EVOKED POTENTIALS

Creativity's Links to Time and Temperament

If tomorrow wasn't such a long time, then lonesome would mean nothing to me at all.
–Bob Dylan

Great achievements often take time, so a creator must have the ability to persevere until the plan is completed. But not all plans prove to be practical, and a creator must have a sense of when insufficient progress has been made for the time invested. Most relevant for our understanding of the role time plays in creativity is our perception and mental image of time, or what we might term "cognitive time."


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Cognitive time is the duration of an event. Perceived and mental images often contain a sequence of events. Each event, the time between events, and the entire sequence of events has a specific duration or chronological distance that is inherent in the mental image. We compare the chronological distance of our perceived "what is" with our imagined "what should be." I envision that it takes 10 minutes to walk the dog, so when my son fails to return after an hour, I am worried.

The perceived passage of time is a quantity, and quantity is a property shared by all of our sensory modalities. Whether something is brighter or darker, louder or quieter, heavier or lighter, faster or slower are examples of quantified perceptions. Quantity for any sense is abstracted by our multimodal parietal lobe (Curr. Opin. Neurobiol. 2004;14:218-24). Our conscious estimation of time is influenced by our circadian rhythms. When people are isolated in a chamber without any time cues and allowed to wake and sleep as they desire, their bodies unconsciously maintain biological rhythms, for example in body temperature fluctuation. When asked to judge the passage of time, we overestimate during periods of higher body temperature and maximal wakefulness, and underestimate during periods of lower body temperature and greater sleepiness (Physiol. Behav. 2001;72:589-93). The hour my son spent walking the dog would have seemed longer to me at 4 a.m. than at 4 p.m.

All creative plans have a time frame. We decide whether the progress gained over the time spent on a creative effort matches the chronology embedded within our envisioned action plan. How we react to the progress of our creative effort within the perceived time frame is influenced by our temperament. Dr. C. Robert Cloninger defines temperament as an unconscious property based on our automatic responses to perceived stimuli. Such responses determine whether we are driven more by the search for reward vs. the avoidance of punishment, and how well we tolerate and persist in the face of "frustrative nonreward."

Dr. Cloninger defines four dimensions of temperament as novelty seeking (motivated by the possibility of unexpected reward), harm avoidance (happy simply to avoid punishment), reward dependence (needing praise), and persistence ("perseverance despite frustration and fatigue"). Character, he says, is driven by three dimensions: self-directedness (willpower to achieve one's own goals), cooperativeness with other individuals, and self-transcendence (the acceptance that the self is part of a universal whole). Individual differences in temperament and character define our individual personalities (Arch. Gen. Psychiatry 1987;44:573-88; Arch. Gen. Psychiatry 1993;50:975-90).

Those who are more highly motivated by the search for novelty are more likely to envision and pursue the realization of something new (what should be) than are individuals who prefer the avoidance of harm (leave well enough alone). We may be temperamentally biased to envision something better than we perceive, thus generating the motivational voltage that initiates creative behavior. Temperament determines our reactive set point; our tolerance for the status quo and for unrewarded action; how patient and perseverant we tend to be; and when it is time to alter our plan.

Of course, not every new idea is good. Character (which is based upon conscious, insight-oriented learning) allows us to regulate ourselves, our interactions with others, and our integration with more universal themes of nature and spirituality. Our ability to learn consciously that a temperament-driven gut response can be maladaptive allows us to modify our reaction consciously.

To achieve a creative goal usually requires persistence over an extended period of time, even in the absence of external encouragement. During a task in which subjects were asked to rate facial expressions, individuals with higher persistence scores performed with greater accuracy. The task had some periods that most subjects found boring. During the boring test periods, those individuals with higher persistence scores had better overall task performance and maintained activation of brain reward centers on fMRI, whereas those with lower persistence scores had poorer overall performance and deactivated those same reward regions (Proc. Natl. Acad. Sci. U.S.A. 2003;100:3479-84). If the goal of the task is itself assumed to be rewarding to the participant, reward activation during this period of boredom or frustrative nonreward may imply that the goal is more effectively maintained in the minds of those who are more persevering.

Individual differences within each of the seven dimensions of personality correlate with different patterns of regional brain activity (J. Neurosci. 2005;25:6460-6), providing some biological validity to these personality constructs. Personality and temperament are qualities of the individual creator, and they influence how the individual creator behaves and interacts with others. How society in turn reacts to the creator and the creative product ultimately defines creative success, as we shall consider in the next edition. ■

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LETTERS

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Biomarker Helps Stratify Traumatic Brain Injury Patients

BY MIRIAM E. TUCKER

FROM THE ANNUAL MEETING OF THE SOCIETY FOR ACADEMIC EMERGENCY MEDICINE

BOSTON – The biomarker glial fibrillary acidic protein accurately distinguished between mild and moderate traumatic brain injury, between mild traumatic injury and controls, and between patients with and without intracranial lesions on CT in a prospective cohort study of emergency department patients with head injuries.

Glial fibrillary acidic protein (GFAP) is found in glial cells and is specific to the central nervous system. Found in both gray and white brain matter, it has recently been identified in serum, which makes it an attractive candidate as a clinical biomarker. Currently, the Glasgow Coma Scale (GCS) is the primary measure used to assess patients with head injury, but it can be influenced by intoxicants, medication, other injuries, or hypoperfusion and was not actually intended as an emergency department tool. "Really what we'd like is to develop some kind of biomarker that can be [measured] quickly and accurately, just like we do troponin for ischemia, or creatinine or bilirubin. Some type of blood test for the brain is our ultimate goal," said Dr. Linda Papa, director of academic clinical research, graduate medical education, Orlando Health, and an attending emergency physician at Orlando Regional Medical Center.

The study enrolled adult patients at three level 1 trauma centers who presented with mild or moderate blunt traumatic brain injury (TBI) and loss of consciousness or change in sensorium. Patients were enrolled from the ED and had blood samples collected within 4 hours of injury. All received CT scans. Control groups included patients with orthopedic trauma or motor vehicle trauma without head injury, and normal healthy people recruited from an ad. One aim of the study was to collect a large amount of normative data, she noted.

A total of 307 patients were enrolled in the study, of whom 108 had a TBI. The TBI patients had a mean age of 39 years (range 18-89), and 65% were men. A total of 97 had GCS scores of 13-15 (mild), and 11 had GCS scores of 9-12 (moderate). Of the 97 with GCS 13-15, 24 (25%) had CT scans positive for intracranial lesions, and of the 11 patients with GCS scores 9-12, 8 (73%) had positive CTs. Controls included 176 normal individuals, 16 with non–head injury motor vehicle accidents, and 7 with orthopedic injuries.

Blood samples were drawn within a mean of 2.7 hours after injury. The GFAP biomarker first appeared in the serum within an hour (among those who had blood drawn that soon), increased until 3-4 hours, then leveled off. "It's very interesting that so early in the course of injury, you can see a marker appearing in the blood," Dr. Papa commented.

Early GFAP levels were able to distinguish TBI patients from uninjured controls with an area under the curve (AUC) of 0.90 (1.0 is perfect), and differentiated those with mild TBI (GCS 15) from all controls with an AUC of 0.88. Mean GFAP levels in patients with negative CT scans versus those with positive CT scans were 0.335 ng/mL and 2.168 ng/mL, a highly significant difference with an AUC of 0.79.

The findings, if validated, suggest that early elevations of GFAP can be a potentially useful clinical tool in determining whether to image patients who are intoxicated or sedated, to admit or discharge patients from the ED, to assess severity of brain injury in a multiple trauma victim, to seek neurosurgical consultation and/or transfer to a neurosurgical facility, and to assess whether the patient can return to play or duty, she said. ■