COORDINATION OF SECONDARY CIRCULAR REACTIONS

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1. Core Definition and Placement in Piaget's Model

The **Coordination of Secondary Circular Reactions** represents the fourth of six substages within the Sensorimotor Period (birth to approximately two years old), as articulated by Swiss psychologist **Jean Piaget** in his seminal theory of cognitive development. This phase generally spans the developmental window from eight to twelve months of age and marks a profound transition in the infant's interaction with the external world. Unlike the preceding substage, which involved the accidental discovery and repetition of pleasing actions (secondary circular reactions), this stage introduces **intentionality** and **goal-directed behavior**. The infant is no longer merely repeating an action for its own sake but is actively employing known behavioral patterns, or schemas, as tools to achieve a pre-determined outcome.

Crucially, this substage is defined by the infant's capacity to coordinate two or more previously separate actions or schemas to attain a specific objective. For example, if a favorite toy is partially hidden behind a blanket, the infant does not simply attempt to reach the toy directly; instead, the infant employs one schema (e.g., pushing the blanket aside) as a means to execute a second schema (e.g., grasping the toy). This deliberate blending demonstrates a rudimentary form of planning and problem-solving, indicating that the infant now understands the relationship between actions (means) and consequences (ends). This cognitive advance signifies the breaking point between non-intentional reflexes and early forms of conscious planning, providing the foundation for subsequent intellectual growth throughout the remaining sensorimotor period.

Piaget viewed this coordination as evidence of a burgeoning understanding of causality and object relations. The infant begins to recognize that external objects and events exist independently and can be manipulated through specific sequences of actions. This newfound ability to structure behavior hierarchically (Action A must precede Action B) is the primary cognitive achievement of this phase. Failure to achieve or progress through the **Coordination of Secondary Circular Reactions** phase, therefore, often serves as a significant clinical marker signaling potentially **delayed cognitive development** or issues in the maturation of executive functions such as planning and impulse control.

2. Transition from Secondary Circular Reactions

Substage three, the stage of Secondary Circular Reactions (four to eight months), is characterized by the infant discovering that certain actions, usually involving objects outside their own body (such as shaking a rattle or kicking a mobile), produce interesting results, leading to their repetition.

However, these actions lack true foresight; the pleasurable outcome is discovered accidentally, and the repetition is merely habitual. The transition into Substage four involves a fundamental cognitive restructuring wherein the infant transforms these accidental discoveries into intentional instruments. The means are adapted before the goal is attained.

The shift is characterized by the differentiation of the goal from the means. In Substage three, the action *is* the goal (e.g., shaking the rattle is the satisfactory end). In Substage four, the action is recognized as a separate entity designed to *facilitate* the goal (e.g., shaking a hand to get attention is a means to achieve the goal of parental interaction). This intellectual leap requires enhanced memory capacity and the ability to hold the desired outcome (the goal) in mind while executing the preparatory steps (the means). This conscious application of past experience to a novel, goal-directed situation represents the earliest form of non-random, intelligent behavior, transitioning the infant from passive reactor to active orchestrator of their environment.

This transitional phase is sometimes subtle but always critical. It requires the infant to generalize learned behaviors--taking a schema originally used for one specific object (like batting at a toy) and applying it to a completely different context (like knocking over a block tower that is obstructing a different item). This cross-contextual application of schemas demonstrates the flexibility and integration of previously isolated behavioral patterns, moving away from simple stimulus-response loops toward genuine cognitive processing and strategic deployment of behavior.

3. Key Characteristics and Behavioral Manifestations

The behaviors observed during the Coordination of Secondary Circular Reactions stage are highly diagnostic of the infant's developing cognitive architecture. The infant begins to display sophisticated behavioral sequences that clearly differentiate them from earlier stages. The primary manifestation is the visible establishment of a goal *before* the action begins, demonstrating internal cognitive representation of the desired state.

One of the most powerful characteristics is the use of the **obstacle maneuver**. When faced with a barrier preventing access to a desired object, the infant will intentionally displace the barrier using a previously mastered secondary circular reaction (the means) before reaching for the object (the end). This coordination is direct evidence of the hierarchical organization of schemes. Previously, an obstacle would simply frustrate the infant or cause them to give up; now, the obstacle itself becomes the target of the initial strategic action.

Furthermore, infants in this stage exhibit early signs of **anticipation** of consequences. They not only act deliberately but also seem to expect specific results from their combined actions. They might look at the obstruction, then look at the goal, and then execute the plan, suggesting an internal mental representation of the sequence. This anticipation is central to the concept of intentionality; the infant understands, at a primitive level, that the world operates according to

predictable physical laws, which they can exploit to their advantage. This reliance on established action patterns to solve new problems is the hallmark of the substage, showing a significant move toward deliberate experimentation.

4. The Emergence of Intentionality and Problem Solving

The emergence of genuine intentionality is arguably the single most important cognitive achievement of Substage four. Prior actions, even those repeated with vigor, were not truly intentional in the sense of a means being consciously employed to achieve a foreseen end. Intentionality implies a cognitive framework where the goal is mentally established first, and the actions are then selected and ordered specifically to meet that goal. The coordination of two schemas--one serving as an instrument (the means) and the other serving as the desired outcome (the end)--is the practical expression of this internal intentionality.

The problem-solving strategies employed are still rudimentary and heavily dependent on actions the infant has already internalized through repetition (the secondary circular reactions). The infant cannot yet invent new means on the spot, but rather applies established actions in novel combinations. For instance, the infant might learn to pull a rug to bring a toy closer (a common example of means-end coordination). The pulling action is a familiar schema, but applying it as a tool to retrieve an out-of-reach object demonstrates a new level of strategic adaptation.

This newfound ability to link behaviors strategically allows the infant to overcome immediate environmental obstacles and extend their influence over their surroundings. This cognitive advancement is vital for developing concepts of space and causality. By intentionally causing events, the infant gains empirical evidence confirming that specific actions lead to specific, predictable results, strengthening their internal model of the physical world and setting the stage for more complex forms of mental representation and hypothesis testing in later stages.

5. Relationship to Object Permanence

The **Coordination of Secondary Circular Reactions** substage is intrinsically linked to the development of **object permanence**, the understanding that objects continue to exist even when they are not perceived by the senses. While earlier stages show only fleeting interest in absent objects, Substage four marks the first time infants actively search for objects that have been completely hidden. This search behavior is necessarily an act of coordinated schemas: the infant must successfully execute the "uncovering" scheme (moving the cloth) before executing the "grasping" scheme (retrieving the object).

However, the understanding of object permanence in this stage remains incomplete, characterized by the persistence of the classic **A-not-B error** (or the "Stage 4 Error"). If an object is hidden repeatedly at location A and the infant successfully retrieves it, and then the object is hidden at

location B in plain sight, the infant will often still search for the object at the original location A. Piaget interpreted this error not merely as a failure of memory, but as a limitation in the infant's understanding of the object's independence from their own actions. The object is still conceptually tied to the successful schema used to retrieve it (the action performed at A), rather than being localized in physical space B.

The existence of the A-not-B error underscores that while Substage four introduces complex coordination and intentional retrieval, the mental representation of objects is still concrete and action-bound. The infant has mastered the physical coordination required for searching but has not yet fully internalized the abstract concept of an object existing autonomously in space, regardless of the retrieval attempt. True, complete object permanence is only achieved in Substage six, when the infant can perform mental substitutions and solve the invisible displacement problem.

6. Developmental Timing and Cognitive Significance

The typical timing of this substage, between eight and twelve months, places it at a critical intersection of physical and cognitive maturity. The infant is typically mobile (crawling or cruising), possessing the necessary motor skills to physically execute the coordinated schemes required, such as reaching around obstacles or moving barriers. This synergy between physical capacity and cognitive advancement is essential for the successful completion of the stage's developmental tasks.

The cognitive significance of mastering the Coordination of Secondary Circular Reactions is enormous, as it represents the fundamental groundwork for future planning, decision-making, and executive function. By establishing the means-end relationship, the infant begins to operate not just in the present moment but with a short-term future goal in mind. This strategic thinking is the precursor to complex problem-solving abilities that will characterize later childhood.

As noted in developmental assessments, delay in achieving this stage can be indicative of underlying issues. The ability to coordinate actions intentionally is tied to neural maturation, particularly in areas related to working memory and frontal lobe activity. If an infant approaches 12 or 13 months without demonstrating reliable coordination of two separate schemas to reach a goal, clinicians may investigate factors contributing to developmental divergence, focusing specifically on motor skill acquisition, attentional capacities, and overall cognitive processing speed.

7. Criticisms and Modern Revisions of the Stage

While Piaget's framework remains foundational, modern developmental research has offered several criticisms and revisions regarding the precise timing and mechanisms of the Coordination of Secondary Circular Reactions. Contemporary researchers, often employing more sophisticated experimental techniques (such as habituation and preferential looking), suggest that infants

possess cognitive capacities, including object knowledge and intentionality, much earlier than Piaget proposed.

One major line of criticism focuses on the motor constraints inherent in Piaget's tasks. Critics argue that the A-not-B error, for example, may not solely reflect a failure of cognitive understanding but rather limitations in inhibitory control or motor planning. If the task is simplified, or if infants are merely allowed to *look* rather than *reach* for the object, evidence suggests earlier competence. This implies that the true cognitive breakthrough of intentionality might occur before eight months, but the physical manifestation (the coordination of two complex motor schemas) is delayed until the infant has the requisite motor maturity.

Furthermore, cross-cultural studies have shown variability in the timing of this stage, suggesting that environmental factors, parenting styles, and cultural practices that encourage or discourage independent exploration can impact the speed at which infants develop these coordinated schemas. Despite these criticisms, the concept of the Coordination of Secondary Circular Reactions remains a vital descriptive tool for developmentalists, accurately capturing the behavioral shift from reactive repetition to proactive, goal-directed problem-solving behavior that occurs near the end of the first year of life.

Further Reading

Jean Piaget - Wikipedia
Piaget's Sensorimotor Stage of Cognitive Development
Psychology Dictionary: Coordination of Secondary Circular Reactions
The A-Not-B Error: A Review of the Literature