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Understanding and Reframing Our Expectations for Aging: Finish Line Bias and Predictive Processing

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ABSTRACT

Experiences shape learning. Learning shapes expectations and leads to predictions. Predictive Processing (PP) is the result of our experiences and efforts to make sense of current as well as future events. Predictive processing is now a well-established principle describing the governance of our perception. Our interactions with the world are guided by PP via movements (motor control), as well as our sensory and social expectations (e.g. relationships, weather, taste). We form predictions overtly and silently, building these expectations on what we have learned and what we have lived (experiences). In matters of competitive performance and even in exercise for fitness, predictive processing can effectively and in some occasions out-predict laboratory-based tests of physiologic capacity. Finish Line Bias (FLB) is a novel concept, introduced in this paper, that adopts Predictive Processing (PP) and provides weight to a person's established goals of "when I can let up", or "are we there yet", serving as a complement to an actual finish line (race) or complement to a figurative (imagined) finish line. This article will explore and explain how PP and FLB influence what we all are currently experiencing - aging. The intersection of and relationship-between PP and FLB are integral in forming our impressions-of-self as related to aging, serving as a powerful influencer on what we expect aging to look like and our ability to positively influence the process.

Keywords: Predictive Processing; Finish Line Bias; Artificial Intelligence; Confirmation Bias

Abbreviations: PP: Predictive Processing; FLB: Finish Line Bias; AI: Artificial Intelligence; SPA: Self-Perception of Aging

Introduction

No matter the future of technological advances in Artificial Intelligence (AI), the human brain - your brain - is the most likely, most accessible, most consistent, and most powerful influencer that you will experience. Our experiences and beliefs shape our perceptions and ultimately our identities (how we refer to and what we expect-of ourselves). These identities and perceptions create a lens that we see future events through, using predictive processing. These beliefs often directly influence behaviors and ultimately outcomes – cognitive through physical – surrounding what we believe we can and what we do accomplish. A reductive yet acceptable description of how we form PP is through our biopsychosocial influences – lived experiences, biology, social and cultural influences.

Predictive Processing

How we form Predictive Processing (PP) influences our daily movements and motor control decisions. We analyze surfaces for stability and friction, analyze oncoming traffic (automobile and pedestrian), and assimilate past experiences "this has worked well in similar situations", all in an effort to optimize life. Our PP governs our actions in life, sport and work. Predictive processing can additionally govern our attention in movement (prioritizing a car that is swerving or a walker with their unruly dog ahead) and attention in relationships ("I bet that he will be late."; "I expect that my doctor will not even ask me about _____."). Predictive processing can also offer a projection that influences our identity and ultimately our lived experiences, "I am 80 years old.", can be an entirely completely different statement for two different individuals. The notion that, "This is how aging is supposed

to go" is our healthspan version of PP, influenced as mentioned above, by our own biopsychosocial experiences. While it is beyond the scope of this paper, a very brief summary of PP includes this overview:

Predictive Processing Influences [1-5]:

1. Dynamic subconscious and conscious updates on what has occurred and what will occur in the future, given similar contexts
2. Sensory – motor planning – outcome loops that create hypothesis-testing for future motor control. What I attempted to do and what worked, or did not.
3. Real-time assessments collect contextual data including environment and self – to predict what is best, and what is likely to occur
4. Success-driven models (successful predictions) to reinforce processing and (Hebb's Theory: "Neurons that fire together, wire together")
5. Error-driven models to do the same, reinforcing expectations for aberrant sensations or failures.

These system situation examples may help to elaborate from the list above:

- Future high speed motor control decisions (sport, driving, mobility)
- Expectations of capacities, positive or negative, in performance
- Expectations regarding social and cultural outcomes, influencing biases
- Expectations for sensory experiences (taste, visual perception, hearing)
- Expectations regarding the chronicity (persistence) of a condition, reinforcing attentional loops which may govern expectations of pain, dizziness, errors in motor control, errors in cognition, irritable bowel, dysautonomia and more
- Expectations in aging, a known health condition or even the weather in a current season.

Predictions Shape Current Perceptions and Future Expectations

Building on the bullet-points from above, PP will influence your expectations, your attention, your experiences, your perception, and ultimately your exertion. These practical examples may assist in your efforts to deepen your understanding of predictive processing:

1. Negative statements to self: "I cannot do math", "I am always going to have pain"
2. Positive statements to self: "I can do this", "This will not hurt"
3. Placebo-like conditions, believing that the coffee is caffeinated or that this ointment
4. This ointment will stop the itching.
5. Mistakenly seeing a surface as slippery leading to altered gait mechanics
6. Expecting a level of spiciness that is higher or lower than what you ultimately sense
7. Watching for your back pain, knee pain or dizziness to "be there" in the morning

While we might reductively state that "our perceptions" guide our movements, behaviors, sensory receptors and the like, it would be more active that our PP is the true influencer. We perceive and create future predictions based on past events, with a bias toward the most recent and most voluminous experiences. In The Brain That Chooses Itself (2024), we read that these predictions create a bias, influencing how we frame sensations, interactions, and outcomes that differ from our planned motor control.

Predictive Processing in Aging

It may true and it may be easy to write, "Biopsychosocial experiences influence our prediction of how we will age.", yet, what does this mean and how do we "get here"? As established above, our predictive processing influences our perception of current events and experiences. This is related to confirmation bias, leading us to see and experience what we expected (predicted). Suffice to say that our impression of aged, old, elderly or any other related term that is presently in or out of favor, starts very young and is consistently reframed throughout life [5]. What and whom we define as "old" at 10 years old is entirely different than those same descriptors once we are 25, and again at 35, again at 50 and so on. In 1977, when I was 8 years old, I played catch with my then 54 year old grandfather in our backyard in Des Moines, Iowa. I vividly recall this very experience. I fashioned myself as a promising baseball pitcher and knew that he was a former professional (semi-pro) pitcher. I have no photographs of this event and have heard no stories about this memory – this is my own internal lived experience, retold many times (by me to myself) throughout my life. "My grandfather was agile and muscular. He was in great shape, but 54 years old was old (to me) at that time. This memory was formative for my expectations of "old", yet my definition of old has evolved...he was two years younger than I am now."

We become what we expect, what we think we can, and what we have seen. My parents are very active physically and continue to be in good function (cognitive and physical definitions). It should be clear and evident that my parents' example of aging sets my expectations and influences my predictions. For me, I continue to run 25-40 miles per week, am an active singles "pickleballer". I swim and lift weights daily. This is all written to define how my perception of age is defined by my lived experiences and has changed throughout my life – influenced by bio (my health) psycho (what I predict/expect) and social

(what I have seen in my network and ascribe for my culture), culminating in my identity or how I describe myself. The social influences that reach us have expanded throughout time from tribe to culture to country to world, for good or bad, as communication and technology has evolved. Ultimately, our circle of influencers on what we expect from aging has changed from that backyard to my back pocket (cell phone). As you have now read, what a person expects and predicts for themselves in aging is influenced by biopsychosocial elements. These predictions change with our own experiences, but also how society has addressed aging continues to evolve. When we see or read stories about senior athlete successes or read updates on the science of aging (life expectancy projections, malleability through our own life actions) we then update our predictive processing toward the aging experience. Had I seen frailty in my 50 year old grandfather or my parents, this would impact my own predictive processing. A little knee or back pain here, a comment about my posture there, a forgetful moment – these might be handled much differently had I lived an experience that influenced my PP on aging as one that included disability or frailty. These experiences have shaped my identity, my expectations – my predictive processing.

Introducing Finish Line Bias

While Finish Line Bias (FLB) is not an entirely new concept, to this point it has only been used to describe competitive racing mindsets largely in periodicals and internet newsletters more so than scientific journals. While this application of FLB on aging is novel, readers may find this to be intuitive, adding value to our understandings of the most ubiquitous of human experiences – aging.

Finish Line Bias in Aging

We are all "only" aging 24 hours every day. Right? Well, our predictive processing influences our expectations at 20, 40, 60 and 80, such that each day in our eighties may be absorbed or framed much different than a day in our twenties – partially based on The Finish Line Bias (FLB). As we approach our own projection of lifespan – the finish line – we may either succumb-to the FLB and fulfill our own prophecies accordingly; or attempt to influence the proximity of the finish line. We may indeed use FLB as a motivator to "race well" and "endure" a long journey, knowing that ultimately there will come a finish line.

Predictive Processing and Finish Line Bias: Intersectional Influences on Aging

Predictive processing influences my expectations on lifespan – my own predicted finish line. I really do not ever need to state internally or aloud that I expect to live to 95 or 120. I have already framed and will continue to (only modestly, from here) adjust my impressions of the last 1/3 of my "race". An unexpected illness or injury may significantly alter my actual lifespan or my PP of such, yet for now, I see myself at mile 13 in a 26.2 mile race, a marathon. Let us adopt the analogy of a marathon to introduce the concept of Finish Line Bias (FLB). As I have completed some 17 marathons and over 70 triathlons of different lengths – I am quite familiar with the finish line experience. When you have given your all, you can somehow continue to run at full speed one moment, then cross that line, after which you may need help to or are feeling too much of any symptom (pain, stiffness, fatigue, nausea) to advance. Finish Line Bias can be a self-imposed or setpoint in life event whereupon a person ascribes the notion, "I can make it to here…but cannot advance at the same pace after this point.". Now, let us pivot from the finish line analogy in races. Finals week, a wedding, a move, a new home completed, the birth of a child, after a funeral or "in the offseason", are examples of other finish lines that do not include a literal tape to be broken or stripe on the ground. Yet these finish lines are just as real and may even feel more intuitive to you. On to FLB, where we may see ourselves as approaching the finish line with fatigue, or having crossed the line and needing a break. We may even experience a let-down (mental health needing solitude; immune health experiencing illness) immediately after the literal or figurative finish lines. Perhaps you have, after one of these events have passed a peak point, "finally allowed myself to process" or (after finals), "…allowed myself experience the illness that I was holding-off [6]".

Predictive Processing on Longevity: Behavioral Ramifications as Our Self-Ascribed Finish Line Approaches

Combining PP with FLB on aging, we see that our identity and expectations may pivot yet again as we approach our own finish line Tovel and colleagues (2019) referred to as the Self-Perception of Aging (SPA) [7]. This may begin when we enter the last 1/3 of our projected life expectancy or may only begin after we experience a life event that causes us to consider mortality. There is no "best" model here. No judgement to be ascribed. Rarely would we find that a person is perfectly and purely (always and toward all matters) an optimist, realist, or pessimist. We all frame our experiences differently. Extending our knowledge of pain neuroscience into what is now becoming known in Somatic Symptom Disorders, in Illness Anxiety Disorders, and in Functional Neurologic Disorders, the frequency that we think about any problem (internal focus), indicates the potential that this dominant mindset may increase or magnify the problem [8-11].

As for PP on longevity, the more we think about "it" (our mortality) the more likely it becomes that these thoughts about aging and mortality can begin to occupy a dysfunctional amount of "brain space and mind time" – in the form of ruminative thoughts. This field is as yet untapped, so we can only hypothesize that this frequency of thought may be most significant difference between the three approaches or mindsets: optimist, realist, and pessimist. So, why does any of this matter? Practically speaking, these points summarize the significance:

1. What I expect of myself as I age frames my lived experiences. When I stop doing (participating in) any activity – this disuse in and of itself will lead to pruning and learned non-use. Skills that you will lose can be directly predicted by activities that you stopped engaging in – either because you cannot, you are told that you should not, or you believe that a person your age "does not". These influences on my expectations and eventual predictive processing are often summarized as the biopsychosocial lenses.

2. My attention toward errors that I attribute to aging (right or wrong in those ascriptions) will influence how these errors are given weight in my ongoing predictive processing about aging. Errors in memory, losses of balance, reaction speed and calculations are all routinely considered as I update my impression of self on a daily basis with consolidation in sleep. More attention to errors leads to future predictions of the same and (to some degree) the increased frequency of said errors (imbalance, pain, mild cognitive impairment, urge incontinence) [8-11].

3. What society expects of me and tells me that I can or cannot do, may be influenced by my PP or may alternatively influence my PP and my identity. This is supported by work on stereotype bias.

4. If I approach my finish line as a person that is nearing the end or can barely hang-on, my race pace will be influenced – mightily. I may be able to dig-in and "finish strong" or I may keep checking my proverbial watch or asking "are we there yet" to drivers and race officials…feeling the looming sense of fatigue which may accompany my mindset regarding the race.

5. Your brain's predictions about your abilities and present state are powerful - yet are modifiable. How are you presently envisioning your finish line? Should you consider reframing this to sign-up for a longer race? Would you be positively influenced by this opportunity to train now and finish your race with your best or optimized race pace? It really does not matter how many people you pass along the way. While this might feel like an attractive and gamified mindset, what can feel healthiest is to model a strong finish…positioning yourself to finish more strongly than people might expect of you.

The Influence of Healthcare on Predictive Processing and Finish Line Bias

"You have the spine of an 80 year old!"; "You walk like you are 90!"; "What do you expect, she is 88 after all?"

Health care is not always healthy. From stereotypes about aging to projections on the experiences of a condition, education, wellness and health care, are not a place to deliver nocebos. Nocebos inform our PP toward lowered or suppressed expectancies. As Michelangelo Buonarroti was quoted to have said, (paraphrased) "The greatest danger is not that our aim is too high and we miss it, but that it is too low and we reach it." He concluded this quote with, "Remember, your limits are often self-imposed.". Imagine, hundreds of years later, that we repackage this with analogies of the day, life as a race, wherein a self-imposed (PP) location of a finish line can influence our pace and ultimately our demise. When we lower our expectations as a function of beliefs, we are indeed, "more likely to meet them".

Scientific Support, Future Research and Related Concepts

Finish Line Bias has a relationship to a phenomenon known as the Let-Down Effect [6]. The Let Down Effect refers to both physical and psychological symptoms that develop after a singular stressful event or after an extended period of high alert. These symptoms can frequently be tied to suppressed immune system activation, elevated cortisol and imbalanced hormones, expressed in range from illness (colds, infection, poorly healing wound or migraines) to emotional changes (irritability, anxiety, blunted affect or even mild depression) [6]. Our understanding of resilience and grit are also related (and developing) themes. Authors such as Angela Duckworth and Sharon Horesh-Bergquist have explored these concepts in their bestselling books, "Grit" [12], and "The Stress Paradox [13]". Current and future research on PP appears to be coalescing around brain networks and the capacity to create rule-sets, predictions and expectations as quickly in older age [1-4]. In addition, many groups are studying expectations of aging on the aging process itself [7,14-16].

Conclusion

Leveraging a unique contribution of Predictive Processing and Finish Line Bias, we may be positioned to ask ourselves these questions, and benefit from the exercise of asking:

- "Am I nearing my self-predicted finish line and find myself experiencing a sense that may be more a function of prediction, than physiology? Fatigue, stiffness, pain, weakness, cognitive error.
- "Am I nearing my self-predicted finish line and find myself to be motivated to finish strong, feeling buoyed by my lifelong approach of healthspan investment?"
- "Am I seeing my finish line as far away and find myself motivated to pace for a strong race ahead."

About the Author

Dr. Mike Studer is looking forward. He is a self-described soon-to-be 57 year old first time senior athlete soon to be competing in the World Senior Games in pickleball. He cannot see his finish line presently because no matter fast he runs…it (his self-ascribed finish line) seems to be repositioned farther into the future each day.

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