Learning statistical regularities from the environment is ubiquitous across domains and species. It has been argued to support the earliest stages of language acquisition, including identifying and learning words from fluent speech (word-segmentation). We ask how the Statistical Learning mechanisms involved in word-segmentation interact with the memory mechanisms needed to remember words, if they are tuned to specific learning situations. We show that, when completing a memory recall task after exposure to continuous, statistically structured speech sequences, participants track the statistical structure of the speech stream, but hardly remember any items at all and initiate their productions with random syllables (rather than word-onsets) despite being sensitive to probable syllable transitions. Only discrete familiarization sequences with isolated words produce memories of actual items. Conversely, Statistical Learning predominantly operates in continuous speech sequences like those used in earlier experiments, but not in discrete chunk sequences likely encountered during language acquisition. Statistical Learning might thus be specialized to accumulate distributional information, but dissociable from the (declarative) memory mechanisms needed to acquire words.