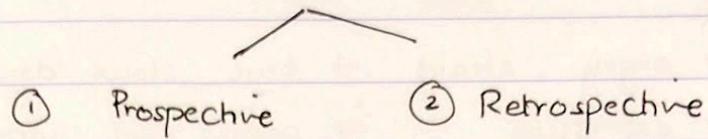


Time Perception



Types of Time

- ① Biological time / Body clock - 24 hour circadian rhythm.
- ② Mind time (perceived time) - mind creates sensations of time
- ③ Objective time on clocks

Notion of past, present & future is key to consciousness

Factors that influence time

- ① Emotions } Prospective
- ② Attention
- ③ Memory → Retrospective

Holiday Paradox

a good holiday whizzes by, yet feels long
when you look back

Project Goal

is to best understand and represent time perception
and not to best estimate one's time perception

A

Emotions and time perception

Slow

- {
 - angry, afraid → time slows down
 - depression → people w/ depression give time estimates that are on average twice as long as non-depressed people
- boredom, sadness slows down time

Fast

- {
 - ADHD - hyperactive time
 - happy (Dopamine)

B

Attention / Focus: the more absorbed you're in a task, the less attention you pay to time - Attention Gate Model

C

Memory

The more memories you've, the longer the event seems in retrospect

Chronostasis - the illusion that time stands still.

Einstein theory of relativity tells us that there's no absolute time

Time Perception in Different Brain Areas

- ① Cerebellum - helps us get an estimate of milliseconds also called 'little brain' - helps us co-ordinate movement by processing huge quantities of information from the nervous system.
- ② Pre-frontal cortex - help us estimate seconds
- ③ Basal ganglia - control movement using the neurotransmitter dopamine to put break on your muscle
 - Blocking receptors for dopamine causes people to underestimate the amount of time that has passed [time slows down]
 - Recreational drugs speed up time as they increase the levels of dopamine
- ④ Anterior Insular Cortex - allows us to detect how our body feels and is responsible for gut feelings
Interoceptive awareness
People who are deprived of their senses say time passes slowly.

Brain oscillations, esp alpha waves of brain activity are also related to time, e.g. during anaesthetic experiences, we lose perceptions of time.

Slow Dance is a picture frame that makes real objects appear to move in slow motion

Strobe lights have been used to see into fast motions

By using high speed strobe lights blinking 80 times/second, your eyes cannot even see that they are blinking - the light looks continuous

By synchronizing the strobos to the high speed vibrations of objects, the illusion of slow motion is created.

This is called persistence of vision

A stroboscope is used to make a cyclically moving object appear to be slow moving or stationary

When a rotating or vibrating object is observed with the stroboscope at its vibration frequency, it appears stationary.

① If object vibrates/rotates at the same speed as the strobe light blinks, then the object will seem motionless.

② If the vibration rate is different from the strobe light blink rate, then you get a slow motion effect whose speed is proportional to the difference between the vibration/rotational rate and strobe blink rate.

If flash occurs equals to the period of rotation (or a multiple of it, e.g. $2\pi n/\omega$, where ω is angular frequency), the point will not appear to move.

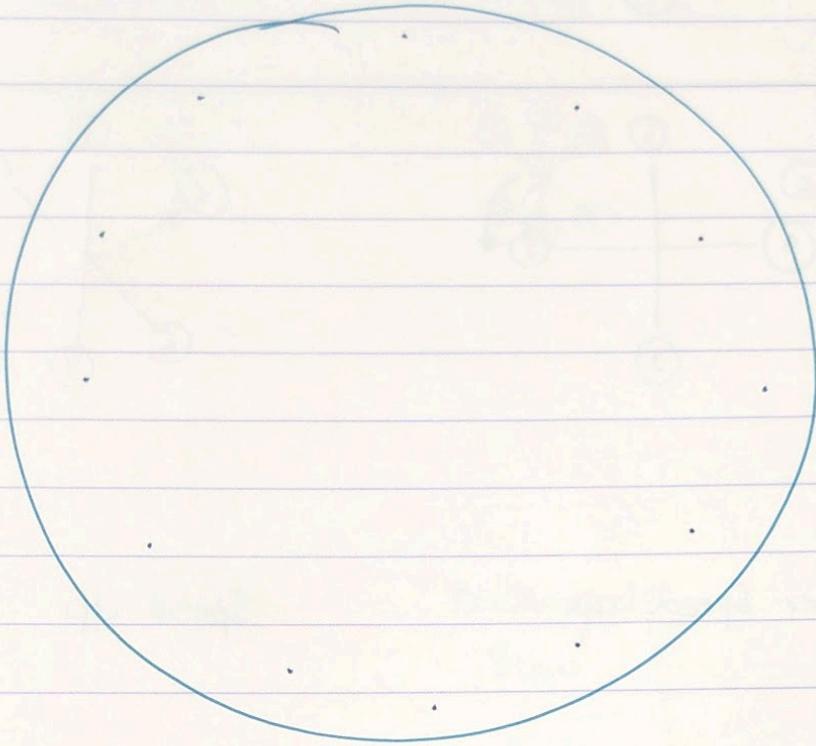
Any non-integer flash setting will make the mark appear to move forward or backward, e.g. a slight increase of frequency will make it appear backward.

Persistence of vision refers to the optical illusion that occurs when visual perception of an object does not cease for some time after the rays of light proceeding from it have ceased to enter the eye.

16 frames/sec is minimum to cause the mind to stop seeing flashing images

Modern theatrical films run at 24 frames/sec.

It is important to distinguish between frame rate and flicker rate, which are not necessarily the same. In physical film systems, it is necessary to pull down the frame, and this pulling down needs to be obscured by a shutter to avoid the appearance of blurring; therefore, there needs to be ~~be~~ at least one flicker per frame in film. To reduce the appearance of flicker, modern projectors are designed to add additional flicker periods, typically doubling the rate to 48 Hz or 72 Hz.

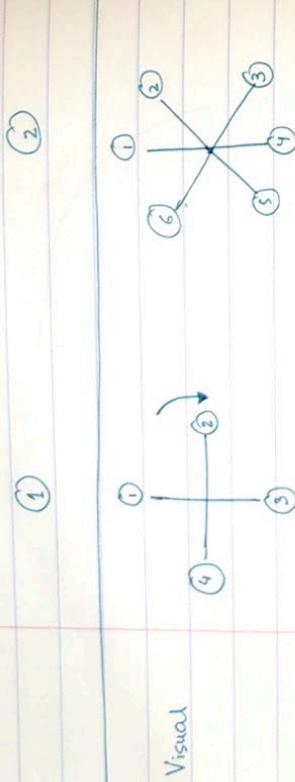


Let's say full rotation is x sec and there are y dots. Then each dot is $\left(\frac{x}{y}\right)$ sec and the overall frequency is $\left(\frac{1}{\frac{x}{y}}\right)$ Hz

Different parameters of the system

- ① Strobe light frequency
- ② Rotational frequency.

x : period of rotation



Nature of Motion

Hyper

Speed up

Time

Visual

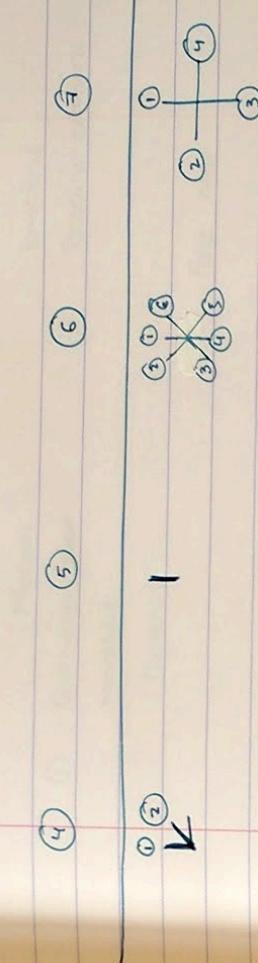
Backwards
Slow

Smooth
Continuum

Frozen

Slowed
Down

Backwards
Fast



Strobe
Light Period

$\frac{1}{6}x$

$\frac{1}{4}x$

$\frac{1}{2}x$

always
on?

$\frac{5}{6}x$

$\frac{3}{4}x$

$\frac{5}{4}x$

$\frac{7}{4}x$

$\frac{9}{4}x$

$\frac{11}{4}x$

$\frac{13}{4}x$

$\frac{15}{4}x$

$\frac{17}{4}x$

$\frac{19}{4}x$

$\frac{21}{4}x$

$\frac{23}{4}x$

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$\frac{429}{4}x$

$\frac{431}{4}x$

$\frac{433}{4}x$

$\frac{435}{4}x$

$\frac{437}{4}x$

$\frac{439}{4}x$

$\frac{441}{4}x$

Motion

- ① Continuous ~~stop~~
movement
(Baseline)

Emotions

Baseline emotions

Fast time

- ② Continuous fast
movement
- ③ Skipping 10
dots ($\frac{1}{6}$)

- ① Happy
② Hyperactivity
③ Focused

Slow time

- ④ Skipping 15
dots ($\frac{1}{4}$)
- ⑤ Slow ticking
time

- ① Waiting
② Sad
③ Anxious
④ Afraid
⑤ Angry.
⑥ Bored

- ⑥ Very slow
ticking

↗ ~~attention~~

- ⑦ Backward/Frozen

What is the role of AR?

- ① Show different time zones (More information)
- ② See in the past, visualize scenes and time perception with it (Historic view of time)
- ③ (Therapy) E.g. if your time is too fast, show them relaxation mediums. → Dandelions

What is the Goal?

Help people understand the mood and cognitive states better by reflecting on their perception of time

What is the role of light?

- ① Speed of light - use strobe light effect to speed up or slow the perceived speed of the hand
- ② Color of light - color reflects mood & cognitive state.

Open questions

- ① Should we used sound?

⑩ I decided to make a clock which shows people their perception of time
and perception of time is linked to emotional & cognitive state

⑪ How to use light?

① Shape light to show different time pace

② Light color to show emotional & cognitive state

⑫ How to use AR?

① Other information, e.g. different time zones

② Historic view - renew your day on this clock

③ Therapy if you're worried

② FOCUS on AUGMENTED REALITY

③ How objects in AR INTERACT with real WORLD

④ But it was ZOOMED IN too much

④ Trouble integrating with PHYSICAL Objects Environments without

⑤ So I decided to integrate with one specific Object, not the whole environment

⑥ HALLUCINATIONS with AR?

⑦ Slow Motion

⑧ Accurate view of people's perception of Time

⑨ What influences our perception of time

