Psychology

UDC 159.953.5:81'243

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MOVEMENT AND BODILY MEMORY AS A TOOL FOR REDUCING ANXIETY IN SPEAKING: SENSORIMOTOR MECHANISMS OF PHRASE RETENTION

Summary. *Speaking anxiety remains a significant barrier in foreign language learning, often accompanied by physical symptoms that disrupt lexical retrieval. This paper explores movement-based phrase encoding as an alternative mechanism for reducing anxiety. Motor memory formed through gestures and enacted speech provides additional retrieval pathways that are less dependent on anxiety-sensitive verbal processing.*

Key words: *speaking anxiety, embodied learning, motor memory, gesture, foreign language learning.*

Foreign language speaking anxiety does not operate on the same mechanisms as general public-speaking fear, and conflating the two has long complicated both research design and classroom intervention. A student who presents confidently in their native language is drawing on a system that has been automatised over years of use, where lexical retrieval, syntactic assembly, and phonological output run largely below conscious awareness. In a second language, none of that automaticity exists yet. Every utterance requires deliberate, effortful construction under real-time social observation, and the gap between

intention and execution is visible to everyone in the room. That visibility is a significant part of what makes the experience so acutely distressing.

Horwitz and Cope's foundational 1986 conceptualisation of foreign language anxiety as a distinct affective variable established that it comprises three interacting components: communication apprehension, fear of negative evaluation, and test anxiety. Of these, communication apprehension tends to dominate in classroom settings where spontaneous speaking is required. Students report not a general nervousness but something more specific: a sudden inaccessibility of language that was demonstrably present moments before. They studied the material. They knew it during preparation. Under social evaluation, it is gone.

This phenomenology points toward a neurobiological explanation rather than a motivational or attitudinal one. The student who goes blank during oral production is not suffering from insufficient effort or inadequate study. They are experiencing the downstream consequences of hypothalamic-pituitary-adrenal axis activation on the memory systems that store and retrieve linguistic knowledge. Stress hormones, primarily cortisol, exert well-documented inhibitory effects on hippocampal function. The hippocampus is central to declarative memory. Under acute stress, cortisol suppresses the synaptic plasticity mechanisms in the hippocampus that support retrieval, producing exactly the subjective experience students describe: knowing something and being unable to access it simultaneously.

What makes foreign language speaking particularly vulnerable to this disruption is the degree to which it depends on declarative memory at early and intermediate stages of acquisition. Unlike native language production, which has been proceduralized through years of use, second language output requires learners to consciously retrieve vocabulary, apply grammatical rules, and monitor their own output for accuracy, all under the cognitive pressure of real-time

interaction. The declarative system is doing the heavy lifting at precisely the moment when stress is most likely to impair it.

The emotional valence of the speaking situation amplifies this dynamic. Performance anxiety generates anticipatory cognitive processing that itself consumes working memory resources. A learner rehearsing possible failure scenarios, monitoring their own visible signs of distress, and attending to the evaluative gaze of peers is allocating attentional resources that are no longer available for language production. MacIntyre and Gardner's research on the relationship between anxiety and language performance documented a consistent negative correlation between self-reported anxiety and oral output quality, with the relationship becoming stronger rather than weaker as task difficulty increased. High-stakes spontaneous speaking is where anxiety and performance deficits concentrate most reliably.

The theoretical case for gesture-based vocabulary acquisition rests on dual coding theory and its neurobiological extensions. Paivio's original framework proposed that verbal and imagistic information are stored and processed through distinct but interconnected systems, and that memory for items encoded through both channels is more robust than memory for items encoded through either channel alone. Subsequent neuroimaging research has substantially refined this account, revealing that the relevant distinction for gesture-based learning is not verbal versus imagistic but verbal versus sensorimotor.

When a learner encodes a foreign vocabulary item by performing an iconic gesture, one that physically represents the meaning of the word through shape, movement, or spatial relationship, they are recruiting motor cortex, premotor cortex, and the cerebellum alongside the language networks that handle phonological and semantic processing. The word is encoded not only as a verbal trace but as a motor program. Retrieval of the word later reactivates both traces. Macedonia and von Kriegstein demonstrated using functional MRI that words learned with gestures showed significantly greater activation of motor and

premotor regions during retrieval than words learned verbally, with corresponding differences in hippocampal involvement: the gesture-encoded words relied less heavily on hippocampal retrieval mechanisms.

This neural architecture has a direct consequence for anxiety-related performance. The basal ganglia and cerebellum, which support procedural and motor memory, receive different neuromodulatory input than the hippocampus and are substantially less sensitive to cortisol-mediated suppression. When stress hormones disrupt hippocampal retrieval, producing the blank-mind experience that anxious language learners describe, the motor traces encoded through gesture remain accessible through a parallel pathway. The learner who has encoded a phrase through repeated physical enactment retains a motor route to the word even when the declarative route is blocked.

The role of the hippocampus in initially consolidating gesture-motor associations deserves attention alongside its vulnerability to stress. During encoding, the hippocampus participates in binding the verbal, visual, and motor components of the memory trace into a coherent episode. Over subsequent repetitions, this binding gradually transfers elements of the memory to cortical and subcortical motor networks through consolidation. The stress-resilient motor trace is not available from the first encounter with the word. It develops through repeated practice. Single exposure to a gesture during vocabulary instruction produces minimal benefit. The motor memory that resists anxiety-induced disruption is built through distributed, repeated enactment across multiple sessions.

Research findings do not implement themselves, and the gap between a laboratory result and a functional classroom activity is where most embodied learning initiatives stall. Three variables determine whether gesture-based vocabulary instruction actually produces the stress-resilient motor memory described above, or simply adds physical movement to a lesson without changing

its cognitive architecture: what gets taught through gesture, how gestures are created and rehearsed, and how practice is distributed across time.

Not all vocabulary responds equally to embodied encoding. The motor memory advantage is strongest for lexical items that have a natural physical correlate - action verbs, concrete nouns, spatial prepositions, phrases describing procedures or bodily experience. These map onto iconic gesture because there is something physical in their meaning to represent. A phrase for ordering food or describing pain gives a learner material to work with physically. A phrase expressing doubt, probability, or logical consequence does not yield to the same treatment with anything like the same fidelity, and the resulting gesture tends toward arbitrariness. Arbitrary gestures, as Macedonia [6] documents, produce no reliable retention advantage over standard verbal repetition. The practical implication is not that abstract vocabulary should be excluded from embodied approaches entirely, but that instructional time is better spent encoding high-frequency concrete items through gesture first, before attempting to extend the method into more semantically opaque territory.

Gesture iconicity is not negotiable. The research is unambiguous on this point: arbitrary gestures, movements that bear no representational relationship to the meaning of the target phrase, produce no reliable memory advantage over verbal repetition alone. The gesture must depict something about the word's meaning: the shape of the referent object, the trajectory of the action, the spatial relationship being described, or the embodied experience associated with the concept. Designing iconic gestures for a vocabulary set requires advance preparation by the instructor, who needs to think carefully about what each phrase means in physical terms before teaching it. This requires that the teacher approach the material as a problem of physical representation, not just linguistic definition.

Learner-generated gestures outperform instructor-modelled gestures across the studies reviewed. When learners invent their own movements for target phrases, retention is higher than when they copy movements provided by the

teacher. The likely mechanism is deeper semantic processing: inventing a gesture requires the learner to analyse the meaning of the phrase in order to represent it physically, which constitutes elaborative encoding. Copying a gesture requires only motor imitation. The instructional sequence matters as much as the gesture itself. A teacher who demonstrates a pre-designed gesture and asks students to copy it is producing motor imitation, not elaborative encoding. The student who invents a gesture - who has to look at a phrase, extract its meaning, and find a physical form that captures something about that meaning - has already done the semantic work that makes the encoding stick. The teacher's job in this phase is not to supply the answer but to interrogate arbitrary solutions: to ask what the movement actually represents, to redirect gestures that bear no meaningful relationship to the phrase, and to push the class toward physical representations that would be legible to someone who had never seen the vocabulary before. That standard - legibility from movement alone - is a practical proxy for iconicity.

Motor memory consolidation does not happen in a single session. The neurobiological process by which a gesture-vocabulary pairing migrates from hippocampus-dependent episodic representation to the more robust procedural system requires the trace to be reactivated repeatedly across separate time points. One rehearsal is negligible. The effect builds across distributed practice. In practical terms, this means that gesture work introduced during a lesson on Monday carries almost no anxiety-resistant memory value unless it is physically rehearsed again later in the week, and again the week after. The rehearsal does not need to be long - a few minutes of retrieval practice with full physical enactment is sufficient - but it has to happen on a separate day, under conditions where some forgetting has already begun. That partial forgetting, and the retrieval effort required to overcome it, is what drives the consolidation process forward.

Emotional context during encoding enhances retention. Scenarios with genuine communicative stakes, role-plays where something is at risk, interactions structured around real information gaps, tasks where movement carries social

meaning, produce stronger encoding than neutral drilling. Buccino and Mezzadri observe that embodied language learning achieves its maximum effect when physical enactment is embedded in communicative situations that carry affective weight [4]. A student performing a gesture while genuinely trying to communicate something to a classmate who does not already know the answer is encoding the gesture-phrase pairing in a richer contextual network than a student performing the same gesture in isolation during a drilling exercise.

The social dynamics of embodied activities also serve anxiety management in ways that go beyond the neurobiological. Movement normalises imperfection: when everyone in the room is physically enacting vocabulary, the visible awkwardness of a learner struggling with a phrase is distributed across the group rather than concentrated on one individual. The evaluative gaze, which is a primary driver of communication apprehension, is diffused when all participants are simultaneously engaged in physical production. Teachers who have implemented gesture-based vocabulary work consistently report that students who are otherwise reluctant to speak voluntarily participate in embodied activities, particularly before they have sufficient confidence for verbal output alone.

Implementation at scale requires acknowledgment of what the research does not yet establish. Optimal repetition counts have not been identified. The relative contribution of gesture complexity, iconicity degree, and learner age to the size of the memory advantage remains unclear. Whether the benefits observed for vocabulary transfer to grammatical structures is an open question. Long-term follow-up beyond six months is rare in the existing literature. Practitioners adopting gesture-based instruction are therefore working with a well-supported but still developing evidence base, and systematic collection of classroom outcome data has genuine scientific value beyond its immediate pedagogical application [5, p. 3].

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