of the *material causes* (the biological substrates), the *final causes* (the adaptive function), and the *formal causes* (the abstract description of the changes in the state of the organism). In a nutshell, I suggest that a comprehensive conceptual characterization of a psychological process would require formulating its corresponding efficient, material, formal, and final causes.

Consider, for example, defining the process of learning as a relatively permanent change in behavior determined by previous experience. In this definition, the efficient cause of learning would be equivalent to the specific environmental events that trigger, afford, and provide feedback to the learning process. The material cause would correspond to the body; especially the central and the peripheral nervous system, but also the genetic endowment and the endocrine

system that play key modulating roles in the learning processes. The formal cause may be represented by a negatively accelerated power function typical of practice, commonly observed in extended patterns of learning. The final cause is an increase in the survival likelihood of the organism and its genetic endowment. Let me provide an additional example from the field of decision-making under uncertainty. For instance, deciding between (a) a 70% chance of winning \$100, or (b) a 35% chance of winning \$250. In this form of decision-making, the efficient cause is the set of alternatives presented to the participant. The material cause is the prefrontal cortex, modulated by dopaminergic channels that modulate sensitivity to rewards. The formal cause may be Bernoulli's utility function, and the final cause is the maximization of utility.

I regard this characterization as a useful checklist in psychology and neuroscience to explicitly formulate definitions of the psychological processes under study. However, I would like to emphasize that this definition is not meant to prescribe, in the sense that *any* characterization of a psychological process has to fulfill these requisites. Some philosophers of science like Paul Feyerabend (1975) have made it clear that prescriptions such as the *scientific method* cannot automatically ensure interesting and innovative research results. In consequence, considering and formulating the efficient, material, formal, and final causes of a psychological process is only conceived as a guideline that may increase the clarity of theories and models, the precision of the communication of research results, and the organization of the different levels of explanation.

An additional advantage of formulating psychological processes in terms of the four Aristotelian causes is that it may also contribute to distinguishing between the notion of psychological processes and the notion of plain psychological events. For example, it is very useful to

distinguish between the psychological process of abstraction and its involvement as an underlying process to account for everyday psychological phenomena like deception and lying (e.g., Ariely & Norton, 2007).

A related issue commonly found in today's experimental research is the focus on a single task or experimental paradigm without specifying the criteria to group together or to separate the different research programs using this task. Consider, for instance, the vast amount of research that has investigated the effects associated to the Stroop task. The usual relative increase in the reaction time to the name of the colors printed in an incongruent ink-color has been the focus of research from the perspective of multiple psychological processes, such as attention, motor learning, working memory, language acquisition, so on. For example, when the Stroop task is used to study motor learning, it would be useful to formulate the four hypothetical causes of the process in order to distinguish it from the cases in which the task is used to study attention. Particularly, this formulation in terms of the four elements proposed above is especially helpful because the hypothetical final causes of these two processes might be quite different. In the case of attention, the final cause might be to select and filter irrelevant information; in the case of motor learning, the final cause might be to prepare and to program frequently required responses.

### **Consequences for a Taxonomy of Psychological Processes**

In my previous essay on the topic of psychological processes, I took the widely used classification mainly popularized by Vygotski in which basic processes are distinguished from higher-order psychological processes. Unfortunately, I have not found in Vygotski or in other classical writings like James's *Principles of Psychology* (1890), further explanations about why this classification should be adopted. Which is the key criterion to take for granted this binary

classification of psychological processes? And furthermore, is this classification a plain methodological distinction? Or does it also indicate something substantially different in the nature of basic and higher-order processes?

Before tackling these questions I should first distinguish between *absolute* and *relative* criteria commonly used to tell apart different types of psychological processes. An example of an absolute criterion is consciousness, in the sense that any process that requires conscious effort may be classified as complex or belonging to the group of higher-order processes, whereas any process that does not require consciousness may be classified as a basic process. This absolute criterion does quite a good job in organizing many research fields. From this perspective, for instance, most bottom-up processes involved in perception, associative learning, or emotion might be classified within the basic type of processes. Whereas top-down processes like reasoning, judgment, or decision-making might be sorted as higher-order processes. Another, more classical, example of an absolute criterion would be to ask whether a certain psychological process is exclusive for humans or whether it is shared by other species. In this sense, processes such as language would constitute an example of higher processes, whereas associative learning would be an instance of basic processes, mainly because the first is only present in humans but the latter is shared across various species. This is, by the way, the classification approach presumably adopted by Vygotski to distinguish between basic and higher-order processes. The landmark of higher order processes for Vygotski lies in the unique human ability of internalizing socially constructed practices such as the use of signs (Vygotski & Cole, 1978).

One difficulty with absolute criteria is that it becomes hard to define them. For example, is consciousness a psychological process? Or is it simply a psychological state? Should consciousness itself be classified as a basic or as a

higher-order process? An alternative way to organize psychological processes may be based on a *relative* criterion instead of an absolute criterion. A relative criterion consists, for example, in the assumption that higher psychological processes are those in which a combination of at least two basic psychological processes underlies or subserves other higher-order process. Conversely, basic processes cannot be accounted for by any combination or reduction to some other psychological processes.

More precisely, I would like to advance the idea that defining psychological processes in terms of their material, efficient, formal, and final causes may also help to distinguish between basic and higher-order processes. In other words, whenever another Psychological Process A is invoked to account for the material, efficient, formal or final cause of a Process B, then Process B constitutes a higher-order process. For example, according to the relative criterion I endorsed above, memory processes may subserve most forms of learning because otherwise there would be no way to explain the retention of previously acquired information or skills evident in learning tasks. Interestingly, this use of a relative criterion may generate a more detailed taxonomy of psychological processes that surpass the current binary distinction between basic and higher-order processes. In principle, the classification cannot contain more than five degrees of freedom because any hypothetical higher-order process cannot have more than the four different Aristotelian types of causes.

An additional advantage is that this kind of definition in terms of the four causes may help to further clarify circumstances in which psychological processes are also used to describe fields of research. Note that this thesis only concerns psychological *processes* but not to psychological *events*. This is so because psychological events normally require the identification of the primary and subsidiary psychological processes that underlie them. For instance, to return to a

previous example, the psychological event of lying may be explained by appealing to a process of abstracting the costs and anticipating possible negative consequences for telling the truth. The primary phenomenon of deception is, in turn, subserved by other processes such as language, abstraction, memory, emotion, and motivation. In this case, because lying is a psychological event but not a psychological process in itself (despite the fact that it is accounted for in terms of different psychological processes) we cannot argue that lying is in itself an explanatory psychological process. Therefore, different researchers interested in the psychological phenomena related to lying may actually be studying different psychological processes. They might be even studying sociological and biological processes.

Finally, for the sake of clarity, I would like to provide an everyday example to distinguish between psychological processes, psychological phenomena, psychological events, and states. A friend of mine was always afraid of driving, after having an accident. When he knew he had to drive he displayed some strong somatic markers of anxiety. I told him that Pavlovian conditioning may play a key role in the configuration of his phobia and I advised him to go to psychotherapy. His therapist conducted a desensitization treatment and taught him a few relaxation techniques. Now my friend can drive again. In this example, Pavlovian conditioning is the *psychological process* used to account for my friend's fear. The *psychological phenomenon* is anxiety. Fear is the plain, everyday *psychological event* that he usually experienced when he had to drive. The therapy modified my friend's *psychological state* by assigning new relaxation conditioned responses to previous stressful conditioned stimuli. In turn, the four Aristotelian causes may be used to define precisely Pavlovian conditioning. The efficient cause of Pavlovian conditioning is the set of pairings between unconditioned stimuli and conditioned stimuli

that lead to the formation of a set of conditioned responses. The material cause is the amygdala and the hippocampus. The formal cause may be described by the Rescorla-Wagner model. The final cause is to improve the adaptation to his everyday environment.

### Discussion

I have suggested that the meaning of psychological processes as explanatory tools in the construction of theories may be clarified by using the four Aristotelian causes. This implies that research centered on the brain mechanisms of psychological processes covers mainly the material causes. I have also suggested that relative definitions of psychological processes may be based on the idea that basic psychological processes do not have another psychological process lying in the core explanation of either its material, efficient, formal, or final causes, whereas higher-order psychological processes invoke another subsidiary process as at least one of its causes. Further conceptual research on this topic could investigate specific research fields and attempt to find key explanatory causes usually invoked within them to check whether a few psychological processes and principles are ultimately formulated within each field.

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