Considerable attention has been given to the notion that there exists a set of human-like characteristics associated with brands, referred to as brand personality. Here we combine newly available machine learning techniques with functional neuroimaging data to characterize the set of processes that give rise to these associations. We show that brand personality traits exist a priori inside the minds of consumers. That is, as opposed to being constructed via reflective processes, we were able to predict what brand a person is thinking about in a passive viewing task, based solely on the relationship between brand personality associations and brain activity. In addition, we found brand personality contents were distributed across a wide set of brain areas, in particular those previously implicated in reasoning, imagery, and affective processing. Taken together, these results support connectionist models where brand personality emerges from weighted activity across a distributed set of units, and represent an important first step in enabling consumer researchers to access and connect information conveyed by the brain (“what”) to their specific neuroanatomical substrates (“where”).