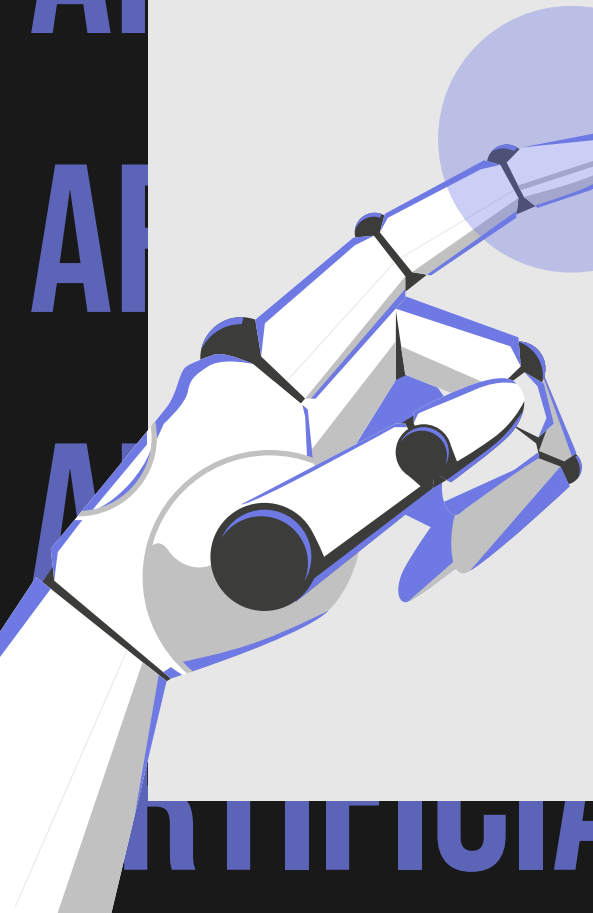

ITERATION AND OBIQUITOUS COMPUTING

Carmen María Noblejas Carreto
Lucian Andrei Negoita

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   - Evolution of HCI: From command-line interfaces to graphical UIs and beyond.
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2. Introduction to Ubiquitous Computing (Ubicomp)
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   - Adaptive Interfaces: Personalization and user context adaptation
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   - Ethical Considerations: Privacy, data security, and surveillance in ubicomp environments
   - Future Trends: Predictive interfaces, AI integration and zero UI
   - Conclusion: Summary and outlook on the future of HCI and Ubicomp
7. Bibliography.

01.

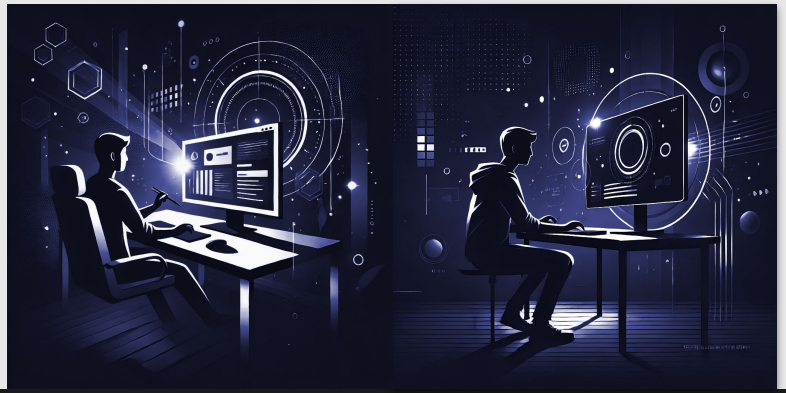
INTRODUCTION TO HCI

1.1. DEFINITION OF HCI: BASIC CONCEPT AND IMPORTANCE

ARTIFI
INTELL
(AI)

Human-Computer Interaction:

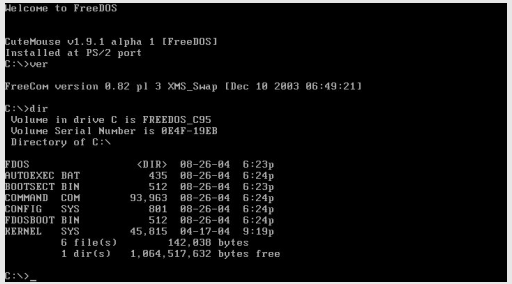
- Critically important in computer science
- Bridges the gap between computer systems and human users
- User-centered design and usability



1.2. EVOLUTION OF HCI: FROM COMMAND-LINE TO GRAPHICAL UIS

FROM COMMAND LINE

- interfaces where based on a line command making it less intuitive for the users



GRAPHICAL UIS

- Adaptative, modern and immersive experiences in interfaces
- Making technology more accessible, intuitive and seamlessly integrated
- Future promises more accessible, intuitive and context, awareness

1.3. CORE PRINCIPLES OF HCI: USABILITY, USER-CENTERED DESIGN AND FEEDBACK LOOPS

01.
USABILITY

How easy, efficient and satisfying it's for the users to interact with the system

Key components:
- learnability
- efficiency
- memorability
- error tolerance
- satisfaction

02.
USER-CENTERED DESIGN

Iterative design focussing on the user's needs, preferences and limitations

Steps:
- Research and Empathy
- Define Requirements
- Design and Prototype
- Evaluation and Iteration

03.
FEEDBACK LOOPS

System communicates the result of the user's interactions. Useful and helpful

Types:
- Visual Feedback
- Auditory Feedback
- Haptic Feedback

ARTIFICIAL INTELLIGENCE (AI)

/(AI)

02.

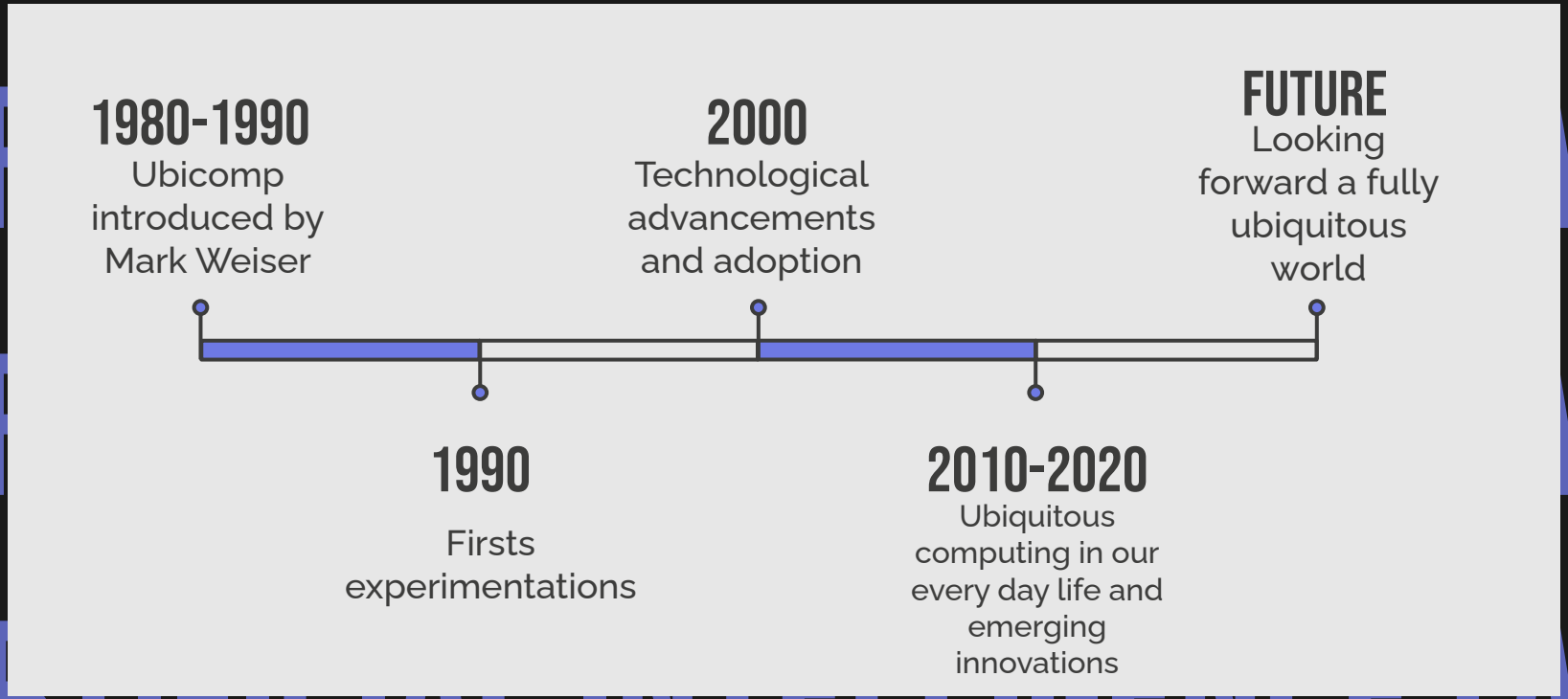
INTRODUCTION TO UBIQUITOUS COMPUTING (UBICOMP)

2.1 DEFINITION OF UBIQUITOUS COMPUTING

How it is and how it relates to HCI

- Ubicomp -> World in which computers and digital devices are integrated completely into our environment
- Perform interaction through interconnected systems
- Make computing “invisible”
- Make technology intuitive and responsible.

2.2. HISTORICAL CONTEXT: MARK WEISER'S VISION



2.3. KEY CHARACTERISTICS OF UBICOMP

PERVASIVENESS

- Seamless embedding
- Devices are everywhere

INVISIBILITY

- Unobtrusive technology
- Hide complexities of technology

CONTEXT AWARENESS

- Enables the different devices to sense and respond.
- Recognize context

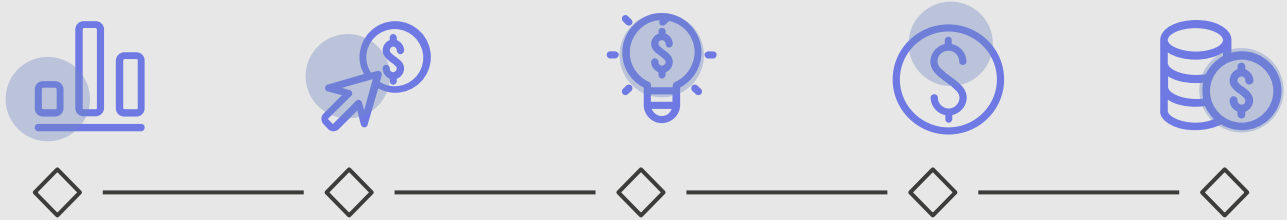
MOBILITY

- Access resources anytime and anywhere
- Users freedom

03.

THE ROLE OF HCI IN UBIQUITOUS COMPUTING

3.1. HOW HCI ADAPTS TO UBICOMP: FROM DESKTOP TO PERVASIVE ENVIROMENTS



FROM FIXED INTERFACES TO PERVASIVE ITERACTIONS

Interaction points spread across various devices and locations

SEAMLESS INTEGRATION

Goal: Blend technology into the user's environment

CHALLENGES

Multi-device synchronization and real-time responses

3.2. INTERACTION MODALITIES: MULTIMODAL INTERFACES

VOICE INTERFACES

- Voice recognition
- Provide information, control devices and carry out tasks
- Contextually aware

>>>>

GESTURE CONTROL

- Gestured-based interfaces
- Rely on intuitive movements

>>>>

AR/VR AND SPATIAL COMPUTING

- Interact with digital content being part of the physical world

>>>>

3.3. CONTEXT AWARE SYSTEMS

Ability of a system to recognize and adapt to the user's current situation

UNDERSTANDING USER COMPLEXITY

CHALLENGES AND ETHICAL CONCERNS

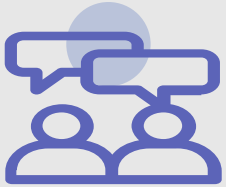
DESIGNING ADAPTIVE INTERFACES

04.

USER EXPERIENCE IN UBIQUITOUS COMPUTING

4.1 CHALLENGES IN UBICOMP UX DESIGN

SYSTEM COMPLEXITY

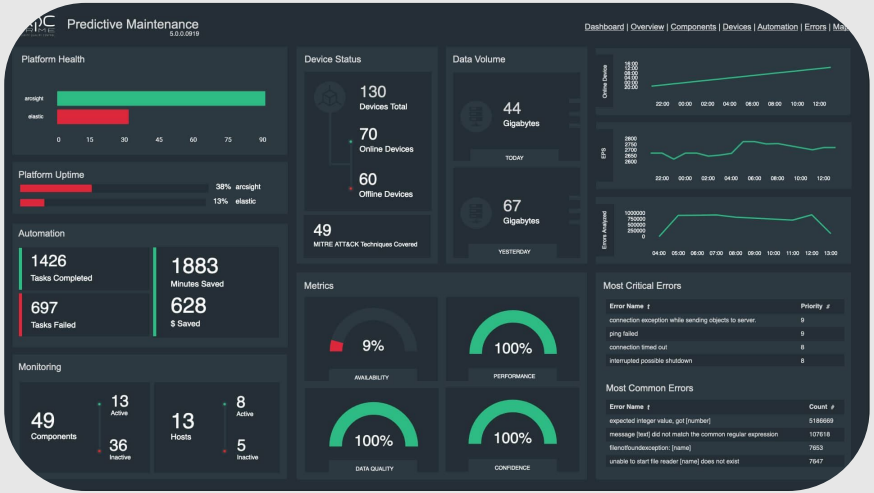


PRIVACY RISK

CONTEXT SWITCHING

4.2 COGNITIVE LOAD

INFORMATION DISPLAYED



AL CE (AI)

4.2 COGNITIVE LOAD

HIGHLIGHT

BALANCE

AL
CE
(AI)

SMART HOMES

COMPONENTS

Thermostats, security cameras, lighting...

CONSIDERATIONS

Smooth transitions between
Manual-Automated control
Privacy
Security

CONTEXT AWARENESS

Real-Time adaptation

05.

DESIGN PRINCIPLES FOR HCI IN UBIQUITOUS SYSTEMS

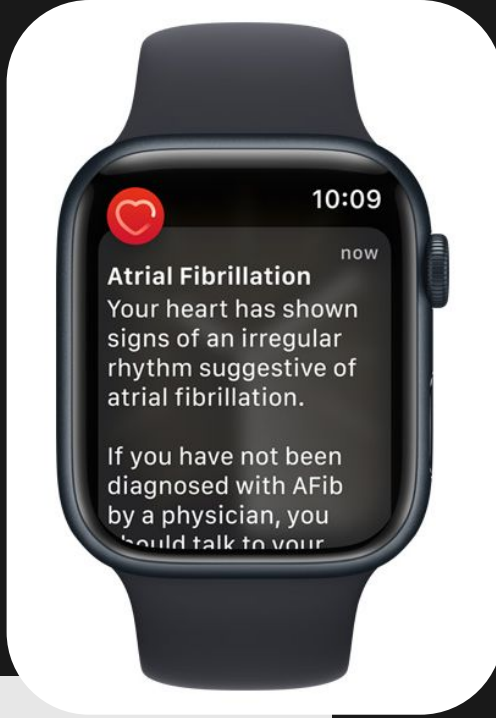
5.1 NATURAL INTERACTION

INVISIBLE INTERFACES

WEARABLES GESTURES

AR[illegible]L INTELLIGENCE (AI)

5.2 ADAPTIVE INTERFACES



USER BENEFITS

PERSONALIZATION

Adjust to:
- Preferences
- Repeated actions

CONTEXT

- Conscious level
- Heart beat rate
- Proximity

5.2 SEAMLESS TRANSITIONS

INTER-DEVICE COMMUNICATION

INTEROPERABILITY

06.

FUTURE OF HCI IN UBIQUITOUS COMPUTING

6.1 RISKS

PRIVACY

User trust comes from transparent data practices

>>>>

DATA SECURITY

Must be:

- **Encrypted**
- **Anonymized**
- **Audited**

>>>>

SURVEILLANCE

Clear Consent from the user

>>>>

6.2 FUTURE TRENDS

AI-DRIVEN PREDICTIVE INTERFACES

Offer relevant suggestions, before request

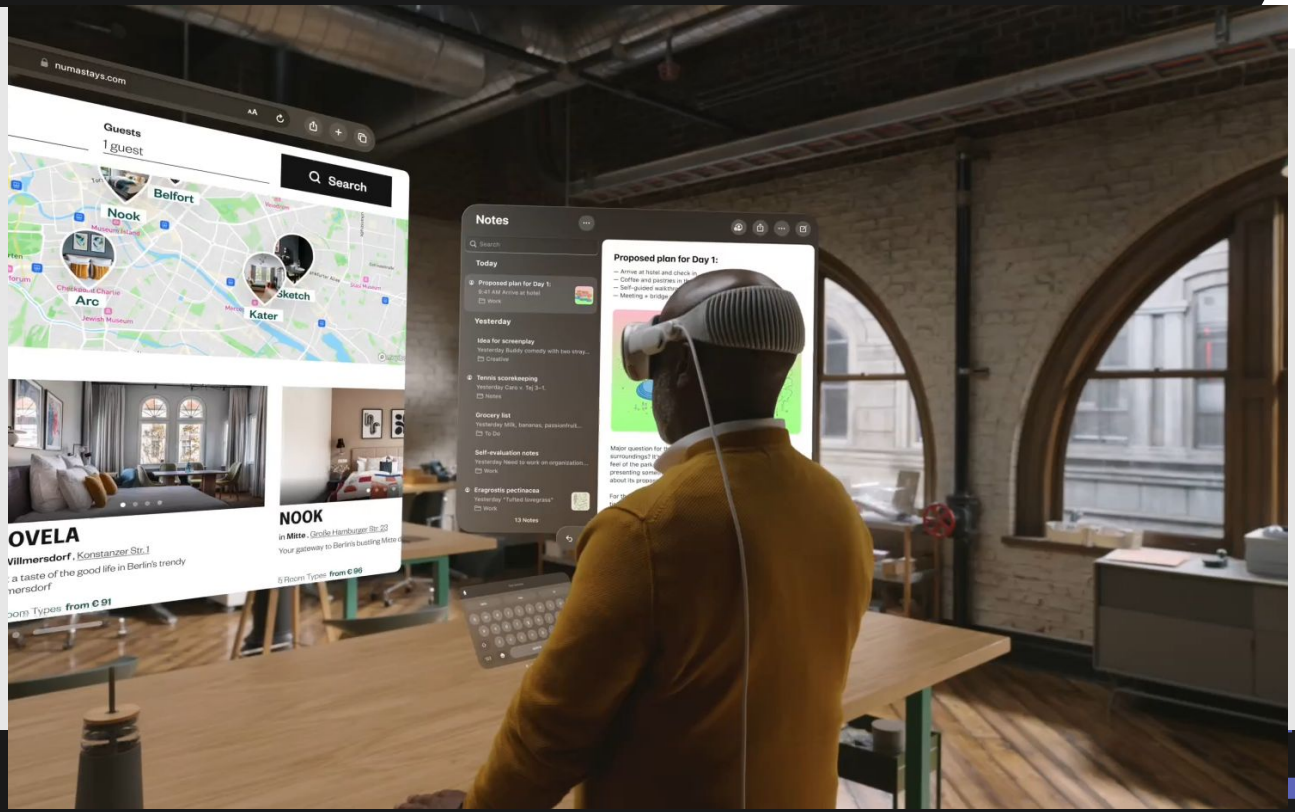
Transition from work to leisure

ZERO UI

No need for **screen** or **physical interfaces**

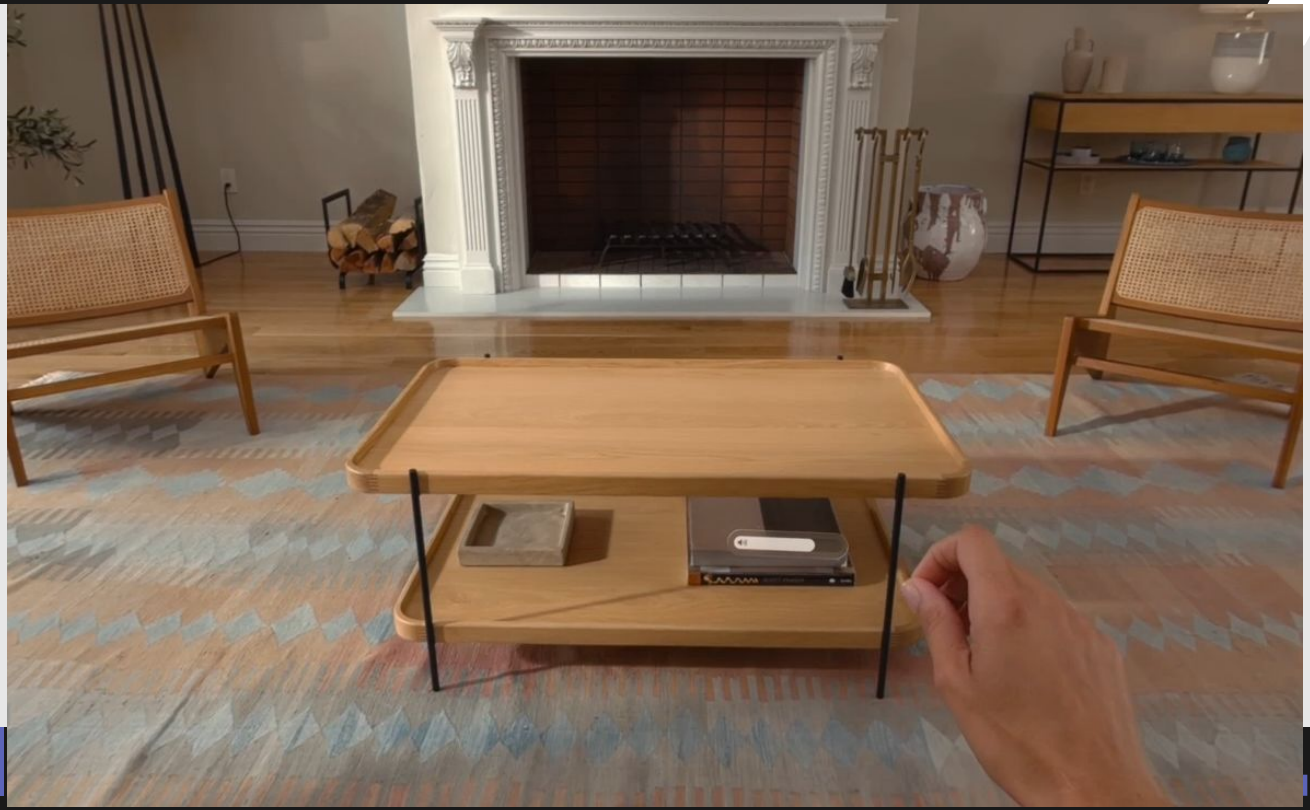
Voice command
Gestures

6.2 FUTURE TRENDS



6.2 FUTURE TRENDS

6.2 FUTURE TRENDS



07.

BIBLIOGRAPHY

BIBLIOGRAPHY

Hong, J., & Landay, J. A. (2002). *Challenges in Ubiquitous Computing: Mobile Interactions and Context-Aware Design*. ACM International Conference on Ubiquitous Computing. https://www.cs.cmu.edu/~jasonh/publications/ubicomp2002-challenges-interaction-design-submitted.pdf

Browser London. (2023, noviembre 6). *The influence of cognitive load in UX design and how to balance it*. Browser London. https://www.browserlondon.com/blog/2023/11/06/the-influence-of-cognitive-load-in-ux-design-and-how-to-balance-it/

UX Pilot. (n.d.). *Cognitive load balancing in UX design*. UX Pilot. https://uxpilot.ai/blogs/cognitive-load-balancing-ux-design

Full Clarity. (n.d.). *Understanding cognitive overload in UX design*. Full Clarity. https://fullclarity.co.uk/insights/cognitive-overload-in-ux-design/

Chung, V. (2023). *Advancing smart home technology: A UX/UI case study*. Medium. https://medium.com/@vivianchung_45670/advancing-smart-home-technology-a-ux-ui-case-study-f6b526d44e2d

Wikipedia Contributors. (n.d.). *Natural user interface*. Wikipedia. https://en.wikipedia.org/wiki/Natural_user_interface

Raw Studio. (n.d.). *Zero UI: Redefining the future of human-technology interaction*. Raw Studio. https://raw.studio/blog/zero-ui-redefining-the-future-of-human-technology-interaction/

ARTIFICIAL INTELLIGENCE (AI)

BIBLIOGRAPHY

Akrich, M., & Latour, B. (2016). *Gradual engagement: Interaction techniques for enhancing information transfer in ubiquitous environments*. *Interacting with Computers*, 23(1), 40-58. https://academic.oup.com/iwc/article/23/1/40/696461

Interaction Design Foundation. (n.d.). *Context-aware computing: Context-awareness, context-aware user interfaces, and implicit interaction*. In *The Encyclopedia of Human-Computer Interaction, 2nd ed.* https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/context-aware-computing-context-awareness-context-aware-user-interfaces-and-implicit-interaction

Marquardt, N., & Greenberg, S. (2012). *Gradual Engagement: Facilitating information transfer in ubiquitous environments*. Microsoft Research. https://www.microsoft.com/en-us/research/wp-content/uploads/2016/10/Gradual-Engagement-ITS-2012.pdf

McKinsey & Company. (2022). *Putting data ethics into practice*. McKinsey Digital. https://www.mckinsey.com/capabilities/mckinsey-digital/our-insights/tech-forward/putting-data-ethics-into-practice

Input UX. (n.d.). *Predictive user experiences: How AI anticipates user needs and enhances interactions*. Input UX. https://www.inputux.com/post/predictive-user-experiences-how-ai-anticipates-user-needs-and-enhances-interactions

Interaction Design Foundation. (n.d.). *Human-computer interaction and context-aware systems*. https://www.interaction-design.org

MIT Technology Review. (n.d.). *Emerging trends in ubiquitous computing*. https://www.technologyreview.com

ARTIFICIAL INTELLIGENCE (AI)

BIBLIOGRAPHY

IEEE Spectrum. (n.d.). *Future of interaction modalities and ubiquitous computing*. https://spectrum.ieee.org

Nielsen Norman Group. (n.d.). *Usability and user-centered design principles*. https://www.nngroup.com

Smashing Magazine. (n.d.). *User experience and multimodal interaction insights*. https://www.smashingmagazine.com

IEEE. (n.d.). *IEEE pervasive computing journal*. https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=7756

Stanford University. (n.d.). *Human-computer interaction course materials*. Stanford University. https://hci.stanford.edu

Xerox PARC. (n.d.). *PARC research archives on human-computer interaction and ubiquitous computing*. https://www.parc.com

ScienceDirect. (n.d.). *Ubiquitous computing*. Retrieved from https://www.sciencedirect.com/topics/computer-science/ubiquitous-computing

ARTIFICIAL INTELLIGENCE (AI)

THANKS

Do you have any questions?

THANKS

Do you have any questions?

THANKS

Do you have any questions?

PROBLEM VS. SOLUTION

PROBLEM

Mercury is the closest planet to the Sun and the smallest one in the Solar System—it's only a bit larger than the Moon

Venus has a beautiful name and is the second planet from the Sun. It's hot and has a poisonous atmosphere

SOLUTION

ARTIFICIAL INTELLIGENCE (AI)

THEM

Mercury is the closest planet to the Sun and the smallest one in the Solar System—it's only a bit larger than the Moon

US

Venus has a beautiful name and is the second planet from the Sun. It's hot and has a poisonous atmosphere

TARGET

65%

35%

GENDER

+60

+50

+40

AGE

€1,500/YEAR

AVERAGE SPEND

MERCURY

JUPITER

VENUS

PROFESSION

MARKET SIZE

MERCURY

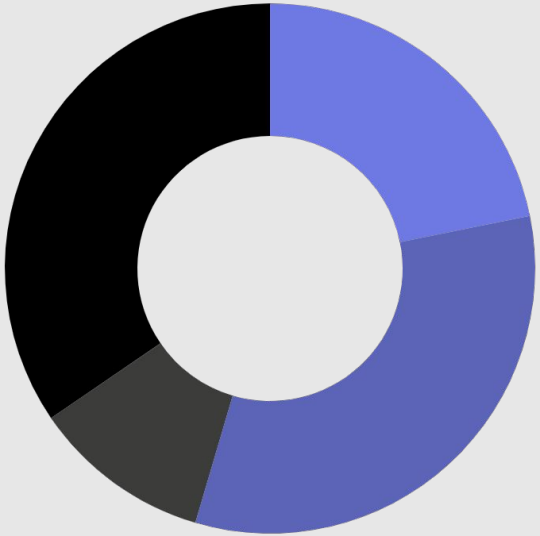
It's the closest planet to the Sun

VENUS

Venus is the second planet from the Sun

MARKET SHARE

24%	Mercury is the closest planet to the Sun
36%	Venus is the second planet from the Sun
12%	Mars is actually a very cold place
38%	Jupiter is the biggest planet of them all



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COMPETITION ANALYSIS

	COMPANY 1	COMPANY 2	COMPANY 3	COMPANY 4
JUPITER	✓	✗	✗	✓
SATURN	✓	✓	✗	✗
NEPTUNE	✗	✓	✗	✗

03.

SALES AND MARKETING PLAN

You can enter a subtitle here if you need it

OUR PARTNERS

PARTNER 1

Mercury is the closest planet to the Sun

PARTNER 2

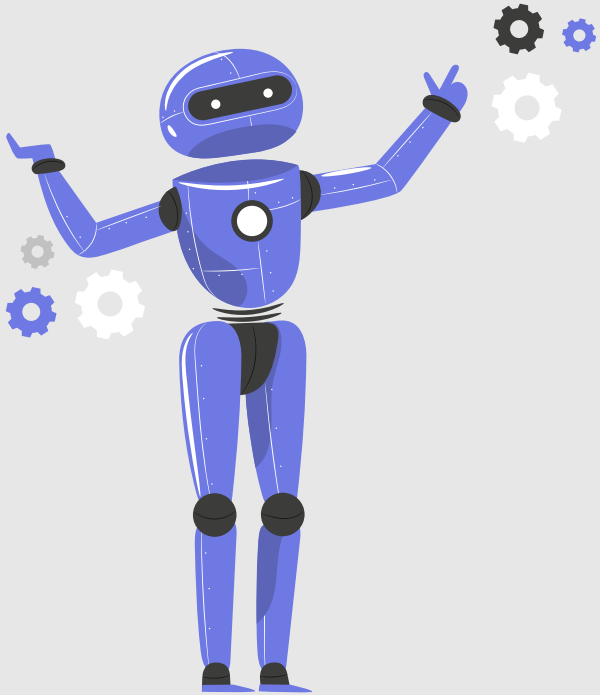
Venus is the second planet from the Sun

PARTNER 3

Mars is actually a very cold place

PARTNER 4

Jupiter is the biggest planet of them all



OUR SERVICES

MERCURY

Mercury is the closest planet to the Sun

VENUS

Venus has a beautiful name, but it's terribly hot

MARS

Despite being red, Mars is a cold place, not hot

JUPITER

It's the biggest planet in the Solar System

SATURN

Saturn is the ringed planet and a gas giant

NEPTUNE

It's the farthest planet from the Sun

ARTIFICIAL INTE (AI)

AWESOME WORDS

(AI)

OUR PLANS

BASIC

Mercury is the closest planet to the Sun and the smallest one

€35

>>>>

PRO

Saturn is a gas giant, composed mostly of hydrogen and helium

€50

>>>>

PREMIUM

Jupiter is a gas giant and the biggest planet in the Solar System

€85

>>>>

SALES AND DISTRIBUTION

CHANNEL 1

Venus is the second planet from the Sun

CHANNEL 2

Despite being red, Mars is a cold place

CHANNEL 3

Saturn is a gas giant and has several rings

CHANNEL 4

Jupiter is the biggest planet in the Solar System

ADVERTISING AND PROMOTION

MERCURY

Mercury is the closest planet to the Sun

VENUS

Venus has a beautiful name, but it's terribly hot

MARS

Despite being red, Mars is a cold place, not hot

ARTIFICIAL

(AI)

04.

MANAGEMENT PLAN

You can enter a subtitle here if you need it

OUR TEAM

JENNA DOE

You can speak a bit about this person here

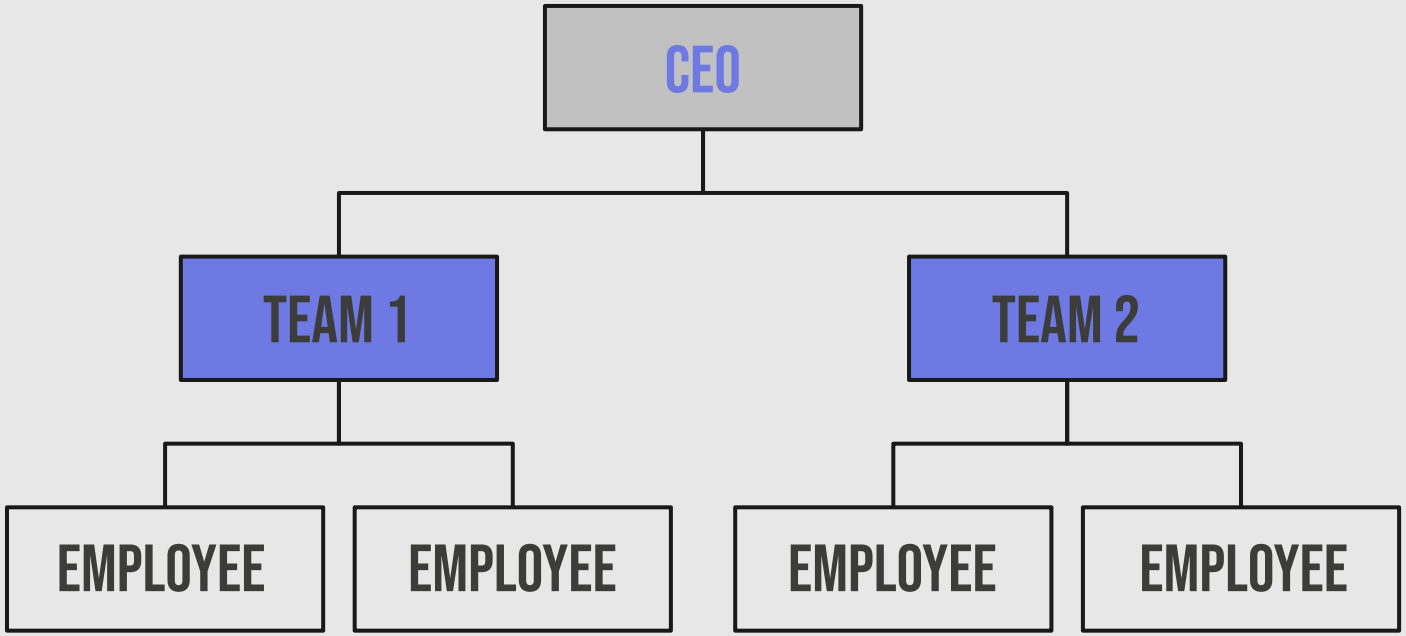
TIMMY JIMMY

You can speak a bit about this person here

SUSAN BONES

You can speak a bit about this person here

ORGANIZATIONAL CHART



OUR PARTNERS

PARTNER 1

Mercury is the closest planet to the Sun

PARTNER 2

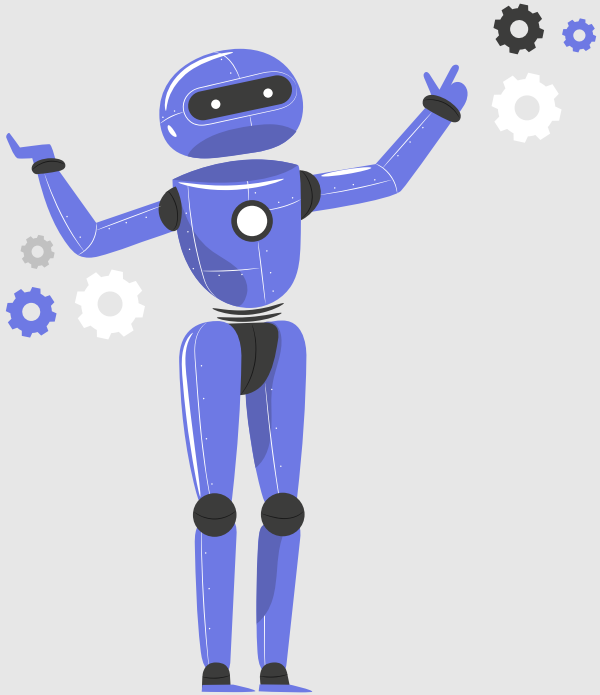
Venus is the second planet from the Sun

PARTNER 3

Mars is actually a very cold place

PARTNER 4

Jupiter is the biggest planet of them all



05.

OPERATING PLAN

You can enter a subtitle here if you need it

A PICTURE ALWAYS REINFORCES THE CONCEPT

06.

FINANCIAL PLAN

You can enter a subtitle here if you need it

ARTI (AI)

ARTI (AI)

$150,000

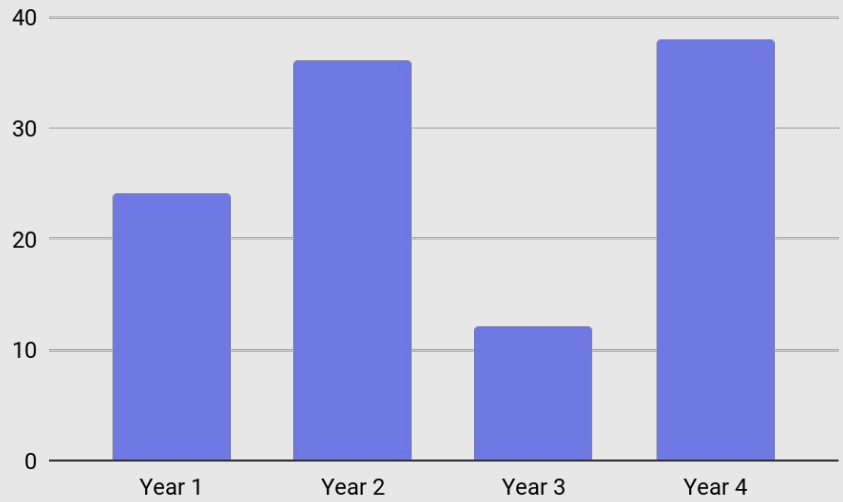
Big numbers catch your audience's attention

AP
IN
(AI

“This is a quote, words full of wisdom that someone important said and can make the reader get inspired.”

—SOMEONE FAMOUS

PREDICTED GROWTH



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MERCURY

It's the closest planet to the Sun and the smallest one in the Solar System. This planet's name has nothing to do with the liquid metal, since Mercury was named after the Roman messenger god

BALANCE SHEET

ASSETS

What the company owns by itself

3,5M

LIABILITIES

What the company owes to others

1K

EQUITY

The difference between both

7K

THANKS

Do you have any questions?

youremail@freepik.com

+91 620 421 838

yourcompany.com

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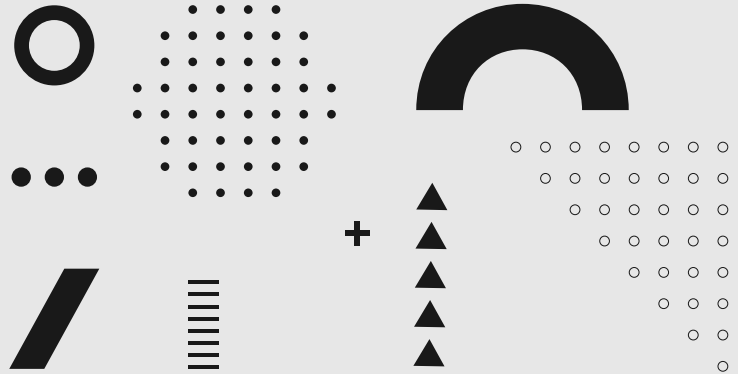

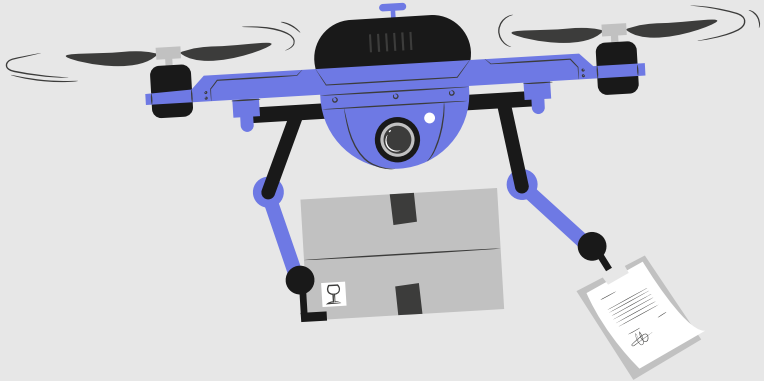

ARTIFICIAL INTELLIGENCE (AI)

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- Group of three modern architects
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Pana

Amico

Bro

Rafiki

Cuate

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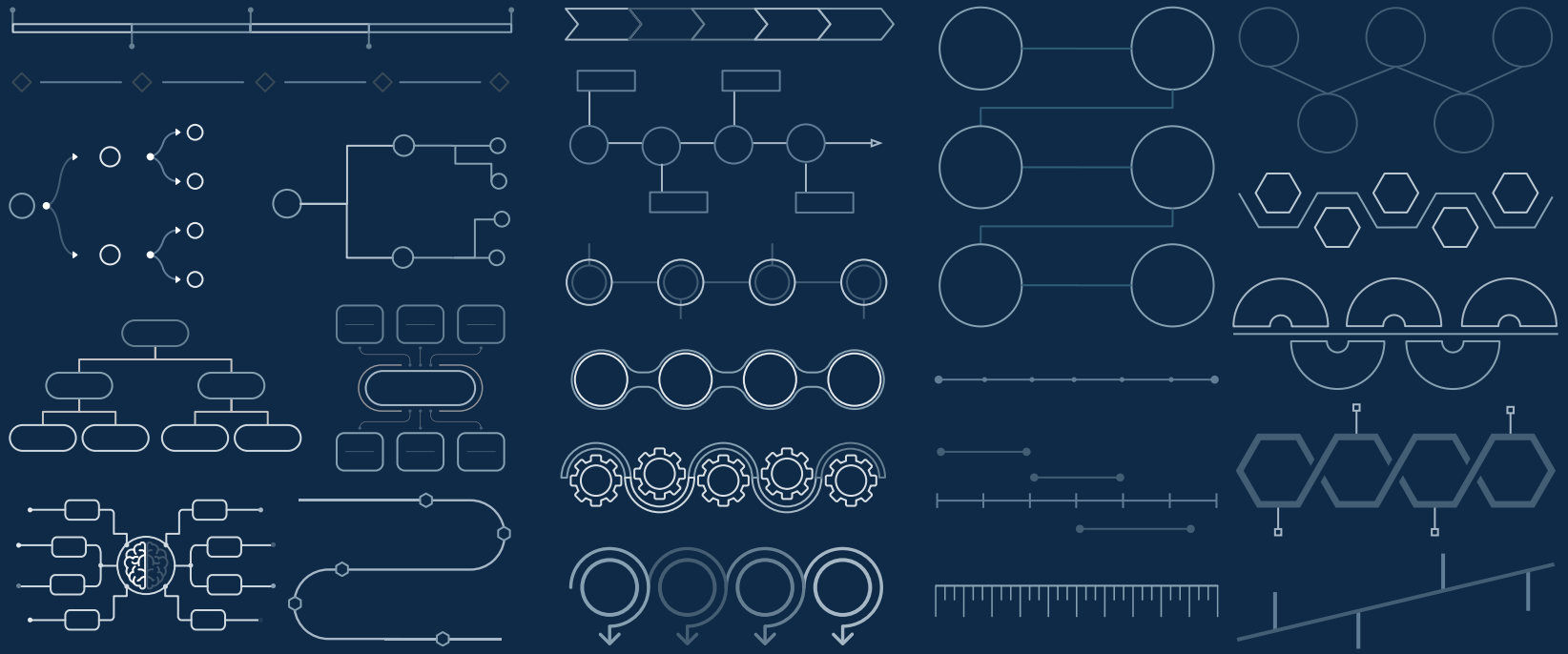

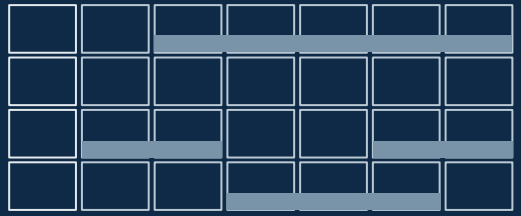

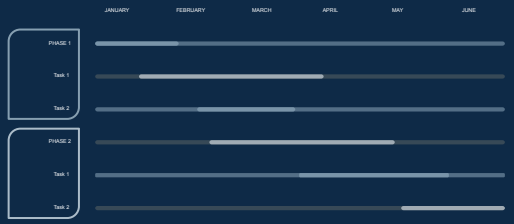
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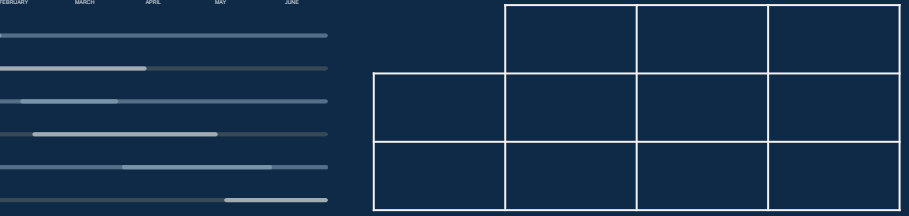
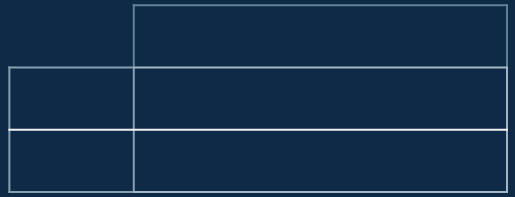
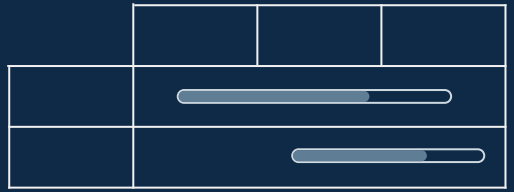
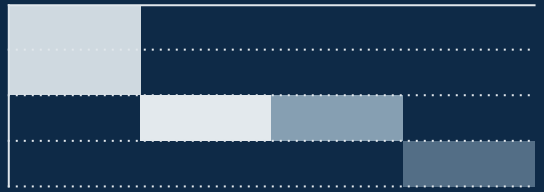
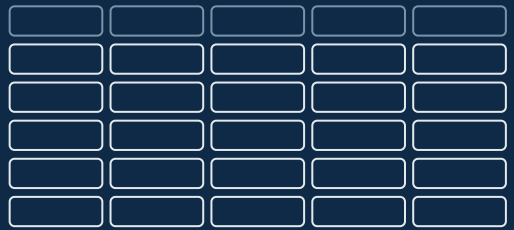
Task 1
Task 2

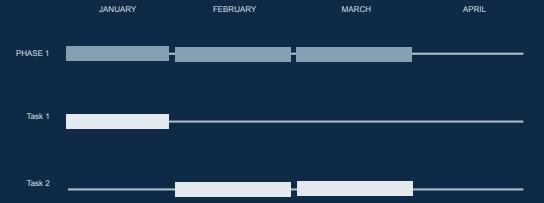


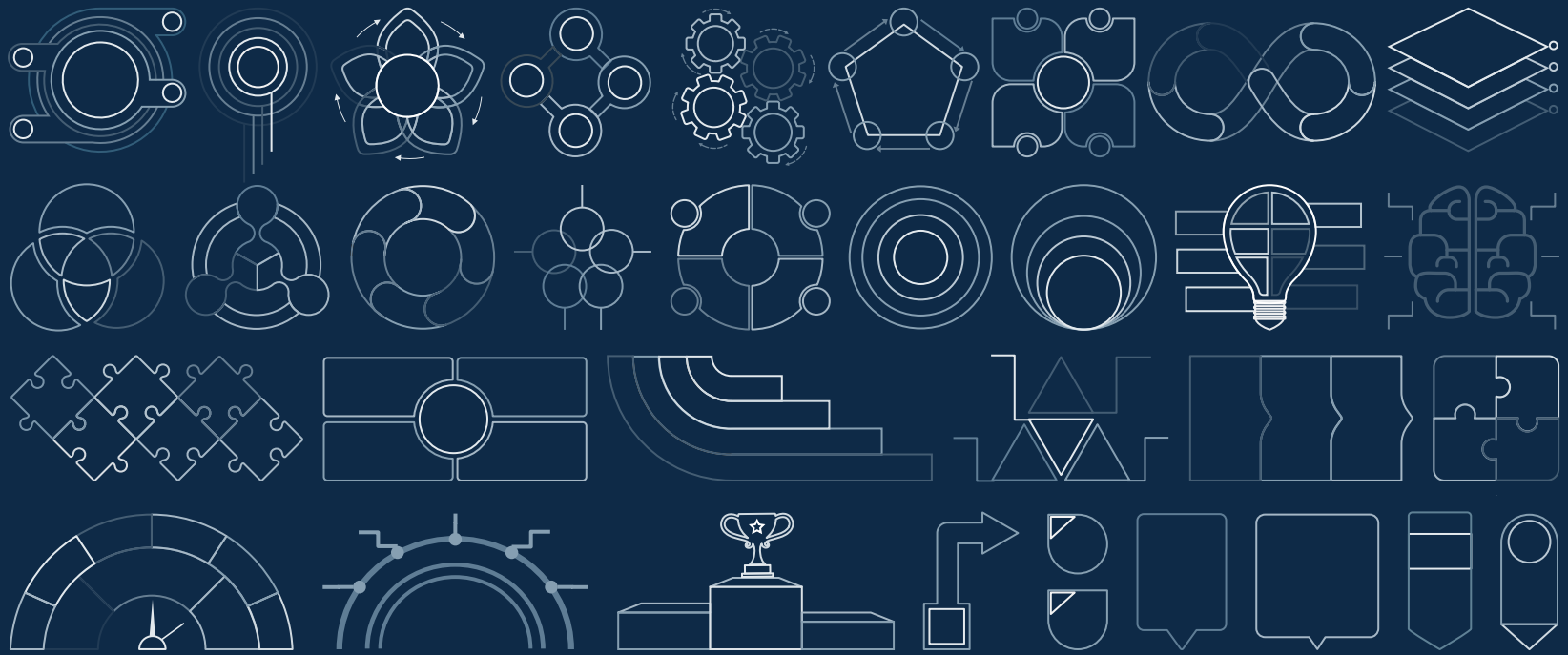


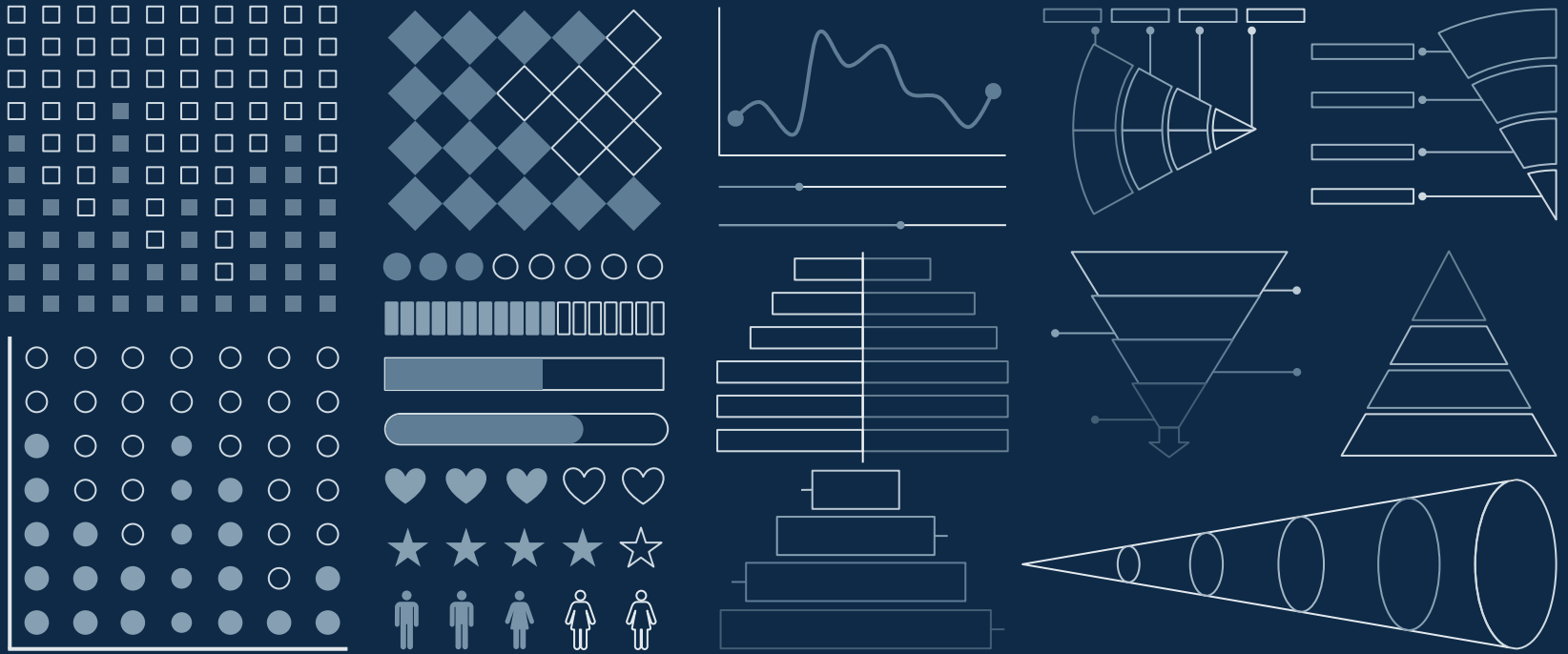







JANUARY
FEBRUARY
MARCH
APRIL
PHASE 1
Task 1
Task 2





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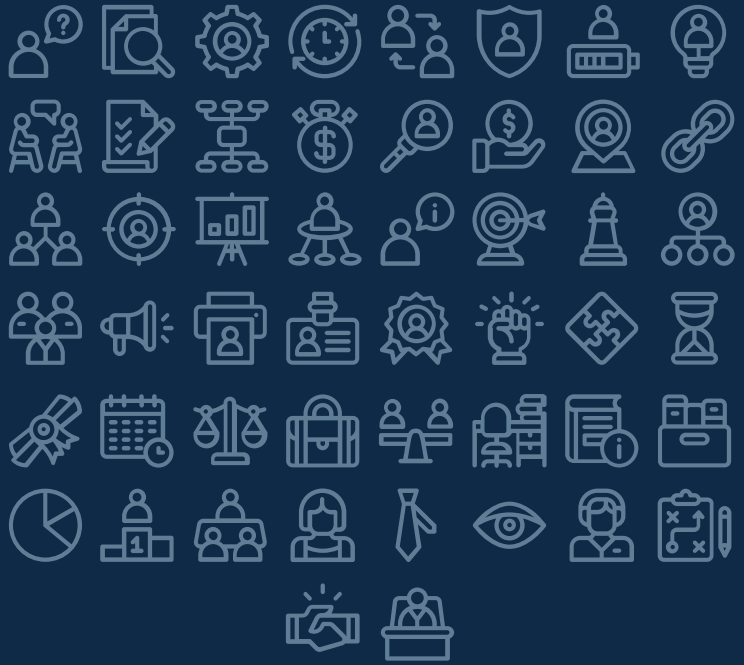

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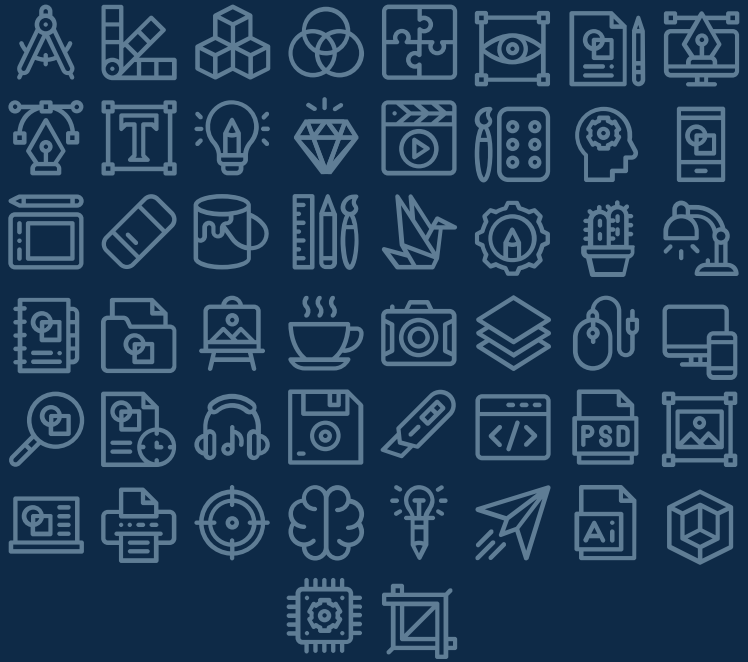
Creative Process Icons



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