

SPEKTRUM
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PETRA HURAI

TIME IN *MOTION*

A COMPARATIVE STUDY
OF SUBJECTIVE TIME PERCEPTION

To uncover the invisible
presence of *subjective* time,
which is *omnipresent*.

INTRO

In today's fast-paced society, time often feels like it's slipping away more quickly than ever before. The constant stream of information, rapid technological advancements, and visual overload from screens have all contributed to a heightened sense of urgency and acceleration in daily life.

This modern experience raises questions about how the pace of society interacts with our subjective perception of time. Visual stimuli, particularly in environments saturated with motion, advertisements, and digital content, play a significant role in shaping how fast or slow we feel time is passing. As our world speeds up visually, our sense of time may follow.

Understanding the relationship between visual stimuli and time perception has broad implications for areas like design, virtual reality, and cognitive psychology, revealing how our sensory experiences shape our sense of time.

TIME IN *MOTION*

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THE CONCEPT OF SUBJECTIVE TIME

Time, as a general concept, has always been a fundamental aspect of human life, structuring how we work, communicate, and organize society. However, the COVID-19 pandemic brought about a significant shift in how we perceive and value time.

With lockdowns, remote work, and social distancing, the traditional boundaries of time—such as fixed work hours or daily routines—became blurred. Many people found their sense of time either speeding up or slowing down, as the rhythms of daily life changed dramatically.

This disruption forced society to reconsider its relationship with time, with more focus on flexibility, work-life balance, and mental health. Post-pandemic, the acceleration of digital technologies and visual stimuli through screens

has continued to shape how we experience time, further intensifying our sense of urgency and fast-paced living.

The importance of the concept of subjective time has grown as individuals seek greater control over their lives, emphasizing personal rhythms over societal expectations.

A proper understanding of the abstract concept of subjective time is essential, as it's a universal phenomenon experienced by everyone, yet its effects are highly personal and varied. Subjective time refers to how each individual perceives the passage of time, which can fluctuate depending on emotional state, environmental factors, or even visual stimuli. Unlike objective time, which is fixed and measurable, subjective time can stretch or compress.

TIME IN MOTION

00.01 THE CONCEPT OF SUBJECTIVE TIME



1 - PETRA HURAI, EXPERIENCE OF TIME, 2023-2024

This fluid nature of subjective time underscores the importance of designing with it in mind.

Whether in the context of physical spaces, digital interfaces, or everyday products, designers must recognize that their creations will inevitably shape users' perceptions of time. By understanding this abstract concept, they can craft experiences that align with people's psychological states, enhancing well-being, productivity, or relaxation.

For example, in a fast-paced work environment, designs that minimize distractions and provide visual clarity can help users feel more in control of their time.

Subjective time is something we all live with, yet interpret uniquely, gaining a deeper comprehension of this phenomenon allows us to create environments that not only serve practical needs but also resonate with our innate temporal experiences.

In product design, time is often seen as just another functional element, typically represented through devices like clocks or digital displays. However, the concept of designing with time—both objective and subjective—goes beyond the mere display of time. This approach incorporates time as an essential part of the design process, whether that's in creating new ways to measure and experience time or understanding how time interacts with the user's perception of the product or environment.

By integrating subjective time into design, we shift from simply tracking time to enhancing how people emotionally and psychologically interact with it. Whether we are crafting environments that slow time down to foster relaxation or speeding up the perception of time to increase productivity, designing with time means understanding that

00.01 THE CONCEPT OF SUBJECTIVE TIME

time is both a measurable reality and a deeply personal experience.

Objective time is straightforward and measurable, rooted in repeated intervals that can be displayed numerically or visually. Yet, subjective time—the personal experience of time’s passage—is far more complex and multi-sensory, affected by an individual’s emotions, sensory inputs, and surroundings. Recognizing this fluid experience of time allows designers to craft spaces and objects that interact with users’ internal sense of time.

For example, in environments where people are encouraged to relax or reflect, such as spas or meditation spaces, designers can manipulate visual, auditory, and even spatial elements to slow down the perception of time.

The pandemic has heightened our awareness of subjective time, bringing new attention to how our surroundings and experiences shape our temporal perception. As subjective time becomes a more prominent factor in daily life, understanding how to design with this in mind is crucial.

By weaving the concept of time into design—not just as a display element but as an immersive experience—designers can create products and spaces that align more deeply with human needs, whether that be to slow down or to speed up the perception of time.

This unique approach to designing with time rather than merely designing for it helps bridge the gap between how time is measured objectively and how it is experienced subjectively. It challenges designers to rethink the role of time in shaping user experiences, making time not just a concept to be tracked but an integral part of how we engage with the world around us.

TIME PERCEPTION

Time perception, or chronoception, is the subjective experience of how we perceive the duration of events over the period of (objective) time. In psychology and neuroscience, time perception is studied through experiments, with temporal illusions exposing how our brains shape these experiences. The ancient Greeks distinguished between *chronos* (objective time) and *kairos* (subjective time), recognizing that time feels longer or shorter depending on circumstances (Vatakis, 2018).

A parallel can be drawn with Einstein's train paradox (Einstein, 1931), where time is relative depending on the observer's position and movement. Similarly, subjective time is relative to our experiences, shaped by visual and sensory stimuli.

This understanding raises the question: Can we control the perception of subjective time? While full control may be elusive, designing environments that manipulate sensory elements can guide and influence how we experience the passage of time.

Subjective time is relative to our experiences, shaped by *visual* and *sensory* stimuli.

TIME IN MOTION

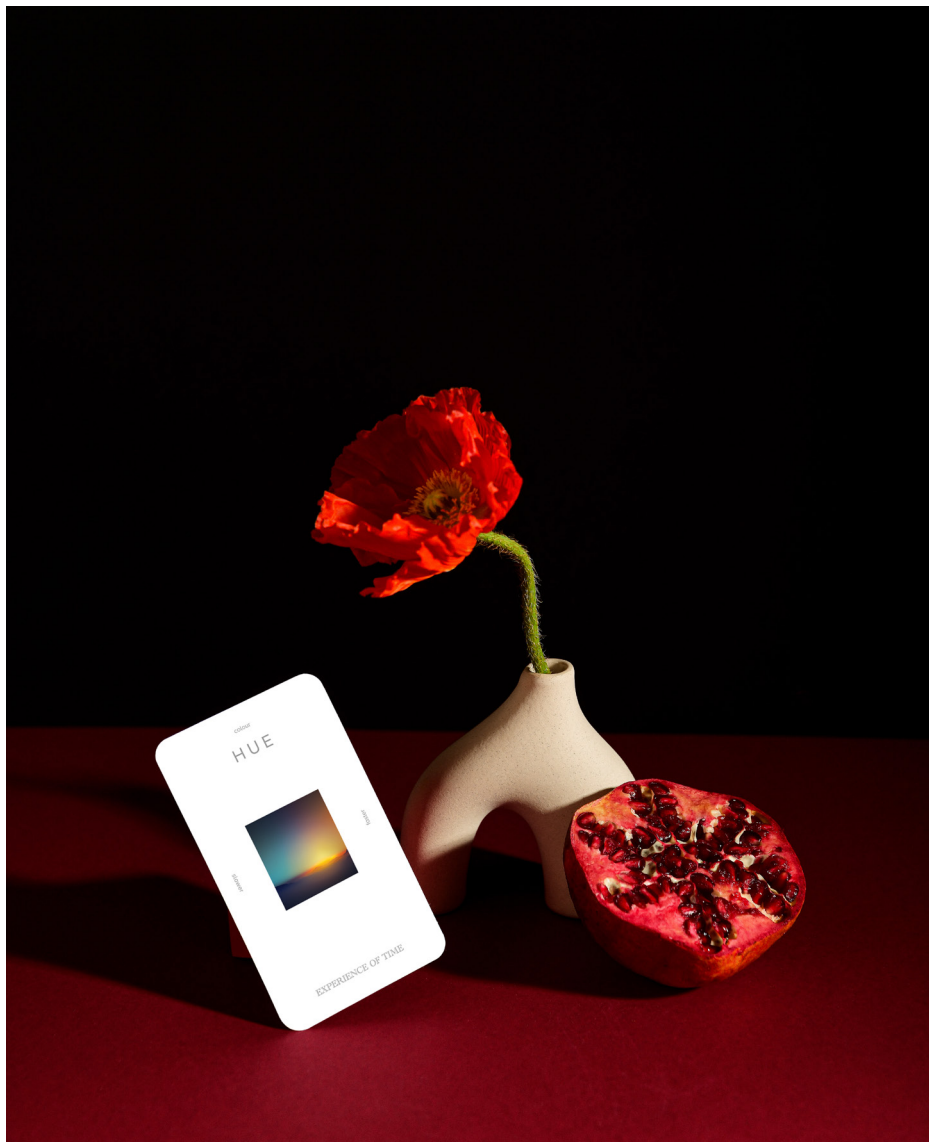
00.10 TIME PERCEPTION

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The Time in Motion project focuses on experimental theoretical research on the perception of subjective time in the context of transportation.

2,3 - PETRA HURAI, TIME IN MOTION, 2024



4 - PETRA HURAI, EXPERIENCE OF TIME, 2023-2024

TIME IN MOTION

00.10 TIME PERCEPTION

The study of time and time perception is central to Petra Hurai's research. Her dissertation, published in 2023, examines the relationship between objective and subjective time, including methods for measuring both and their application in design.

This research led to the Experience of Time project, which investigates subjective time and proposes methods for its measurement and analysis. The project results in an experimental framework that identifies the sensory modalities and stimuli most closely related to and affecting the perception of time's passage (Huraiová, 2023).

...Time is colour.

Time is light.

Time is motion.

Time is shape.

Time is sound.

Time is flavour...

Time is an *experience*.

EXPERIENCE OF TIME

The project EXPERIENCE OF TIME, describes the complex concept of time from the perspective of the design process and social development.

The perception of time is a phenomenon subjectively felt by a person and can be accurately described thanks to research in physics, biology, cognitive psychology, neuroscience, and the like. Petra Hurai's research mainly explores 'subjective time' described through sensory perceptions.

The project considers the subjectivity of time as a characteristic feature that should be included during the design process — 'designing with time.'

The thesis proposes an inspiring tool for designers and the general public; it explores the relational context of subjective time and sensory perceptions through visual clues. (1)

DESIGN AND TIME

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Objective time is straightforward and measurable, rooted in repeated intervals that can be displayed numerically or visually. Yet, subjective time—the personal experience of time's passage—is far more complex and multi-sensory, affected by an individual's emotions, sensory inputs, and surroundings.

Recognizing this fluid experience of time allows designers to craft spaces and objects that interact with users' internal sense of time.

Objective time is measured by a timekeeper—a tool for accurately measuring time. Time itself is not the same as the timekeeper.

A timekeeper can be, for example, a watch or a clock. The exact time is displayed in a certain form (such as visually or numerically) using the timekeeper (dial). To measure and display exact time, we need to understand the **BASIC PRINCIPLE OF TIME MEASUREMENT**.

The basic principle of measuring objective time is a **REPEATED INTERVAL**. The principle of time measurement can be any interval that we can stably and regularly repeat. We measure **DURATION** using a timekeeper. The unit of objective time is 1 second.

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Subjective time is a multisensory experience. It is not a sense (like a “sixth sense”) because subjective time perception is influenced by various sensory inputs (both internal and external). A key variable is also the internal experience of the person. Subjective time (subjective perception of time) can be perceived in a certain form. It follows the same PRINCIPLE OF TIME MEASUREMENT—an interval. This interval can be evaluated in relation to the SPEED of subjective perception, i.e., whether a certain interval feels like it passed faster (subjectively shorter) or slower (subjectively longer). The question (and the focus of P. Hurai’s research) is how such a measurement or perception result can be displayed.

It follows the same PRINCIPLE OF TIME MEASUREMENT—a REPEATED INTERVAL. We measure the subjective speed of time passing. We perceive DURATION through the senses. The unit of subjective time could be the elapsed interval.

TIME DESIGN MANIPHESTO

Product Design—timespace—3 dimensions (height, width, depth) + time (objective, subjective).

In product design, we most commonly encounter the design of wristwatches, wall clocks, or various digital formats. However, in the vast majority of cases, this only involves the design of TIME DISPLAY using numbers.

DESIGNING TIME could mean designing a new form of the principle of time measurement (a new way of repeating intervals), a new concept of time, or a new way of displaying time.

DESIGNING WITH TIME, on the other hand, means designing a product/ space/object with consideration for the parameter of time, which is present in the design process. Here we can also consider subjective time perception.

Just as ergonomics deals with 3 dimensions, which are essential in product design, designing with time addresses timespace, meaning that the time parameter (objective and/ or subjective) is added to the design process.

TIME IN MOTION

Time in Motion is a research project by Petra Hurai and Peter Levársky from the MXLAB research group and TRIMTAB, design-driven science outreach platform led by Michala Lipková, at the Faculty of Architecture and Design (University of Technology in Bratislava, Slovakia). The project examines the relationship between design and subjective time perception, focusing on how external sensory stimuli influence our sense of time.

By exploring which visual elements can stretch or compress our experience of time, the project raises the question: *Can we control how we perceive time?*

Through two video simulations of contrasting atmospheres in a fictional Prague metro carriage, the study investigates which journey feels longer, offering insight into how design shapes our temporal experiences.

The research study is suggesting an approach to design two contrasting metro carriages, each embodying opposing sensory stimuli and design principles. One carriage would be designed to slow down the perceived passage of time, while the other would aim to accelerate the perceived passage of time.

By comparing these two environments, the study seeks to determine which specific sensory stimuli and design aspects are linked to the two polarities of subjective time perception—whether the passing of time feels slower or faster.

This approach offers practical insights for designers, architects, and urban planners to create spaces that influence how we experience the flow time in everyday life.

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The comparative study consists of designing a pair of fictional Prague metro carriages, each incorporating sensory stimuli representing opposing research polarities.

Which *visual stimuli* can make a moment feel longer, and which, on the contrary, make it feel shorter? Can we *gain control* over the perception of subjective time?

The topic of transport, specifically public transportation, has proven to be a fitting subject for research in a comparative study of subjective time perception.

As vehicles are spaces where people spend time on a daily basis, they serve as familiar environments that can effectively illustrate this phenomenon to the general public.

The amount of time spent in public transportation or vehicles represents a significant portion of the 24-hour day. Research on the perception of subjective time in relation to transport is crucial for the future development of the design processes in transportation systems, vehicle interiors, and even autonomous mobility. In autonomous vehicles, the extended perception of time will likely be intensified by the lack of interaction with the vehicle's interior, as there will be no need for driving.

At present, the perception of time is not typically considered in automotive interior design, a factor that the results of this study could potentially influence in the future.

The experimental design for the comparative study Time in Motion therefore focuses on a mode of transport where sensory stimuli and their properties, such as light and brightness, audio and tempo, colors and shades, shapes, and sizes of objects, can be controlled.

The Prague metro serves as the mode of transport, well-known to the general public, with an average of 1,256,613 passengers commuting daily (2).

The perception of subjective time is a multisensory experience. The study, therefore, presents two contrasting atmospheres within the interior of the metro, created through the use of appropriate sensory stimuli of opposing polarity.

TIME IN MOTION
00.30 TIME IN MOTION



In time perception research, the most commonly studied color combination is blue and red, as they are positioned on opposite ends of the visible spectrum.

TIME IN MOTION

00.30 TIME IN MOTION

The given time interval is perceived
as *faster* and subjectively *shorter* if:

COLOUR

the object, environment, or observed surface
is in shades of red

*(Thönes et al., 2018; Smets et al., 1969; Kinzuka et al., 2022;
Shibasaki et al., 2014; Katsuura et al., 2007)*

LIGHT

the intensity or brightness of light decreases, less intense light

(Brigner, 1986)

SOUND

pleasant music is present in the environment, less intense sounds

(Droit-Volet et al., 2013; Goldstone et al., 1978)

TEMPERATURE

a person has an elevated body temperature
or is in a warm environment

(van Maanen et al., 2019)

SCENT

sweet or pleasant scents (e.g., strawberry)

(Baccarani et al., 2021)

COGNITIVE LOAD

the stimuli is less complex

(Ornstein, 1969)

TIME IN MOTION

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00.30 TIME IN MOTION

The given time interval is perceived as *slower* and subjectively *longer* if:

COLOUR

the object, environment, or observed surface is in shades of blue

(Thönes et al., 2018; Smets et al., 1969; Kinzuka et al., 2022; Shibasaki et al., 2014; Katsuura et al., 2007)

LIGHT

the intensity or brightness of light increases, intense light

(Brigner, 1986)

SOUND

music with a fast tempo, intense sounds

(Droit-Volet et al., 2013; Goldstone et al., 1978)

MOTION

the presence of rapid motion / dynamic stimuli extends the perceived time interval - *subjective time dilation*

(J. F. Brown, 1931; S. Goldstone & W. T. Lhamon, 1974; W. T. Lhamon & S. Goldstone, 1974, C. O. Z. Roelofs & W. P. C. Zeeman, 1951)

SCENT

citrus or menthol-type scents

(Baccarani et al., 2021)

COGNITIVE LOAD

the stimuli is more complex

(Ornstein, 1969)

TIME IN *MOTION*

00.30 TIME IN MOTION





9 - PETER LEVÁRSKY, TIME IN MOTION, 2024

CONCLUSION

The theoretical research for the Time in Motion project shows that the perception of subjective time is a highly complex topic that affects everyday life on various levels (physiological, emotional, biological).

However, there is still an insufficient number of individual experiments providing clear results regarding specific sensory stimuli. Changes in subjective time perception are related not only to stimuli with a temporal dimension but also to non-temporal stimuli (size, number).

A significant amount of scientific research is based on a fundamental phenomenon in time perception—Vierordt’s Law. According to this phenomenon, longer stimuli are perceived as shorter, while shorter stimuli are perceived as longer, respectively (Lejeune and Wearden 2009).

The perception and processing of sensory stimuli from the external environment we inhabit significantly influence the individual flow of subjective time.

These stimuli include aesthetic objects, interior design, lighting, chosen color schemes, and the amount of visual stimuli surrounding us.

In an era of overwhelming visual information, overstimulation of the senses often occurs, leading to the disruption of natural instincts and biological rhythms.

A deeper understanding of the relationship between sensory stimuli and their impact on subjective time perception is a key factor in conscious design—not only of environments but also of aesthetic objects, digital technologies, transportation systems, and visual communication.

Reducing the concept of time to the mere display of objective time on clocks misses its essential nature. The goal of this research project is to uncover the invisible presence of subjective time, which is omnipresent, and to uncover its hidden connections to everyday life.

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1 - <https://tr1mtab.com/project/experience-of-time/>

2 - <https://pid.cz/kolik-lidi-jezdi-hromadnou-dopravu-jednotlivych-dnech-ci-mesicich-roku/>

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9 - P. LEVÁRSKY

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TEXT AUTHOR:

Petra Huraiová

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Time in Motion

A comparative study of subjective time perception

Petra Hurai, Peter Levársky

Ongoing research investigates the relationship between design and the subjective perception of time based on external sensory perceptions.

Which visual sensation can “extend” a moment for us and which one can do the opposite? Is it possible to gain control over perceived time?

Two video loops simulate conflicting atmospheres in a fictitious Prague subway car C and ask the question which of the two journeys takes longer.

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