State-Dependent Accessibility Coding System: An Observational Framework for Adaptive Accessibility Across Physiological and Contextual Conditions

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Abstract

Human behavioral and functional performance shows variability across physiological, contextual, environmental, and adaptive conditions even where previously demonstrated skills or learned repertoires are present. Observational frameworks often document behavioral outcomes without systematically operationalizing the variability apparent in adaptive accessibility across changing physiological-regulation conditions. This paper presents the state-dependent accessibility coding system (SDACS), an observational framework that is designed to support the ecological repeated-measures documentation of adaptive accessibility across changing physiological and contextual conditions. In the SDACS framework, adaptive accessibility refers to the moment-to-moment availability of adaptive behavioral, communicative, emotional, cognitive, relational, and regulatory capacities that arise naturally from contexts and demands. This framework distinguishes adaptive accessibility from the stable possession of skills, proposing that individuals can possess established repertoires while demonstrating fluctuating accessibility to those repertoires under changing physiological–regulatory and contextual conditions. The SDACS framework includes observational coding procedures that involve physiological load rating, adaptive accessibility rating, contextual and environmental coding variables, regulation-supportive observation procedures, and documentation of a post-support accessibility shift. The system is proposed as exemplifying an exploratory observational methodology rather than being a diagnostic instrument or direct biological measure of physiological processes. This framework is intended to support future repeated-measures observational study that examines the potential relationships among physiological–regulatory load, contextual conditions, adaptive accessibility, and behavioral organization in varied

ecological environments. Future empirical investigation is necessary to evaluate the feasibility, reliability, construct validity, and potential study applications of the SDACS framework.

1 Introduction

The functioning of human behavior and performance can has substantial variability across contexts, environments, physiological conditions, and time (Barrett, 2017; McEwen, 1998; Sapolsky, 2004). Individuals can demonstrate adaptive engagement, communication, emotional modulation, flexibility, participation in tasks, or organized responses under certain conditions while demonstrating a reduced level of accessibility to those same capacities in different contextual or physiological circumstances. Such variability is commonly observed across educational, clinical, developmental, neurobehavioral, and everyday ecological settings.

In many cases, skills or learned repertoires that have been previously demonstrated do not remain uniformly accessible across changing conditions. Individuals can possess established communicative, behavioral, emotional, cognitive, relational, or regulatory capacities while demonstrating fluctuating accessibility to such capacities across various physiological, environmental, sensory, social, and adaptive contexts. This variability can occur despite the prior acquisition of skills, exposure to instruction, reinforcement history, or repeated successful performance in alternative conditions (Craig, 2002; Damasio, 1999; Gomez Uncu, 2026a).

Observational and behavioral methodologies often focus primarily on observable behavioral outcomes, frequencies of performance, or discrete behavioral events. Although these approaches can effectively document behavioral occurrences, they might not always systematically operationalize moment-to-moment variability in adaptive accessibility across changing physiological–regulatory and contextual conditions. Thus, fluctuations in functional engagement, communications accessibility, flexibility, task participation, and adaptive response can sometimes be interpreted in the absence of structured observational frameworks that are capable of documenting broader state-dependent variability.

Recent studies have stressed physiology, autonomic regulation, interoception, adaptive load, embodied cognition, ecological regulation, and state-dependent learning to suggest that physiological and contextual conditions could influence the accessibility of adaptive functioning over time (Craig, 2002; McEwen & Sterling, 1993; Porges, 2011; Varela et al., 1991). Collectively, these perspectives support the growing interest in understanding human behavior and functioning as dynamic, context-sensitive, and influenced by ongoing physiological–regulatory organization rather than as solely static expressions of learned capacity (Bronfenbrenner, 1979; Kelso, 1995; Thelen & Smith, 1994).

The broader Non-Linear Physiology–Behavior Equation™ framework is used:

$$\begin{array}{c} A \leftrightarrow P \leftrightarrow C \\ \downarrow \\ B \end{array}$$

where antecedent conditions (A), the physiological state (P), and consequences (C) are conceptualized as continuously mutually interacting components in a dynamic nonlinear system, whereas behavior (B) reflects the downstream expressions of this ongoing interaction (Gomez Uncu, 2026a, 2026c, 2026e). According to this, physiological state (P) functions as a dynamic organizing variable through which contextual conditions can influence adaptive accessibility across changing ecological environments and physiological and regulatory conditions.

This paper introduces the state-dependent accessibility coding system (SDACS), an observational framework designed to support the structured ecological documentation of adaptive accessibility across changing physiological and contextual conditions. This framework is proposed as an exploratory observational method, which is designed to support repeated-measures observational investigation of variability in adaptive accessibility, physiological–regulatory load, contextual conditions, and regulation-supportive processes in various naturally occurring settings.

2 Definition of Adaptive Accessibility

Adaptive accessibility is the moment-to-moment availability of adaptive behavioral, communicative, emotional, cognitive, relational, and regulatory capacities in changing physiological and contextual conditions. In the given framework, adaptive accessibility is conceptualized as dynamic, not static, potentially fluctuating in response to ongoing interactions among physiological–regulatory organization, contextual demands, environmental conditions, sensory load, adaptive stressors, and regulation-supportive processes (Barrett, 2017; Kelso, 1995; McEwen, 1998).

Adaptive accessibility is used to distinguish the existence of a repertoire from the functional availability of that given repertoire in specific conditions. An individual can possess established skills, learned behaviors, coping strategies, communicative capacities, and adaptive repertoires but demonstrate different levels of access to those capacities across different physiological–regulatory and ecological states. Thus, previously demonstrated competence does not imply any level of stable or uniformly that accessibly functioned across all contexts and conditions (Damasio, 1999; Gomez Uncu, 2026a; Gomez Uncu & Morejón Rodríguez, 2026).

In various educational, clinical, developmental, and ecological settings, individuals can frequently demonstrate fluctuations in their communication accessibility, task participation, emotional modulation, flexibility, sustained engagement, adaptive response, and organized participation, regardless of any prior acquisition of relevant skills or repeated successful performance in different alternative conditions. This variability can occur across changing sensory environments, social demands, transitions, adaptive-load conditions, fatigue states, illness-related conditions, or broader contextual changes (Bronfenbrenner, 1979; Craig, 2002; Porges, 2011).

This framework proposes that adaptive accessibility can function as a state-dependent construct, influenced by ongoing physiological–regulatory and contextual organization. This perspective does not consider adaptive accessibility to be a fixed trait or stable characteristic but rather as a dynamic and context-sensitive process that is observable across naturally occurring ecological conditions (Friston, 2010; Kelso, 1995; Thelen & Smith, 1994).

It should be noted that the construct of adaptive accessibility is not intended to replace existing behavioral, developmental, educational, or clinical models of learning, skills acquisition, reinforcement, or behavioral analysis. Instead, the framework is intended to support the structured observational investigation of variability in the accessibility of adaptive functioning across changing conditions and physiological–regulatory states.

This can be expressed withing the broader Non-Linear Physiology–Behavior Equation™ framework as follows:

$$
\begin{array}{l}
A \leftrightarrow P \leftrightarrow C \\
\quad\;\; \downarrow \\
\quad\;\; B
\end{array}
$$

where adaptive accessibility is considered to be potentially influenced by ongoing interactions among antecedent conditions (A), physiological state (P), and consequences (C), and observable behavior (B) reflects the downstream expression of this dynamic interaction across ecological environments (Gomez Uncu, 2026a, 2026c, 2026e).

Adaptive accessibility is therefore proposed as an observational and exploratory construct intended to support future repeated-measures ecological investigations of variability in functional engagement, communication accessibility, adaptive participation, emotional modulation, flexibility, and broader adaptive organization across changing physiological and contextual conditions.

3 Theoretical Foundations of State-dependent Accessibility

The concept of state-dependent accessibility has emerged from the growing interdisciplinary recognition that human functioning can vary in response to ongoing physiological–regulatory and contextual conditions. Across multiple study domains, behavioral and functional variability is increasingly considered in relation to stress physiology, autonomic regulation, adaptive load, interoception, ecological regulation, embodied cognition, and state-dependent learning processes (Barrett, 2017; Craig, 2002; McEwen, 1998; Porges, 2011). All together, these perspectives together suggest that adaptive functioning might not remain uniformly accessible across changing physiological and environmental conditions.

In this framework, physiological states (P) are conceptualized as a dynamic and continuously fluctuating organizing variable operating within a broader nonlinear behavioral system. Physiological–regulatory organization can vary across contexts and times according to ongoing interactions among sensory inputs, environmental demands, adaptive loads, fatigue, social conditions, contextual uncertainty, illness-related factors, regulation-supportive processes, and broader ecological influences (Bronfenbrenner, 1979; Sapolsky, 2004; Sterling & Eyer, 1988). Thus, variability in terms of adaptive accessibility can reflect ongoing changes in physiological–regulatory organization instead of solely stable characteristics of competence, learning history, or skill possession.

The broader Non-Linear Physiology–Behavior Equation™ framework (Gomez Uncu, 2026a, 2026c, 2026e) conceptualizes antecedent conditions (A), physiological states (P), and consequences (C) as interactive components within a dynamic nonlinear system, and observable behavior (B) reflects the downstream expression of this interaction:

$$\begin{array}{ccccc} A & \leftrightarrow & P & \leftrightarrow & C \\ & & \downarrow & & \\ & & B & & \end{array}$$

where physiological states (P) are not conceptualized as a singular biological variable but rather as a multi-system and context-sensitive organizational process that is potentially associated with fluctuations in terms of adaptive functioning across ecological environments. This framework emphasizes dynamic interaction, variability, and ongoing physiological-contextual organization instead of static or purely linear interpretations of behavior and functioning (Friston, 2010; Kelso, 1995; Thelen & Smith, 1994).

This conceptualization also draws on physiology-informed frameworks developed within the broader behavioral physiology science architecture. The operationalization of the physiological state framework proposed the need for structured observational and multidimensional approaches to examine physiological–regulatory organization in nonlinear behavioral systems (Gomez Uncu, 2026c). Regulation before instruction emphasizes the potential importance of physiological–regulatory accessibility before instructional engagement or the demands of adaptive tasks (Gomez Uncu, 2026d). Functional regulation assessment (FRA) proposes a physiology-centered observational interpretation of adaptive functioning and behavioral variability across ecological contexts (Gomez Uncu, 2026b). Similarly, the interoceptive communication model (ICM) 2.0 presents a potential influence of physiological–regulatory organization on accessibility to communication, flexibility, emotional modulation, and adaptive participation across changing conditions (Gomez Uncu & Morejón Rodríguez, 2026).

This framework extends these conceptual foundations with the introduction of the SDACS, an observational methodology used to support the structured ecological documentation of adaptive accessibility across changing physiological and contextual conditions. This framework indicates that adaptive accessibility could fluctuate dynamically in relation to ongoing physiological–regulatory and contextual organization while continuously maintaining observational restraint with respect to direct biological inference or causal interpretation.

This framework is not intended to suggest that physiological–regulatory variables replace learning history, reinforcement processes, skills acquisition, behavioral contingencies, or broader environmental influences. Instead, the framework indicates that adaptive accessibility may function as a dynamic, state-sensitive process that is observable across naturally occurring ecological conditions. According to this perspective, variability in terms of adaptive functioning can be examined through structured observational methodologies that are capable of documenting fluctuations in physiological–regulatory load, contextual demands, environmental conditions, and accessibility over time.

This framework therefore uses a physiology-informed, nonlinear, and ecological systems orientation but maintains observational and exploratory positioning. This framework is intended to support future repeated-measures observational investigations of state-dependent accessibility and observe adaptive variability across naturally occurring contexts instead of establishing deterministic, mechanistic, or causal explanations of human behavior and functioning.

4 State-dependent Accessibility Coding System

The SDACS is proposed as an observational coding framework that is designed to document variability within adaptive accessibility across changing physiological and contextual conditions in ecological environments. This framework is designed to support the structured repeated-measures investigation of functional accessibility, physiological–regulatory load, contextual conditions, and adaptive variability across naturally occurring settings and demands (Bronfenbrenner, 1979; Gomez Uncu, 2026a).

The SDACS framework is exploratory, observational, and physiology-informed in structure. It is not intended as a diagnostic instrument, clinical classification system, or direct biological measure of any physiological process. Rather, SDACS is proposed as an ecological and observational methodology to document relationships among physiological–regulatory organization, contextual conditions, adaptive accessibility, and behavioral functioning across time.

This framework is grounded within a nonlinear system in which adaptive accessibility can fluctuate dynamically in response to ongoing interactions among physiological–regulatory conditions, environmental demands, sensory conditions, adaptive load, social contexts, and regulation-supportive processes (Kelso, 1995; Thelen & Smith, 1994). Within this perspective, variability in adaptive functioning is conceptualized as being potentially state-dependent and context-sensitive rather than being uniformly stable across all ecological conditions.

Thus, SDACS was developed to support the structured observational coding of adaptive accessibility in repeated ecological observation intervals. This framework is intended to facilitate the documentation of observable variability within communication accessibility, task participation, emotional modulation, flexibility, adaptive engagement, organized participation, and broader functional accessibility in changing contextual and physiological–regulatory conditions (Gomez Uncu, 2026b, 2026c).

The primary observational components of the SDACS framework include the physiological load rating (PLR), adaptive accessibility rating (AAR), contextual and environmental coding procedures, regulation-supportive observation procedures, and recovery/accessibility-shift observation procedures.

The PLR component is intended to support the observational documentation of physiological–regulatory load in terms of structured coding of observable indicators associated with autonomic strain, sensory–emotional burden, adaptive overload, and dysregulation-related organization during observation intervals (McEwen, 1998; Porges, 2011; Sterling & Eyer, 1988). The AAR component is intended to support structured observation of the moment-to-moment availability of adaptive behavioral, communicative, emotional, cognitive, relational, and regulatory capacities extending across ecological contexts (Gomez Uncu, 2026a; Gomez Uncu & Morejón Rodríguez, 2026).

The framework of SDACS also incorporates contextual and environmental coding procedures that are designed to document ecological variables that are potentially associated with variability in accessibility, including sensory conditions, social demands, transitions, environmental unpredictability, adaptive stressors, and broader contextual influences (Bronfenbrenner, 1979; Gibson, 1979). Procedures of regulation-supportive coding document observable support processes, including co-regulation, environmental modification, pacing adjustments, sensory supports, demand modification, and related accessibility-supportive interventions taking place within ecological contexts (Gomez Uncu, 2026d; Schore, 2003; Siegel, 2012).

Further, SDACS includes procedures of recovery and post-support accessibility observation designed to document observable shifts in adaptive accessibility following the implementation of regulation-supportive processes across naturally occurring conditions. These procedures are intended to support the exploratory repeated-measures observation of accessibility fluctuation, recovery trajectories, and broader ecological variability across time.

A framework is therefore proposed here as a structured observational methodology capable of supporting future empirical investigations of state-dependent accessibility through maintaining observational restraint regarding biological inference, mechanistic interpretation, or causal claims beyond the scope of ecological observational study.

5 Physiological Load Rating

The PLR component of the SDACS has been proposed as an observational index to document physiological–regulatory load across naturally occurring ecological observation intervals. In this framework, physiological–regulatory load refers to the observable degree of autonomic strain, sensory–emotional burden, adaptive overload, dysregulation-related organization, and broader physiological-contextual stress that is associated with a given observation period (McEwen, 1998; Porges, 2011; Sterling & Eyer, 1988).

The PLR framework is intended to support structured ecological observation of physiological–regulatory organization through repeated-measures documentation of observable indicators potentially associated with increased adaptive load or reduced physiological–regulatory stability. This framework does not consider physiological–regulatory load as a singular biological variable but rather as a multidimensional observational construct potentially involving interactions among sensory conditions, environmental demands, contextual stressors, fatigue, illness-related influences, emotional escalation, social conditions, and broader ecological factors (Bronfenbrenner, 1979; Gomez Uncu, 2026c; Sapolsky, 2004).

The scoring procedures for PLR utilize interval-based observational coding designed to document the predominant degree of observable physiological–regulatory load arising in a defined observation interval. Observation intervals can vary according to ecological context, study design, and observational procedures but are intended to support repeated-measures documentation of variability across time and across changing contextual conditions.

The PLR framework includes four operational anchor levels that are intended to support observational consistency across coding procedures.

PLR-0 represents minimal observable dysregulation and stable physiological–regulatory organization during the observation interval. Adaptive engagement and organized participation tend to ne appear broadly accessible without substantial support requirements.

PLR-1 denotes mild observable physiological–regulatory load where adaptive engagement remains largely accessible despite mild dysregulation-related indicators, increased requirements for effort, and emerging contextual strain.

PLR-2 reflects moderate physiological–regulatory load that is associated with observable dysregulation-related interference in adaptive engagement, increased prompt dependence, reduced flexibility, partial accessibility disruption, or increased support requirements in the observation interval.

PLR-3 indicates a high physiological–regulatory load that is associated with substantial disruption in adaptive accessibility, severe dysregulation-related organization, defensive responding, withdrawal, overload-related responding, or markedly reduced organized participation in the observation interval.

The observable indicators that are potentially associated with elevated PLR scoring include motor agitation, emotional escalation, rigidity, avoidance, sensory overwhelm indicators, dysregulated vocal tone, reduced functional communication, elevated prompt dependence, fatigue-related indicators, withdrawal, distress escalation, observable autonomic activation indicators, and broader dysregulation-related patterns occurring within ecological contexts (Craig, 2002; McEwen & Sterling, 1993; Schore, 2003). These indicators are intended to support structured observational coding instead of forming a definitive interpretation of the underlying biological mechanisms.

Importantly, the PLR framework is not intended to provide a direct biological measure of autonomic function, physiological activation, or neurophysiological processes. Instead, it reflects observational documentation of physiological–regulatory organization using ecologically observable indicators within naturally occurring conditions. Therefore, the framework maintains observational restraint regarding biological inference, mechanistic interpretation, or causal conclusions that go beyond the scope of structured ecological observation.

The PLR framework's observational nature introduces several important limitations. The observable indicators could reflect multiple interacting variables, including environmental conditions, social demands, reinforcement contingencies, contextual uncertainty, illness-related factors, developmental characteristics, and broader ecological influences. Further, observational interpretations could in relation to observer experience, ecological complexity, interval duration, contextual ambiguity, and the limitations associated with indirect observation of physiological–regulatory processes.

Thus, the PLR framework is proposed as an exploratory observational methodology that is intended to support future repeated-measures investigations of physiological–regulatory load and adaptive accessibility across changing ecological conditions instead of establishing direct physiological measurements or deterministic interpretations of human behavior and functioning.

6 Adaptive Accessibility Rating

The AAR component of the SDACS is proposed as an observational index to document adaptive engagement, functional availability, organized participation, and accessibility to previously demonstrated adaptive capacities in naturally occurring ecological conditions. In the given framework, adaptive accessibility is in reference to the observable moment-to-moment availability of adaptive behavioral, communicative, emotional, cognitive, relational, and regulatory capacities in a given observation interval (Gomez Uncu, 2026a; Gomez Uncu & Morejón Rodríguez, 2026).

The AAR framework is intended to support the structured ecological observation of variability in adaptive accessibility in changing physiological–regulatory and contextual conditions. According to this perspective, adaptive accessibility is dynamic, context-sensitive, and potentially state-dependent rather than uniformly stable across all environments or demands (Friston, 2010; Kelso, 1995; Thelen & Smith, 1994). This framework therefore distinguishes accessibility from competence, repertoire possession, or prior skills acquisition alone.

An individual can possess communicative, behavioral, emotional, cognitive, or adaptive repertoires while demonstrating fluctuating accessibility to those capacities across different physiological–regulatory and ecological conditions. Accordingly, the AAR framework does not conceptualize reduced adaptive accessibility as necessarily reflecting the absence of learning, competence, or skills acquisition. Rather, the framework proposes that accessibility to adaptive capacities may vary dynamically according to ongoing physiological–regulatory and contextual organization across naturally occurring settings (Barrett, 2017; Damasio, 1999; Gomez Uncu, 2026c).

The procedures of AAR scoring utilize interval-based observational coding that is intended to document the predominant degree of adaptive accessibility observed within a defined ecological observation interval. The observation intervals may vary according to study design, ecological context, or observational procedure, but they are intended to support repeated-measures documentation of variability across time and changing contextual conditions.

The AAR framework incorporates four operational anchor levels intended to support observational consistency with respect to coding procedures.

AAR-0 is representative of minimal or absent observable adaptive accessibility in the observation interval. Adaptive engagement, organized participation, communication accessibility, flexibility, or functional responding appear substantially limited despite available supports or opportunities for participation.

AAR-1 presents limited adaptive accessibility, characterized by inconsistent engagement, reduced organized participation, elevated support dependence, reduced flexibility, partial communication accessibility, or intermittent adaptive responding in the observation interval.

AAR-2 describes partial adaptive accessibility, where moderate engagement, intermittent organization, partial independence, emerging flexibility, or responsive adaptive participation are observable across part of the observation interval.

AAR-3 reflects strong adaptive accessibility, characterized by organized participation, sustained engagement, adaptive communication, flexible responding, emotional modulation, independent participation, and broader accessibility to adaptive capacities in the observation interval.

The observable indicators that are potentially associated with AAR scoring can include communication accessibility, task initiation, sustained attention, flexibility, adaptive participation, emotional modulation, transition tolerance, use of coping or replacement skills, organized engagement, independent responding, social participation, and broader indicators of functional accessibility across ecological contexts (Craig, 2002; Porges, 2011; Siegel, 2012).

Notably, the AAR framework conceptualizes adaptive accessibility as a dynamic, potentially state-dependent process, not a fixed trait or static measure of competence. Accessibility can fluctuate across changing physiological–regulatory conditions, contextual demands, environmental stressors, sensory conditions, adaptive-load states, fatigue conditions, social demands, and broader ecological influences (Bronfenbrenner, 1979; McEwen & Sterling, 1993; Sapolsky, 2004). Here, the framework distinguishes adaptive accessibility from stable repertoire possession or generalized assumptions concerning uniformly available functioning across all conditions.

The AAR framework is not intended as a diagnostic instrument, psychometric intelligence measure, or definitive assessment of overall competence or developmental capacity. Instead, the framework takes the form of an observational methodology to support ecological repeated-measures documentation of variability within adaptive accessibility across changing and varied physiological and contextual conditions.

Several important limitations are have been associated with the observational interpretation of adaptive accessibility. Observable adaptive engagement can be subject to influence by multiple interacting variables, including learning history, environmental contingencies, reinforcement conditions, contextual familiarity, motivational variables, developmental characteristics, communication supports, illness-related conditions, and broader ecological influences. Further, observational interpretation could vary in relation to observer experience, contextual ambiguity, interval duration, ecological complexity, and limitations that are associated with indirect observation of internal processes.

Thus, the AAR framework is proposed here as an exploratory observational methodology that is intended to support future repeated-measures investigations of adaptive accessibility and of state-dependent variability across ecological environments while maintaining observational restraint with respect to causal interpretation or mechanistic inference going beyond the scope of ecological observational study.

7 Contextual and Environmental Coding

The SDACS incorporates contextual and environmental coding procedures intended to support ecological observation of the environmental, sensory, social, and situational conditions occurring during observation intervals. The inclusion of contextual and environmental coding is essential for avoiding reductionistic interpretations of adaptive accessibility variability solely attributable to physiological–regulatory organization independent of ecological conditions (Bronfenbrenner, 1979; Gibson, 1979).

In this framework, adaptive accessibility is considered to emerge through ongoing interaction among physiological–regulatory organizations, environmental demands, contextual conditions, sensory influences, adaptive loads, and broader ecological processes. Accordingly, the SDACS framework proposes that variability in adaptive accessibility could reflect dynamic interaction among several variables simultaneously rather than isolated physiological or behavioral factors alone (Friston, 2010; Kelso, 1995; Thelen & Smith, 1994).

The contextual and environmental coding components of SDACS are meant to support the structured documentation of ecological variables that could potentially be associated with fluctuations in adaptive accessibility across naturally occurring settings. These variables could include sensory conditions, environmental demand intensities, social demand levels, transition conditions, contextual uncertainties, unpredictability, environmental changes, adaptive stressors, and broader ecological modifiers that could occur during observation intervals.

Sensory conditions could include observable environmental factors, such as noise intensity, crowding, sensory complexity, lighting variability, tactile conditions, environmental overstimulation, and other sensory-contextual influences that are potentially associated with adaptive accessibility variability (Craig, 2002; Porges, 2011). Environmental demand variables could include task complexity, performance expectations, instructional intensity, novelty of demands, pace of interaction, and cumulative ecological load occurring within the observation context.

Social demand coding could include the observational documentation of interpersonal complexity, social interaction intensity, participation requirements for a group, communication demands, social unpredictability, and broader interpersonal conditions arising in ecological observation intervals. Transition-related coding procedures could document environmental shifts, activity changes, movement across contexts, interruption of ongoing activities, and broader transition-related variability potentially associated with fluctuations in adaptive accessibility.

The SDACS framework also incorporates observational considerations of contextual uncertainty and environmental change. Uncertainty-related variables here could include the unpredictability of routines, unexpected demands, schedule changes, environmental instability, unfamiliar settings, and other ecological disruptions that are potentially associated with variability in terms of adaptive functioning across observation periods (Sapolsky, 2004; Sterling & Eyer, 1988).

Notably, contextual and environmental coding procedures are adopted to support ecological observation of dynamic interactions rather than any deterministic interpretation of environmental influences alone. The framework does not propose that environmental conditions uniformly determine adaptive accessibility outcomes independent of physiological–regulatory organization or that physiological–regulatory processes function independently of contextual conditions. Instead, SDACS conceptualizes adaptive accessibility as potentially emerging through ongoing interactions among physiological–regulatory organization, contextual conditions, environmental demands, and regulation-supportive processes across ecological environments (Gomez Uncu, 2026a, 2026c).

The inclusion of contextual coding procedures reflects the recognition that ecological variability could substantially influence observable functioning across natural settings. Adaptive accessibility could fluctuate according to changing environmental complexity, sensory conditions, contextual familiarity, social expectations, adaptive-load accumulation, and broader ecological variability that appears across times and settings. Thus, repeated-measures contextual observation is considered necessary for the structured investigation of variability in adaptive accessibility across ecological conditions.

Several limitations arise in terms of contextual and environmental observational coding. In themselves, ecological conditions are inherently multidimensional, continuously changing, and potentially difficult to operationalize in way that is completely precise across naturally occurring environments. In addition, contextual interpretation can vary by observer experience, environmental complexity, observational interval structure, and other limitations that are associated with capturing dynamic ecological interactions in structured observational procedures.

The contextual and environmental coding procedures proposed within SDACS are exploratory observational components intended to support future repeated-measures ecological investigations of adaptive accessibility variability across changing environmental and contextual conditions, maintaining observational restraint with respect to mechanistic or causal interpretation going beyond the scope of ecological observational studies.

8 Regulation of a Supportive Observation Framework

The SDACS incorporates regulation-supportive observational procedures that are intended to document observable support processes that take place within naturally occurring ecological environments. These procedures support the structured documentation of observations of potential associations among regulation-supportive processes, physiological–regulatory load, contextual conditions, adaptive accessibility, and observable shifts within functional engagement across repeated observation intervals (Gomez Uncu, 2026d; Schore, 2003; Siegel, 2012).

In this framework, regulation-supportive processes are observable environmental, interpersonal, sensory, pacing, and contextual modifications that could be associated with changes in adaptive accessibility in ecological observation periods. This framework conceptualizes such processes as components of a broader ecological interaction instead of than isolated intervention variables operating independently of contextual or physiological–regulatory conditions.

Procedures of regulation-supportive observation could include documentation of co-regulation, environmental modifications, pacing adjustments, sensory supports, reduced demands, transition supports, visual supports, environmental predictability strategies, break access, communication supports, and broader accessibility-supportive processes implemented in observation intervals. These procedures are intended to support the structured ecological observation of adaptive accessibility variability across changing conditions instead of evaluating intervention efficacy or establishing causal treatment effects.

Observations that are related to co-regulation could include the documentation of supportive interpersonal engagement, emotional stabilization supports, guided participation, communication support, and broader relational processes associated with observable changes in adaptive accessibility in ecological interaction (Schore, 2003; Siegel, 2012; Stern, 1985). Procedures of environmental modification could include observational documentation of changes in sensory complexity, environmental stimulation, task structure, contextual predictability, social demand intensity, and broader ecological conditions arising during observation intervals.

Procedures of pacing adjustment may include modifications in terms of instructional rate, demand pacing, transition speed, interaction intensity, and broader adaptive pacing variables that are potentially associated with fluctuations in adaptive accessibility across periods of observation. Sensory-supportive observations could include the documentation of sensory modification, environmental reduction of overstimulation, sensory accommodation procedures, and broader sensory-contextual adjustments occurring in ecological interaction (Craig, 2002; Porges, 2011).

The framework incorporates the structured observational documentation of reduced demand, postponed demand, temporary task removals, reduced environmental complexity, and broader contextual modifications that could potentially be associated with observable shifts in accessibility under naturally occurring conditions. Such procedures are conceptualized as ecological support processes that occur within broader contextual interactions rather than as isolated causal variables that independently determine adaptive outcomes.

In addition, SDACS includes the structured observational documentation of post-support accessibility shifts and latency in recovery. Post-support accessibility observations are adopted to document observable changes in adaptive engagement, communication accessibility, flexibility, emotional modulation, organized participation, and broader adaptive functioning, and following regulation-supportive processes through ecological conditions. Recovery latency procedures are intended to support repeated-measures observation of the course of time associated with observable changes in adaptive accessibility that follow contextual or regulation-supportive modification.

It should be noted that the regulation-supportive observation framework is intended to document observable associations among contextual conditions, physiological–regulatory load, adaptive accessibility, and regulation-supportive processes in place of establishing deterministic or causal mechanisms with respect to human behavior or functioning. This framework does not propose that regulation-supportive processes uniformly produce specific adaptive outcomes that are independent of broader ecological interaction, learning history, reinforcement contingencies, contextual variability, developmental factors, and physiological–regulatory organization (Bronfenbrenner, 1979; Gomez Uncu, 2026a).

Several limitations are associated with the observational interpretation of regulatory–supportive processes in ecological environments. Naturally occurring support procedures frequently occur simultaneously with multiple changing contextual variables, which makes precise isolation of specific contributing influences within observational designs difficult. In addition, the interpretation of observable accessibility shifts could vary according to observer experience, ecological complexity, interval structure, contextual ambiguity, and other broader limitations associated with ecological observational methodology.

Accordingly, the regulatory–supportive observation framework within SDACS is proposed as an exploratory observational component, intended to support future repeated-measures ecological investigations of adaptive accessibility variability, contextual interaction, and observable support-associated accessibility shifts in terms of maintaining observational restraint in terms of causal inferences or mechanistic interpretations beyond the scope of ecological observational study.

9 Observer-standardization and -reliability Considerations

The SDACS incorporates observer-standardization and -reliability procedures to support structured ecological observations taking place across repeated observation intervals. Due to observational and exploratory nature of the framework, systematic observer training, operational anchor calibration, interval-coding consistency, and interobserver agreement procedures are essential for the provision of methodological consistency across different contexts of ecological observation.

Observer training procedures are intended to familiarize observers with the conceptual structures of the SDACS framework, as well as the operational definitions, interval-coding procedures, contextual coding variables, and observational scoring anchors associated with the PLR and AAR components. Training procedures could include a review of operational definitions, observational examples, ecological coding exercises, interval scoring practice, and structured discussion of coding ambiguities across different ecological conditions.

Operational anchor calibration procedures support increased observational consistency across repeated coding intervals. The calibration procedures couljd involve repeated review of scoring anchors, comparisons of independently coded observation samples, discussion of scoring discrepancies, and the refinement of interval-coding interpretation across ecological observation contexts. Because adaptive accessibility and physiological–regulatory organization could fluctuate dynamically across naturally occurring conditions, calibration procedures may be particularly important for the reduction of inconsistencies associated with ecological variability and observational ambiguity.

The SDACS framework adopts interval-based observational coding procedures to support the repeated-measures documentation of adaptive accessibility variability across time and contexts. The interval-coding consistency procedures could include standardized observation durations, structured interval definitions, predefined procedures of observational scoring, and the repeated calibration of coding interpretation across observation periods. Observation intervals can vary according to study design, ecological setting, and study objectives, but they should remain sufficiently structured to support repeated-measures comparisons across conditions and times.

Interobserver agreement (IOA) procedures can be used to support the evaluation of observational consistency across multiple observers. A subset of the ecological observation intervals could be independently coded by separate observers for the comparison of PLR, AAR, contextual coding, and related observational variables. Agreement procedures could include percent agreement calculations, interval-by-interval comparison procedures, and additional observational consistency methodologies that are appropriate for the repeated-measures ecological study designs.

The framework also incorporates the observer confidence ratings, which are intended to document observers' perceived level of confidence regarding coding interpretation in a given observation interval. Procedures for observer confidence may support the identification of intervals involving elevated contextual ambiguity, reduced observational clarity, complex ecological interaction, or uncertainty with respect to coding interpretation. These procedures are intended to support methodological transparency and future investigation of observational reliability across ecological conditions.

It should be noted that the SDACS framework recognizes several limitations that are associated with ecological observational methodologies. Observational interpretation inherently involves potential subjectivity that is associated with observer experience, contextual interpretation, ecological complexity, interval ambiguity, and indirect observation of physiological–regulatory organization and adaptive accessibility. In addition, the naturally occurring ecological conditions are subject to continuous change, multidimensional, and potentially difficult to operationalize in a way that preserves complete precision across observation periods (Bronfenbrenner, 1979; Gibson, 1979).

Therefore, the framework does not assume any complete observational objectivity or uniform coding interpretation across any ecological context. Instead, SDACS incorporates the standardization of observers and procedures of reliability intended to support increased observational consistency, acknowledging the inherent complexity and variability that are associated with ecological repeated-measures observation (Gomez Uncu, 2026c; Kelso, 1995).

Future empirical investigation is necessary to evaluate reliability, construct validity, ecological applicability, and broader psychometric characteristics in the SDACS framework. The potential future study directions here could include formal interobserver agreement studies, validation procedures of observer training, interval calibration study, construct validation analyses, repeated-measures reliability investigations, and broader examinations of ecological observational consistency across different populations and contexts.

Thus, observer-standardization and -reliability procedures appearing within SDACS are proposed as exploratory methodological components that are intended to support future repeated-measures ecological investigations that maintain observational restraint in definitive psychometric interpretations beyond the current exploratory scope of the framework.

10 Potential Applications

The SDACS is an exploratory observational framework that is potentially applicable across multiple ecological, educational, behavioral, developmental, and study contexts, involving repeated-measures investigation of adaptive accessibility variability. This framework supports structured ecological observation of adaptive functioning across changing physiological–regulatory and contextual conditions and maintaining observational and non-diagnostic positioning (Bronfenbrenner, 1979; Gomez Uncu, 2026a).

A potential application of SDACS involves observational study within applied behavior analysis (ABA) and related settings in behavioral science settings. In these contexts, this framework may support repeated-measures ecological observation of variability in terms of communication accessibility, adaptive engagement, task participation, flexibility, transition tolerance, and broader functional accessibility across changing contextual and physiological–regulatory conditions. This framework is not intended to replace existing behavioral assessments, reinforcement-based approaches, or contingency-focused observational procedures but to support additional structured ecological observation of variability in adaptive accessibilities across naturally occurring conditions (Gomez Uncu, 2026b, 2026d).

Potential applications could also include educational and developmental observation contexts where variability in organized participation, communication accessibility, adaptive engagement, and functional accessibility can be observed across changing ecological conditions. In educational contexts, the framework could support structured repeated-measures documentation of contextual influences that are potentially associated with fluctuations in terms of adaptive accessibility across classroom, instructional, transitional, and broader environmental conditions (Gibson, 1979; Siegel, 2012).

The SDACS framework can also support observational investigation in neurodevelopmental and interdisciplinary study contexts that involve adaptive variability across ecological environments. Certain potential areas of exploratory investigation include variability in accessibility for communication, adaptive participation, emotional modulation, flexibility, organized engagement, and broader functional accessibility across different sensory, social, environmental, and adaptive-load conditions (Barrett, 2017; Porges, 2011).

Another potential application of SDACS involves the application of repeated-measures ecological study that examines variability in terms of adaptive accessibility across time and contexts. The framework incorporates interval-based observational coding, contextual and environmental documentation, physiological–regulatory load observation, and recovery/accessibility-shift procedures, it can support exploratory investigation of within-subject variability across naturally occurring ecological conditions (Kelso, 1995; Thelen & Smith, 1994).

SDACS's physiology-informed structure could also support broader observational analysis involving state-dependent variability in adaptive functioning. From this perspective, the framework may contribute to the exploratory ecological investigation of relationships among contextual conditions, physiological–regulatory organization, and adaptive accessibility, alogn with observable functional engagement across naturally occurring environments (Gomez Uncu, 2026c; Gomez Uncu & Morejón Rodríguez, 2026).

Importantly, SDACS is not proposed as a diagnostic instrument, clinical classification system, assessment of psychometrics, or methodology of direct physiological measurement. The framework is likewise not intended to establish intervention efficacy, determine treatment superiority, or provide a deterministic explanation of human behavior or functioning. Instead, SDACS is proposed as an exploratory methodology of observation intended to support the structured ecological investigation of variability in adaptive accessibility across changing physiological and contextual conditions.

Several limitations should be taken into account regarding the potential applications of this framework. Variability in ecological observations, contextual complexity, observer interpretation, environmental heterogeneity, and indirect physiological–regulatory observations could substantially influence observational findings across settings and populations. Further, future empirical investigation are necessary to evaluate reliability, construct validity, ecological applicability, and broader study of utility across different observational contexts.

Thus, it is necessary to interpret potential applications of SDACS with caution and within the exploratory observational scope of the framework itself. Overall, the system is intended to support future repeated-measures ecological investigations of adaptive accessibility variability while maintaining methodological restraints regarding diagnostic interpretation, intervention efficacy, and causal claims going beyond the scope of ecological observational study.

11 Limitations

Several important limitations should be taken into account regarding the SDACS and the broader conceptual framework that is proposed in this paper. The SDACS framework is exploratory, observational, and theoretical and should therefore be interpreted within the methodological limitations that are associated with ecological observational study.

First, this framework is developed through structured ecological observation rather than the direct biological measurement of physiological–regulatory processes. The SDACS framework does not incorporate any direct biomarker assessment, autonomic monitoring, neurophysiological measurement, hormonal analysis, or other methodology of direct physiological measurement within its current observational structure. Accordingly, PLR scores and related observational variables necessarily reflect indirect observational interpretation of physiological–regulatory organization rather than a direct biological quantification of underlying physiological processes (Craig, 2002; McEwen, 1998; Porges, 2011).

Second, the framework substantially relies on the observer interpretation of ecologically observable indicators that arise within naturally changing environments. Observational coding can therefore be influenced by observer experience, contextual interpretations, ecological ambiguities, interval structures, environmental complexity, and broader limitations that may be associated with indirect observation of physiological–regulatory and adaptive processes. While the framework does incorporate observer-standardization and interobserver agreement procedures that are intended to support observational consistency, it is unlikely that complete elimination of observer subjectivity will be achieved within ecological observational designs.

Third, ecological observation inherently entails substantial variability in context that can be difficult to fully operationalize or control across naturally occurring environments. Adaptive accessibility could fluctuate in relation to multiple simultaneously interacting variables, including environmental demand, reinforcement contingency, social conditions, developmental characteristics, contextual familiarity, motivational influences, illness-related factors, fatigue, sensory complexity, and broader ecological processes (Bronfenbrenner, 1979; Gibson, 1979; Sapolsky, 2004). Thus, observational findings could reflect multidimensional ecological interactions instead of isolated physiological–regulatory influences alone.

The SDACS framework is in a preliminary and exploratory stage in its conceptual and methodological development. This framework has not undergone formal psychometric validation, construct validation analysis, large-scale reliability investigation, criterion validation, longitudinal validation, or any broader empirical standardization procedures. Future investigations are therefore necessary to evaluate its reliability, ecological applicability, construct validity, observational consistency, and broader study utility across different populations in different contexts.

It is important to note that this framework does not establish causal relationships among physiological–regulatory organization, contextual variables, adaptive accessibility, and behavioral functioning. The observational structure of SDACS is intended to support the documentation of potential associations and ecological variability instead of a deterministic or mechanistic explanation of human behavior and functioning. Thus, relationships observed in future ecological studies should not be interpreted as establishing causal physiological mechanisms that are independent of broader contextual, developmental, environmental, behavioral, or ecological influences (Friston, 2010; Kelso, 1995; Thelen & Smith, 1994).

Further limitations involve the inherent difficulty inherent in the operationalization of complex constructs, such as adaptive accessibility, physiological–regulatory organization, contextual interaction, and ecological variability, with complete precision across different settings and populations. Naturally occurring ecological conditions are dynamic, multidimensional, and continuously changing, so observational categorization could simplify broader interactive processes that occur across real-world environments.

This framework also does not propose that variability in adaptive accessibility can be fully explained through physiological–regulatory variables alone. Human functioning reflects the ongoing interaction among learning history, environmental contingencies, contextual conditions, developmental processes, social interaction, physiological organization, adaptive load, and broader ecological influences. Thus, the framework presented in this paper is intended to support exploratory observations informed by physiology instead of reductionistic interpretation of behavior or functioning (Gomez Uncu, 2026a, 2026e).

Regardless of these limitations, the SDACS framework is proposed as a preliminary observational methodology that is intended to support future repeated-measures ecological investigations of state-dependent variability in adaptive accessibility across changes in physiological and contextual conditions. It emphasizes methodological restraint, ecological observation, conceptual transparency, and exploratory positioning, while acknowledging the substantial empirical work that is necessary for future validation and refinement.

12 Future Study Directions

The SDACS is proposed here as a preliminary observational framework that requires continued empirical investigation, methodological refinement, and broader validation in various contexts of ecological study. This framework is intended to provide an initial observational structure for the investigation of adaptive accessibility variability across changing physiological–regulatory and contextual conditions while recognizing the substantial empirical work that is necessary for future development (Gomez Uncu, 2026a, 2026c).

One important future direction involves pilot studies of feasibility to examine the practicality, usability, observational consistency and ecological applicability of the SDACS framework across naturally occurring settings. These studies could support the preliminary evaluation of interval-coding procedures, processes of observer training, feasibility of ecological observation, procedures of contextual coding, and broader implementation of the methodology across different populations and environments.

Future study could also involve formal interobserver agreement investigation and procedures of observer-standardization validation. Potential areas of investigation include operational anchor calibration, observer training consistency, interval-coding agreement, observer confidence evaluation, and the broader examination of observational reliability across ecological observation contexts. Such research may contribute to the refinement of observational scoring procedures and increased methodological consistency across repeated-measures designs.

Construct validation study represents another important future direction For the SDACS framework. Future studies may examine relationships among PLR scores, AAR scores, contextual variables, ecological conditions, and broader indicators of adaptive functioning across repeated observation intervals. Additional study could explore whether observational accessibility variability demonstrates consistent patterns across different ecological conditions, populations, or adaptive-load states.

Repeated-measures observational study may further support examination of within-subject variability in adaptive accessibility across time and changing ecological contexts. Longitudinal ecological studies may contribute to the investigation of variability trajectories involving communication accessibility, organized participation, emotional modulation, flexibility, adaptive engagement, and broader functional accessibility across different physiological–regulatory and contextual conditions (Bronfenbrenner, 1979; Kelso, 1995; Thelen & Smith, 1994).

Future investigations may also explore the integration of SDACS observational procedures with direct methodologies of physiological or biomarker measurement. Potential areas of exploratory integration could include autonomic monitoring, heart rate variability, sleep-related measures, cortisol assessment, neurophysiological monitoring, wearable devices for physiological measurements, sensory-regulatory monitoring, and broader physiological measurement procedures. Such approaches can support the future examination of potential relationships between ecological observational variables and directly measured physiological indicators across repeated-measures study designs (Craig, 2002; McEwen, 1998; Porges, 2011).

Wearable integrated physiology measures could represent an additional future direction for physiology-informed ecological study involving adaptive accessibility variability across naturally occurring environments. Emerging wearable technologies could support the provision of repeated-measures examination of physiological variability across ecological contexts while simultaneously allowing the observational documentation of contextual conditions, adaptive accessibility, and regulation-supportive processes.

Future longitudinal study could also investigate adaptive accessibility trajectories across developmental, educational, behavioral, and ecological contexts. Such study could examine variability patterns that involve recovery latency, accessibility fluctuation, contextual sensitivity, adaptive-load accumulation, ecological resilience, and broader longitudinal patterns of adaptive accessibility organization across times.

It is important to note that future empirical investigation will be necessary to determine the reliability, ecological applicability, construct validity, psychometric characteristics, and broader study utility of the SDACS framework. This framework is not proposed here as a finalized measurement system or as a validated clinical instrument but rather as a preliminary observational methodology that is intended to support the ongoing ecological investigation of state-dependent variability in terms of adaptive accessibility.

Thus, future research directions involving SDACS should remain grounded within observational restraint, ecological complexity, methodological transparency, and recognition of the multidimensional nature of human functioning across changing physiological–regulatory and contextual conditions. Continued interdisciplinary investigation is likely necessary for the refinement, validation, and broader empirical evaluation of the framework across different study and ecological contexts.

13 Conclusion

The SDACS is proposed here as an observational framework to support systematic investigation of variability in adaptive accessibility across changing physiological and contextual conditions in ecological environments. The framework introduces a structured observational methodology that is designed to document adaptive accessibility variability, physiological–regulatory load, contextual influences, and regulation-supportive processes across naturally occurring settings and repeated observation intervals (Bronfenbrenner, 1979; Gomez Uncu, 2026a, 2026c).

Within this framework, adaptive accessibility is conceptualized as the moment-to-moment availability of adaptive behavioral, communicative, emotional, cognitive, relational, and regulatory capacities across changing ecological and physiological–regulatory conditions. The framework further distinguishes adaptive accessibility from stable repertoire possession or generalized assumptions regarding uniformly available functioning across all potential contexts and environments (Damasio, 1999; Gomez Uncu & Morejón Rodríguez, 2026).

The SDACS framework adopts a physiology-informed, nonlinear, and ecological systems orientation and maintains observational restraint regarding causal interpretation, biological inference, and mechanistic explanation of human behavior and functioning (Friston, 2010; Kelso, 1995; Thelen & Smith, 1994). Instead of proposing deterministic interpretations, the framework supports structured ecological observation of potential associations among contextual conditions, physiological–regulatory organization, adaptive accessibility, and observable functional variability across time.

It is important to note that SDACS is given as an exploratory observational methodology instead of as a diagnostic instrument, validated psychometric system, or direct physiological measurement framework. The framework requires continued empirical investigation, methodological refinement, reliability evaluation, construct validation, and broader ecological examination across different populations and study contexts.

Future repeated-measures observational study could contribute to further refinement and empirical evaluation of the framework by investigating within-subject variability, ecological accessibility fluctuation, contextual interaction, physiological–regulatory organization, and broader patterns of state-dependent adaptive functioning across naturally occurring conditions (Craig, 2002; McEwen, 1998; Porges, 2011).

Accordingly, the SDACS is here proposed as a preliminary observational framework that is intended to support continued interdisciplinary investigation of adaptive accessibility variability across changing physiological and contextual conditions while maintaining methodological transparency, ecological sensitivity, and scientific restraint appropriate to the current exploratory scope of the framework.

14 Conflict of Interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

15 Author Contributions

Yoandra M. Gomez Uncu: Conceptualization, development of the theoretical framework, formal analysis, writing–original draft, and writing–review and editing.

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18 Ethics Approval

Not applicable. This study did not involve human participants, animals, or identifiable data.

19 Consent to Participate

Not applicable.

20 Consent to Publish

Not applicable.

21 Data Availability Statement

Not applicable. This manuscript presents a conceptual and theoretical framework and does not include empirical datasets.

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23 Figure 1. SDACS Observational Architecture

Figure Note: The figure illustrates the observational organization of the SDACS framework rather than implying any deterministic or causal directional mechanisms among variables. The framework is observational, ecology-based, and exploratory in nature, and it is intended to support structured repeated-measures investigation of adaptive accessibility variability across changing physiological–regulatory and contextual conditions.