# Control Of Action Model

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**Primary Disciplinary Field(s):** Cognitive Psychology, Neuropsychology
**Proponents:** Donald A. Norman, Timothy Shallice

## 1. Core Principles

The **Control of Action Model**, also widely recognized as the **Attentional Control of Action Model** or the **Norman and Shallice Model**, offers a sophisticated dual-process framework for understanding how human actions are selected, managed, and executed. This influential cognitive model, proposed by cognitive scientist **Donald A. Norman** and British neuropsychologist **Timothy Shallice**, posits that action selection is not a monolithic process but is, in fact, governed by two distinctively different yet integrated systems. These systems are the **Contention Scheduling System (CSS)** and the **Supervisory Attentional System (SAS)**. The core principle of the model lies in its ability to differentiate between routine, automatic behaviors that require minimal cognitive oversight and novel, complex situations that demand conscious, effortful control.

The model's fundamental assertion is that our cognitive architecture is designed to efficiently handle a vast range of tasks by strategically allocating attentional resources. Routine actions, which comprise a significant portion of our daily activities, are managed by a largely automatic system, freeing up higher-level cognitive capacity. Conversely, when individuals encounter situations that are new, challenging, or require careful deliberation, a specialized executive system intervenes to guide behavior. This division of labor ensures adaptability and operational efficiency, allowing individuals to navigate both predictable environments with ease and unpredictable circumstances with deliberate thought and strategic planning. The interplay between these two systems forms the bedrock of how human intentionality translates into action, accommodating both the habitual and the volitional aspects of behavior.

## 2. Historical Development

The **Control of Action Model** emerged as a seminal contribution in the mid-1980s, primarily articulated in the groundbreaking work "Attention to Action: Willed and Automatic Control of Behavior" by **Donald A. Norman** and **Timothy Shallice**. Their collaboration was instrumental in synthesizing distinct threads of research from cognitive science and neuropsychology into a coherent framework. Prior to their work, theories of attention and action often struggled to provide a unified explanation for how individuals shift between effortless, automatic behaviors and effortful, controlled ones, particularly in the context of everyday slips of action and the challenges faced by individuals with neurological impairments.

Norman, with his background in cognitive science and human-computer interaction, brought

insights into information processing and the architecture of the mind, while Shallice, a prominent neuropsychologist, contributed extensive knowledge from studies of patients with frontal lobe damage, whose deficits highlighted the necessity of a supervisory control mechanism. Together, they developed a model that not only provided a theoretical account for normal cognitive function but also offered a powerful explanatory tool for understanding executive dysfunction. The model marked a significant evolution in cognitive theory by providing a structured, testable hypothesis about the functional segregation of automatic and willed control, thereby laying a crucial foundation for subsequent research into executive functions, attention, and the neurocognitive underpinnings of voluntary behavior.

## 3. Key Concepts and Components

**Contention Scheduling System (CSS):** This component of the model is responsible for the management and execution of highly practiced, routine, and largely automatic actions. The CSS operates by selecting among a repertoire of "schemas" or mental action units that represent well-learned sequences of behavior. These schemas are activated by environmental cues and internal states, and they compete for control of the motor system based on their relevance and activation strength. Once a schema is activated, it tends to run to completion without requiring direct conscious attention. Examples include habitual actions such as walking, riding a bicycle, typing familiar words, or driving on a well-known route without much thought. The efficiency of the CSS allows for rapid, fluid execution of everyday tasks, minimizing the cognitive load and freeing up attentional resources for more demanding processes. Failures within the CSS can lead to "slips of action," where an intended action is inadvertently replaced by a more habitual or strongly activated one.

**Supervisory Attentional System (SAS):** In stark contrast to the automaticity of the CSS, the SAS is a higher-level executive control system that becomes engaged during non-routine, novel, complex, or potentially dangerous situations that cannot be adequately handled by existing schemas or where the automatic responses of the CSS need to be overridden. The SAS is characterized by its capacity for deliberate, conscious control and plays a critical role in executive functions such as planning, decision-making, problem-solving, error detection and correction, and the generation of novel responses. When faced with an unfamiliar task or a situation requiring a strategic approach--for example, learning a new skill, navigating an unknown environment, or resolving conflicting demands--the SAS actively intervenes. It biases the selection of appropriate schemas, inhibits inappropriate ones, and creates new action sequences as needed. Damage or dysfunction of the SAS is frequently associated with executive function deficits observed in various neurological and psychological conditions, highlighting its crucial role in flexible and adaptive behavior.

## 4. Applications and Examples

The **Control of Action Model** provides a highly intuitive and practically applicable framework for comprehending a broad spectrum of human behaviors, particularly the critical distinction between automatic and controlled processing. A quintessential example frequently employed to illustrate the model's dynamics is the act of driving a car, which vividly demonstrates the interplay between the two systems. Consider a scenario where an individual is driving on a familiar, straight, and uncongested highway. In this context, numerous aspects of driving, such as maintaining speed, steering within the lane, and routine signaling, are largely managed by the **Contention Scheduling System**. These actions are highly practiced, almost reflexive, and require minimal conscious effort. The driver's established "driving schemas" are efficiently activated and operate in the background, allowing their mind to engage in other concurrent activities, such as listening to a podcast or conversing with a passenger, without significantly compromising driving performance.

However, the moment the driving conditions transition from routine to non-routine, the **Supervisory Attentional System** immediately becomes critically engaged. For instance, if the driver suddenly enters a bustling, unfamiliar city with dense traffic, intricate intersections, numerous pedestrians, and a plethora of road signs requiring interpretation, the SAS takes over. The driver must now actively deploy attentional resources to engage in complex planning, such as determining the correct route, processing and adhering to new traffic regulations, making rapid and precise decisions regarding lane changes, monitoring multiple environmental variables simultaneously, and actively inhibiting habitual responses that might be inappropriate in this novel context. This palpable shift from predominantly automatic, CSS-driven processing to effortful, SAS-guided control beautifully exemplifies the model's capacity to explain how cognitive resources are dynamically reallocated based on the demands of the task and the complexity of the environment, ensuring that behavior remains adaptive, safe, and goal-directed even in the most challenging real-world scenarios.

## 5. Criticisms and Limitations

While the **Control of Action Model** has undeniably been profoundly influential and has offered a foundational understanding of the mechanisms underlying action control, it is not without its share of criticisms and inherent limitations. One significant area of scholarly debate revolves around the precise nature and the intricate interaction between the **Contention Scheduling System** and the **Supervisory Attentional System**. Some critics have argued that the binary distinction between these two systems, although conceptually powerful and heuristically valuable, might oversimplify the complex and often highly integrated continuum of automaticity and control that is evident in the functioning of the human brain. The exact mechanisms through which the SAS effectively monitors, intervenes, and overrides the outputs of the CSS, or how novel action schemas are initially learned and subsequently integrated into the largely automatic CSS, remain areas that

necessitate further nuanced empirical investigation and theoretical refinement.

Furthermore, while the model excels at explaining phenomena such as "slips of action" and certain patterns of executive function deficits, some research perspectives suggest that it may not fully encompass all facets of goal-directed behavior. Specifically, its original formulation may not adequately account for the profound influence of emotional states, motivational drives, individual differences in cognitive capacity, or the role of implicit learning processes. The model's predominant emphasis on a top-down, executive control mechanism has also prompted questions regarding the extent of "bottom-up" influences and how emergent properties arising from complex neural network interactions might contribute significantly to action selection and self-regulation. Despite these areas of ongoing discussion and potential refinement, the Norman and Shallice model steadfastly remains a cornerstone in both cognitive psychology and neuropsychology, continuing to provide a robust and enduring framework that inspires extensive research into the intricate processes governing human attention, action, and cognitive control.

## Further Reading

Supervisory Attentional System - ScienceDirect Topics
Executive Function - Oxford Research Encyclopedia of Psychology
Attention and Action: Control of Human Performance - Annual Review of Psychology