Journal for the Child Development, Exceptionality and Education, 6(1), 33-40
June 2025 e-ISSN: 2757-7554
jcdee.com

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Review Article

Why time speeds up with age

Anna Scott[1]

School of Education, Eastern New Mexico University, US

Article Info

Received: 13 March 2025
Accepted: 25 May 2025
Online: 30 June 2025

Keywords
Childhood cognition
Developmental psychology
Neuroplasticity
Temporal processing
Time perception

Abstract

In this literature review, I examine the research that seeks explanation for why children see time moving slow, while adults often say that time flies. Drawing on neurological, emotional, linguistic, and experiential factors, the study explores why children often perceive time as moving more slowly than adults. Rapid synaptogenesis, heightened neuroplasticity, and faster neural firing in childhood create detailed memories of experiences, and it leads to lengthening the feeling of time. As individuals age, increased cognitive efficiency, reduced novelty, and established routines lead to fewer memory anchors and a compressed sense of time. Language development assists children in their understanding of abstract temporal relationships. Emotional intensity and attention shape their feeling of time duration. Differences in heuristics, biological rhythms such as heart rate and metabolism, and the attentional gate model also help explain the widening gap in time perception across the lifespan. Children's reliance on routines, emotional salience, and relational cues is very different from adults' dependence on task-based estimation and temporal landmarks. The feeling of time passing depends on biological, cognitive, and emotional development, and it offers an insight into why childhood seems endless and adulthood seems fleeting.

To cite this article

Scott, A. (2025). Why time speeds up with age. *Journal for the Child Development, Exceptionality and Education, 6*(1), 33-40. DOI: https://doi.org/10.5281/zenodo.1

Introduction

This literature review attempts to investigate how cognitive development impacts feeling of time. It focuses on neurological, emotional, linguistic, and experiential factors. The purpose of this review is to examine the developmental, biological, and cognitive processes that shape our subjective experience of time and answer the question of why time feels slower in childhood and appears to speed up with age. The scope includes neural mechanisms such as synaptogenesis, myelination, and dopamine regulation. It covers cognitive components like attention, memory, and language acquisition. It also reviews external factors such as routines, emotional experiences, heuristics, and biological rhythms. This review highlights how early developmental stages, marked by rapid brain growth, novel experiences, and rich sensory processing, lead to an expanded sense of time, while adulthood, characterized by routine, fewer novel experiences, and more efficient but selective cognitive processing, results in a compressed perception of time. Since it clarifies how children perceive time differently and why their everyday experiences can seem longer and more intense, an understanding of these changes has important implications for teachers. By recognizing the interplay between brain development and time perception, we can better support children's emotional regulation, attention, and learning by aligning expectations with their cognitive reality.

[1] Graduate Student, School of Education, Eastern New Mexico University, US. B E-mail: Anna.Scott@enmu.edu

Review of The Literature

Cognitive Development and Time Perception

Cognitive development plays an important role in shaping how we see the passing of time (Zélanti & Droit-Volet, 2013). During early childhood, the brain undergoes rapid growth and transformation. Synaptogenesis, the formation of new synaptic connections between neurons, happens at a higher rate during infancy and early childhood than at any other point in the lifespan. Children are constantly processing new information, forming new connections, and adapting to novel stimuli. The world, in a sense, is experienced in slow motion because the brain is working overtime to interpret and store every detail (Fontes et al., 2016).

Children's brains could be thought of as having a faster "neural clock" which is something of an internal pacemaker. The faster neural firing rate means that more "time units" are recorded per second, making experiences feel longer and more drawn out (Jura, 2019). Children often encounter new experiences, and it makes them attend to specifics, so their brains encode these events with rich sensory and emotional detail. This high-resolution encoding of time results in a more expansive perception of duration.

As individuals age, the brain becomes more efficient and less plastic, and it is great for routines, however it may contribute to the compression of time and memory creation. Neural firing of the adult brain is slower than in children's brain. Adult brain is more selective in its attention and creation of memories (Buzsáki, 2006). Adults are more likely to filter out repetitive or non-novel experiences, encoding fewer details. As a result, days may seem to "blur together," and time appears to move more quickly.

Myelination is another neurological component that contributes to the appearance of "flying" time. It is the process through which axons are coated with a fatty sheath to increase the speed of neural communication (McDougall et al., 2018). As this process progresses through adolescence and adulthood, it supports faster cognitive processing but also contributes to streamlined, habitual responses. While beneficial for quick decision-making, this also reduces the sense of novelty and rich sensory processing, both of which are critical in creating the perception of longer durations.

The hippocampus, a region of the brain involved in memory formation and spatial navigation, is more actively engaged in childhood due to the novelty of experiences and environments. In adulthood, as individuals become familiar with their surroundings and routines, hippocampal activity related to time perception may decrease (Howard & Eichenbaum, 2013), contributing to the subjective acceleration of time.

Neurochemical factors also influence time perception. Dopamine, a neurotransmitter associated with motivation and attention, affects the brain's internal timing mechanisms (Fung et al., 2021). Children's naturally higher levels of dopamine (specifically in active, curious phases) may enhance attention to moment-to-moment experiences, making time feel slower. Novel experiences tend to be processed more deeply and stored with more detail (Skavronskaya et al., 2020). Children form more dense memories during new experiences. Each experience is new, rich, and full of sensory detail, which makes time feel expanded. For example, a day at the park or the first day of school might feel incredibly long to a child because their brain is actively processing so many new experiences. For adults, those same experiences may blend into routine and feel like they go by in a flash. These memories create a perception that a lot has happened in a short period, making that time feel longer in retrospect.

According to Duszkiewicz et al. (2019), novelty induces dopamine release in the hippocampus, triggering memory consolidation to boost memory persistence. As a result, time feels longer because the brain is taking in and recording a larger amount of information. Adults often operate on autopilot for familiar tasks, so time seems to fly by because fewer new memories are formed.

Kedar (2023) talks about several cognitive components such as attention, memory, and language, which agrees with studies by Droit-Volet and Zélanti (2013) that claim time perception may result from a complex interaction with several different cognitive factors, such as short-term memory, working memory, and selective attention. Developing brain typically processes information more slowly than a fully developed adult brain, so events can feel stretched out, and it can account for why time moves slowly when you are a child.

The biological development of the brain from childhood to adulthood includes changes in plasticity, neural activity, memory processing, and neurochemistry. These changes influence how time is processed. Understanding these changes offers valuable insight into why childhood summers seem endless, while adult years seem to pass in the blink of an eye.

Language and Temporal Cognition

Language plays a very important part in the development of time perception, because it helps children learn to conceptualize and communicate about time. The process of acquiring temporal vocabulary (before, after, soon, yesterday, and next week) helps children to organize their experiences along a timeline and make sense of duration, sequence, and anticipation (Tillman & Barner, 2015).

Routines and contextual clues help children with learning about time. They start grasping abstract ideas of duration and temporal order when they learn to speak. This is significant because a perception of time is conceptual rather than perceptual. We use language to structure and describe time because we cannot see it (Nelson, 1996).

Studies (Weist,1989) show that the understanding and use of temporal terms begins around age 2–3 but continues to develop into middle childhood. Weist found that preschoolers can use temporal words, however their grasp of how these words map onto actual chronological relationships is still emerging. Children start using temporal terms more reliably and consistently by the time they are 5 or 7 years old (Hudson & Mayhew, 2011).

Cross-linguistic research demonstrates a language's encoding of time can affect how its speakers perceive it (Boroditsky, 2001). The way that different languages depict time spatially varies. For example, Mandarin uses up/down metaphors to say "the last month is 'above month'", and English uses front/back metaphors to say "looking forward to the weekend." These linguistic structures can affect the way that children and adults understand temporal relationships.

Routine-Based Understanding

Children's brains are still developing in areas responsible for understanding abstract concepts such as time. They think about time in concrete, perceptual terms. Zhang and Hudson (2018) assert that rather than being measured in minutes or hours, children's perceptions of time are linked to recognizable patterns or sequences of events (such as meals, playtime, or bedtime). This makes it harder for them to judge or feel how long something has lasted and can lead to the perception that time is dragging. Children might say something happened "yesterday" when it occurred a week ago, or confuse "tomorrow" with "later today."

The limited understanding of temporal sequencing shows that children do not have a complete grasp on the concepts of time and its duration. Time often seems to drag on for young children, which may be explained by their subjective, situational, and relational embodied sense of time (Dýrfjörð K. et al., 2023). Children's feeling of time depends on the sensation's in their bodies and their emotions. A five-minute line wait or a quiet moment before lunch can seem like forever because they lack a firm internal sense of how long those units of time should feel, and this subjective perception makes time seem to stretch when they are bored, waiting, or uncertain of what will happen next.

Adults have experiences to be used as references and ways to organize time (like schedules, goals, or tasks), which allows them to experience faster flow of time. Adults' brains are busy and engaged, and time feels like it is flying by. Children rely on routines and adults for clues about what will happen next, and time may seem unclear and uncertain if those are unclear or inconsistent. This may also add to the impression that time is slow.

Difference in Heuristics

Stojić et al. (2023) argue that children and adults have different heuristics. Heuristics can be viewed as methods we employ to make decisions or find rapid, effective solutions to issues. Younger children in particular lack a fully formed sense of time. They often rely on event-based cues: "It's time for lunch after storytime." How bored or engaged they feel can make time feel longer when they are bored or doing something difficult. More activities in a short period may make it feel longer to children.

Children make use of tangible markers: "It takes one song to clean up," and they use more situational and emotional tactics than rational ones. Children interpret time using the significance of events and rely on their feelings during an activity. Children's perceptions of time are more erratic due to their greater emotional swings and lack of self-control.

Adults use clocks, which make it easier to keep track of the hours and minutes that pass, and they have more experience and cognitive capacity. Task-based estimation is when adults use: "I know it takes me 15 minutes to drive to work." They frequently use their memories to gauge time: if it was busy, it felt fast; if it was uneventful, it felt slow. Adults are better at understanding time intervals and have routines (e.g., "That meeting lasted about an hour").

Children rely more on how they feel or what's happening around them, while adults draw on memory, routine, and internal clocks. This difference helps explain why time feels slower for kids and faster for adults.

Attention and Time Estimation

Zakay and Block (1994) propose the "attentional gate model. " It claims that the amount of attention paid to time affects the perceived duration. This model suggests that our perception of time is contingent upon the amount of time we spend monitoring time. When we are bored or keeping an eye on the clock, our "attentional gate" opens, allowing information to flow through and giving the impression that time is passing slowly. When we are enjoying ourselves and time seems to be passing quickly, the gate narrows and less information is processed. Zakay 's and Block's model offers an explanation for the slow time that children experience. Children are focused on the present and think less about the future than adults. Their world is centered around the here and now, what they're feeling, doing, or anticipating in the immediate moment. Children pay more attention to the passing of time. A child sitting quietly and waiting for lunch may not have mental tools like adults do to distract themselves with planning or reminiscing. Their attention may be unintentionally focused on the passage of time, making a short wait feel longer, and that is why children might think that car rides or standing in lines feel long, even though in reality they are not.

Adults tend to be more distracted by external demands and internal thoughts, like to-do lists, emails, or upcoming responsibilities. These distractions divert attention away from the passing of time, making it feel as though it goes by faster.

Children perceive time more slowly and intensely than adults due to their heightened attention to the present moment and limited comprehension of abstract time measurement, which is explained compellingly by the attentional gate model.

Emotional Experience and Time Perception

Our perception of time is impacted by emotions. Research (Droit-Volet & Meck, 2007) shows that strong emotional experiences, positive or negative, can change our sense of passing time. During times of fear or anxiety, the brain becomes hyper-aware of details, and it leads to a feeling of time slowing down. It is seen as a survival mechanism by Droit-Volet and Meck that allows us to process more information in a shorter period of time. Positive emotions tend to make time feel like it is flying by, because we are less focused on time and more on the experience itself (Sackett et al., 2010).

Children's emotions are more intense than adults'. Their excited emotional states can make time periods feel longer. A single hour of joyful play may feel like an eternity in their world, while moments of frustration or boredom can seem endlessly long. Their developing brains are also still learning how to regulate attention and emotion, both of which influence how time is experienced (Droit-Volet, 2013).

Adults' experiences are more emotionally neutral, because of the repetitive nature of routines, work, and responsibilities. This lack of emotional intensity contributes to the feeling that time speeds up as we age. Studies by Friedman and Janssen (2010) discuss how the routines of daily life and the absence of new experiences create less excitement. It makes time periods feel longer. This helps explain why childhood summers feel endless, while adult years seem to pass in a blink.

Temporal Landmarks and Life Milestones

Significant events in our lives are important to how we organize memories and experience the passage of time. For children, life is filled with a large number of exciting events: birthdays, new school grades, holidays, first achievements like learning to ride a bike or losing a tooth. Each event punctuates their timeline and helps create a strong sense of movement and personal development. These milestones provide structure and help children form memories, which are essential to constructing a coherent sense of self over time (Nelson & Fivush, 2004).

The new and emotionally engaging events that are tied to significant transitions stand out in memory. This density of memorable experiences makes time feel more expansive in childhood. Temporal landmarks act like memory "anchors," allowing children to recall specific years or stages of life in greater detail (Friedman, 1993).

Adulthood has fewer emotional events. The routines of work, caregiving, and day-to-day responsibilities can make one year blur with the next. Adults experience fewer “firsts” and major life transitions, their memory systems have less distinctive material to encode. This can create the impression that time is passing more quickly (Munawar et al., 2018). Studies talk about adults' perception of time acceleration being tied to fewer time landmarks and influenced by repetition of daily life. Without new events to break up the routine, our brains process time with less memories. It leads to the impressions that many years have flown by (Block & Zakay, 1997). It is not just aging that speeds up time, but the loss of temporal landmarks that shape our perspective about the past.

Biological Rhythms and the Subjective Experience of Time

Difference in time perception between adults and children could be possibly explained by difference in heart rate and metabolism. "Biological time theory" offers an explanation that the body’s internal clock is responsible for tracking time. Children's hearts beat faster, and they have higher metabolic rates than adults (Gao et al., 2023). Child's heart may beat 90–120 times per minute, whereas a healthy adult’s heart beats closer to 60–80 times per minute (Guyton & Hall, 2017). These faster biological rhythms act like an internal pacemaker, which causes children to experience time more slowly because of the frequency of "events" (heartbeats, breaths, etc.).

Treisman (1963) presents an internal clock model. The idea is that the neural pacemaker sends pulses to an accumulator in the brain. The more pulses means the longer the perceived duration. If children’s internal clocks tick faster due to elevated physiological activity, they may perceive the same amount of objective time as longer than adults do. Studies have shown that children tend to overestimate short intervals of time compared to adults, likely due to their faster internal timing mechanisms (Droit-Volet, 2013).

Adults’ heart rate and metabolism slow down. The reduced frequency of these physiological events contribute to the perception that time speeds up. In addition, adults frequently divide attention between multiple tasks, and it contributes to underestimating how much time has passed (Zakay & Block, 1994).

More research is needed to understand how metabolic and cardiovascular differences impact time perception. This biological perspective adds an important layer to our understanding of why children and adults experience the passage of time so differently.

Reflection and Subjective Time

Our perception of time is influenced by how we reflect on and interpret our experiences. Adults often look back on long stretches of time using selective memory, and as a result months and years are represented by major life events. This reflection leads to the feeling that time flies by. This effect becomes stronger when daily life feels repetitive or uneventful. Children have fewer years of life experience and they frequently have new experiences. It makes them perceive time as a longer period. The proportion of each year to the rest of their life is larger than for adults, and their reflections are filled with numerous details. This makes time feel slower (Block & Zakay, 1997; Wittmann & Lehnhoff, 2005).

This relates closely to the "reminiscence bump", where people tend to recall more memories from their adolescence and early adulthood than from any other period of life. New, meaningful experiences make more memories, and it influences our sense of time (Rubin, Rahhal, & Poon, 1998). Children, constantly learning and encountering “firsts,” are building this memory base in real-time, whereas adults may reflect on their current life through a narrower, more routine-focused lens.

Psychologists noticed that attention to time itself changes our experience of it. William James, the father of American psychology, observed that time perceived in the moment ("prospective time") differs significantly from time as remembered ("retrospective time"). Our timelines are shaped less by how much we mentally process and not by the actual time length of events (James, 1890). Recent research by Zakay and Block (1994) agrees with this. The research shows that actively attending to time makes it feel slower, while being absorbed in activity often causes us to lose track of time altogether.

The act of reflection is both a mirror and a sculptor of our experience of time. It helps us make sense of the past, but also subtly reshapes how we think time has passed. For adults, compressed memories and streamlined routines can make the past seem short and the present blur by. For children, every moment still feels wide and worth remembering.

Implication for Teachers

Children's brains process time more slowly and encode novel experiences more richly, new learning experiences feel longer and more meaningful. Teachers can use this to their advantage by incorporating novelty, sensory detail, and emotion into lessons (Koslouski et al., 2024). This is a very effective approach for young children, and it improves engagement and retention. Routine is crucial, however it can shorten time and cause students to lose interest. It is ideal to have a mix of predictable structure and emotional or surprising moments.

Young children rely on routines and context rather than abstract time concepts. Students can better grasp time passage with the aid of visual schedules, timers, and regular routines (Selman & Dilworth-Bart, 2023). The use of phrases like "after snack" or "before lunch" and follow up introduction of abstract phrases like "in 15 minutes" or "tomorrow" help children's language and cognitive development.

Emotional experiences last longer and are better remembered. Long-lasting educational memories can be created by incorporating emotionally charged activities such as games, stories, group challenges, or celebrations (Kensinger, 2009). These examples promote long-term retention by creating cognitive "time anchors."

Reflection helps students process their experiences and develop a sense of time, so teachers should encourage it through journaling, class discussions, or drawing (Veine et al., 2020). This type of reflection can be encouraged by questions such as "What do you remember from today?" or "What was your favorite part of the week?"

Children might confuse terms like “yesterday,” “tomorrow,” and “later.” It demonstrates ongoing cognitive and neurological development and not just a language delay (Zhang & Hudson, 2018). Teachers should correct these misunderstandings gently and use concrete examples to build understanding.

The attentional gate model states that perceptions of time are significantly influenced by attention. Time drags when tasks are either too simple or too complex (Zakay & Block, 1994). When children are engaged and "in the zone," time flies. Teachers should design their activities with "flow" in mind. These activities should be just right, not too easy nor too hard, and should provide options, collaboration, and feedback. Lessons need to be broken up into digestible portions and have a varied tempo. To improve focus and control the subjective passage of time, they ought to incorporate movement, music, or sensory breaks.

Students' learning of time estimation and planning skills must be scaffolded by teachers. These are not intuitive and need modeling and practice.Methods such as visual checklists, timers, and figuring out how many songs an activity will take can all be beneficial.

For a child, even a brief break can seem like a long one. By being aware of the developmental differences in how students perceive time, teachers can prevent their frustration. Teachers should modify expectations, because wait times or transitions can be challenging for kids to handle on their own.

The "reminiscence bump" is a period of time when adolescents are in a crucial period for creating enduring memories (Munawar et al., 1918). When teaching this age group, educators can purposefully create memorable, identity-forming learning experiences that students will likely remember for a long time. Academic learning is effective when tied to enduring memories through projects, field trips, community service, and cooperative challenges.

Children who are unsure of what will happen next find time to pass slowly. By avoiding lengthy lectures, monotonous assignments, or ambiguous instructions, teachers can prevent this. It is important to strive for concise, interactive, and unambiguous instructions while incorporating opportunities for active learning.

Conclusion

In conclusion, the sense of time depends on neurological development, emotional intensity, linguistic proficiency, biological rhythms, and cognitive development. Children's rapidly developing brains, heightened emotional experiences, new experiences, and increased neural firing rates all contribute to their perception of time as moving more slowly. Language development and routine-based learning play a role in how children perceive time. Adults employ more task-, memory-, and abstract-based methods. Changes in heuristics, attention, and emotional control also contribute to the discrepancy in how time is viewed across the lifespan. One of the key implications of these findings is the importance of developing age-appropriate educational and therapeutic interventions that consider the ways in which children and adults experience time differently. Our knowledge of how individual neurological variations, cultural influences, and socioeconomic circumstances may affect how time is perceived, however, is still lacking. Future studies might examine how digital technology, sensory environments, and changes in educational pacing affect children's time perception and learning outcomes. Understanding these factors could improve the ways educators structure time in classrooms and how caregivers manage expectations related to children's behavior and attention spans.

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