

# Human Computer Interaction

## CS449 – CS549

Week 5  
Usability Engineering  
Intro to Psychology of HCI

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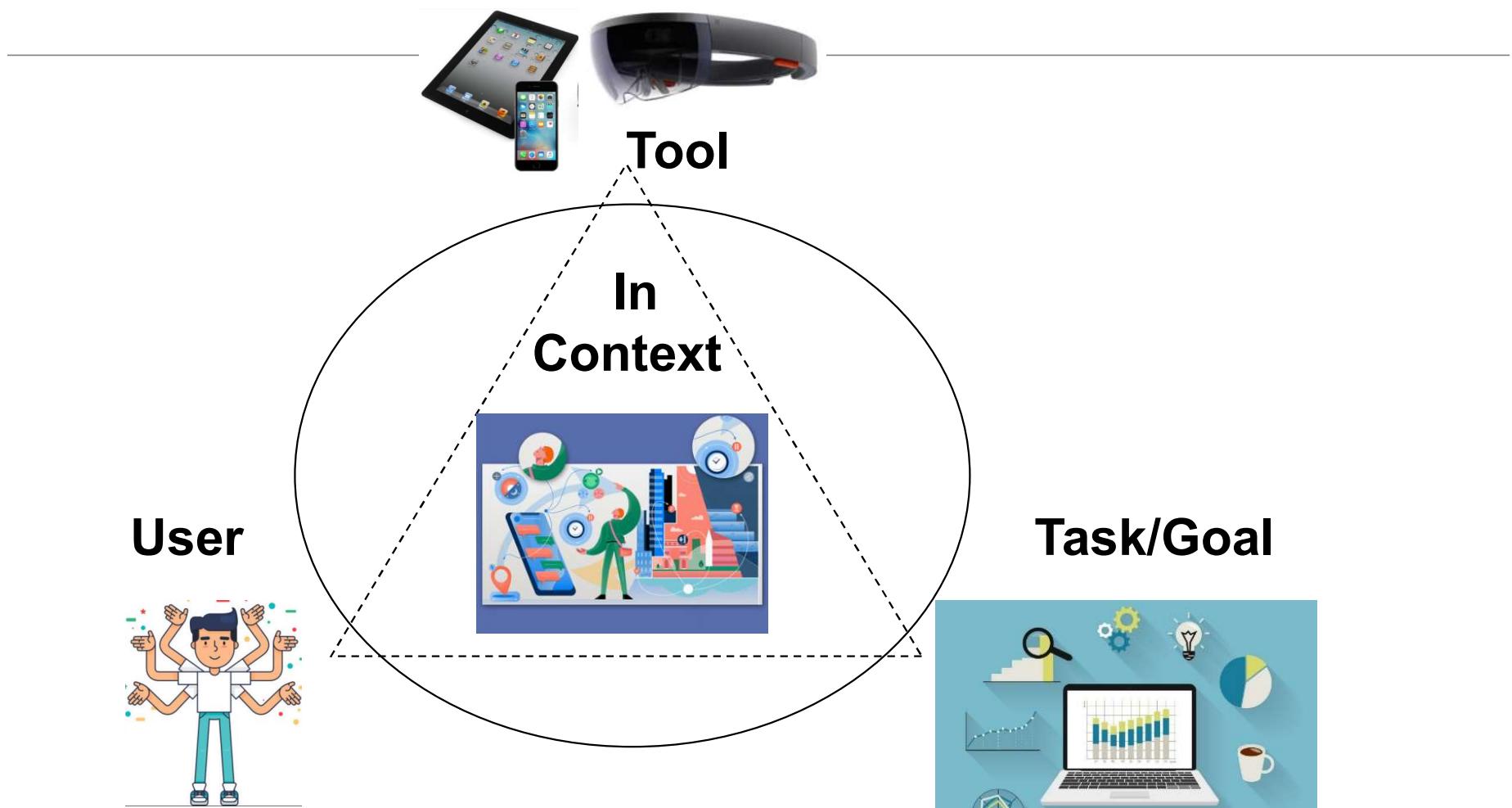
KÜRSAT ÇAĞILTAY

# Assignment-2 - Fitts's Law – Due Monday

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- Find design problem(s) that can be measured by Fitts's Law and propose a solution
- Report:
  1. Problem Definition –How is the design problem related with Fitts' law?
  2. Calculate the Difficulty Index (DI) of the design problem.
  3. How to eliminate the problem from the application. Use Figma, revise the design, calculate new DI
  4. References

# Four Principle components of an HCI System



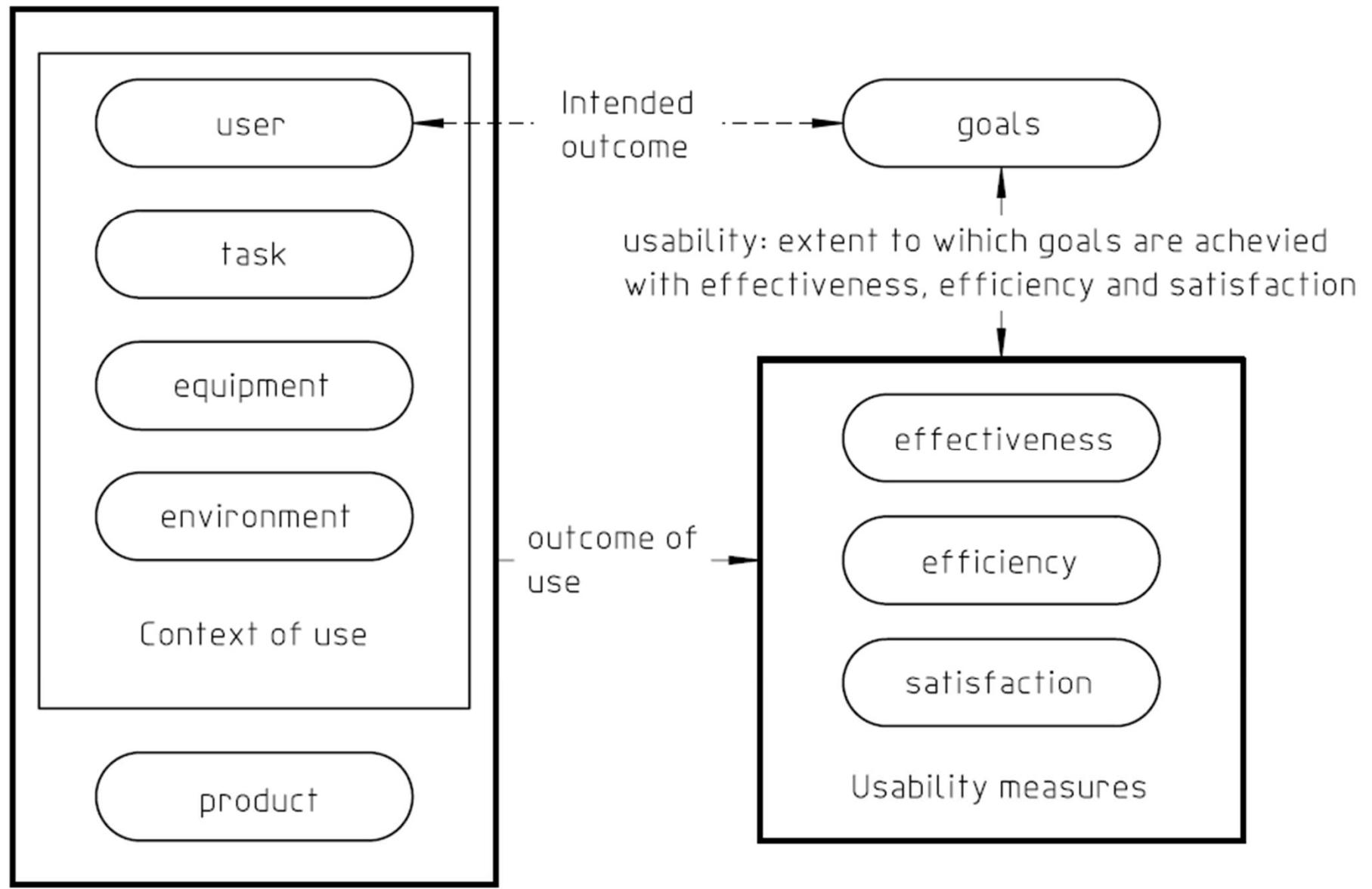
# Operational definition - Universal

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- Usability (of an application) refers to the effectiveness, efficiency, and satisfaction with which specified users can achieve specified goals in particular environments

ISO Ergonomics requirements, ISO 9241 part 11: Guidance on usability specification and measures.

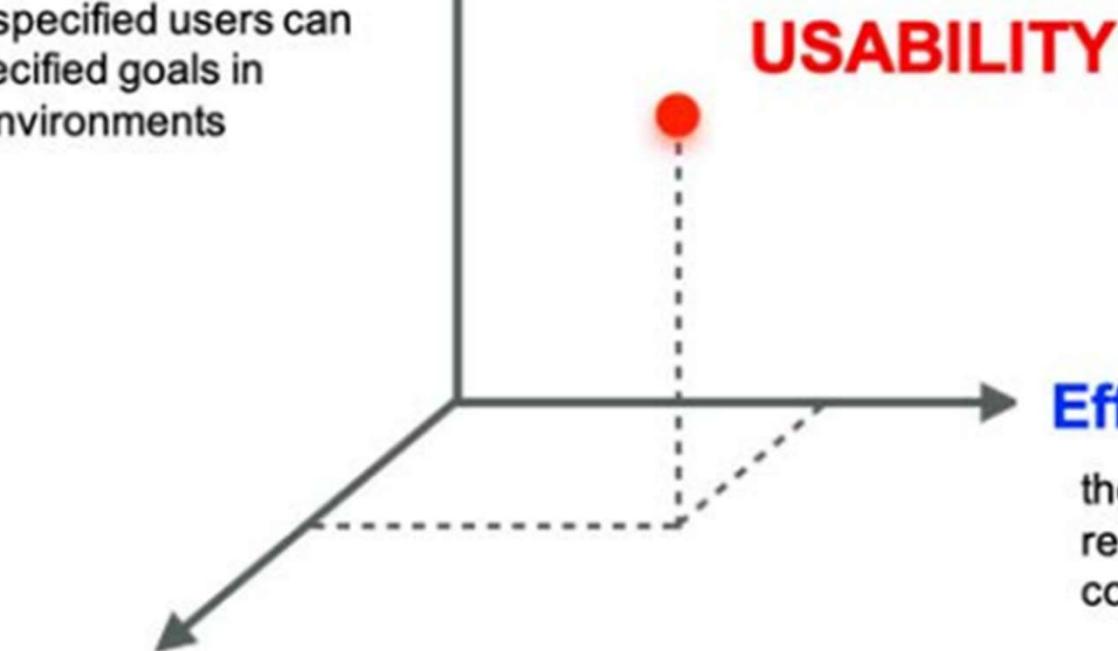
# Usability Framework (ISO 9241-11)



**Effectiveness**  
the accuracy and completeness with which specified users can achieve specified goals in particular environments

**Satisfaction**

the comfort and acceptability of the work system to its users and other people affected by its use

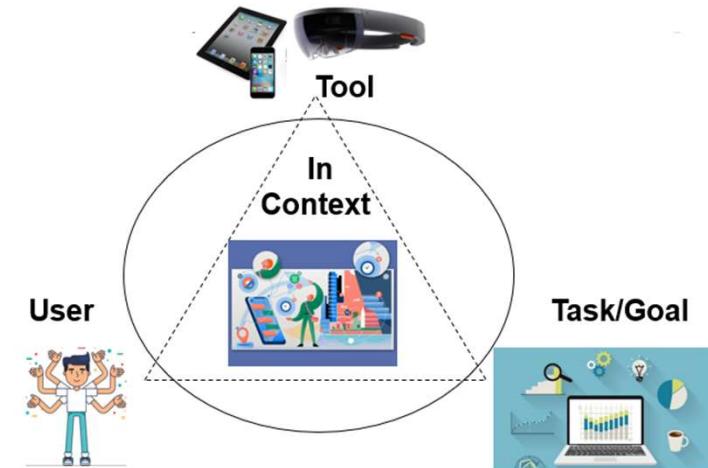


**USABILITY**

**Efficiency**

the resources expended in relation to the accuracy and completeness of goals achieved

ISO 9241:2018



# Effectiveness (etkililik)

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- The extent to which users can achieve their task goals.
- Effectiveness measures the degree of accuracy and/or completion

e.g., if desired task goal is to locate information on a web site then:

Effectiveness= success of user in locating the correct data

# Efficiency

(verimlilik)

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- Measures resources used to perform task
  - i.e., time, effort, cost,
- In case of Web site use, efficiency might equal time taken to complete a task or the navigation path followed etc.

# Satisfaction (Affect)

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- Measures the affective reaction (likes, dislikes, attitudinal response) of users to the application
- Assumed to be influenced but not the same as effectiveness or efficiency e.g.,
  - 2 applications with equal effectiveness, and efficiency, may not be equally satisfying to use
  - or What users like might not be what they need!

# Basis for satisfaction?

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- Positively influenced by effectiveness and efficiency
- Also
  - Personal experience with other technologies?
  - Working style?
  - Manner of introduction?
  - Personality of user?
  - Aesthetics of product?

# Satisfaction is important

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- Good usability studies recognize this

But satisfaction is not enough....

- People often like what they don't use well
- What about empowerment, challenge etc?

# MySU+ example

- Effectiveness
- Efficiency
- Satisfaction

10:30 19° ☀ 94%

Shuttle X

Select the route and the day to see the departure times.

**Weekdays**   Saturday   Sunday

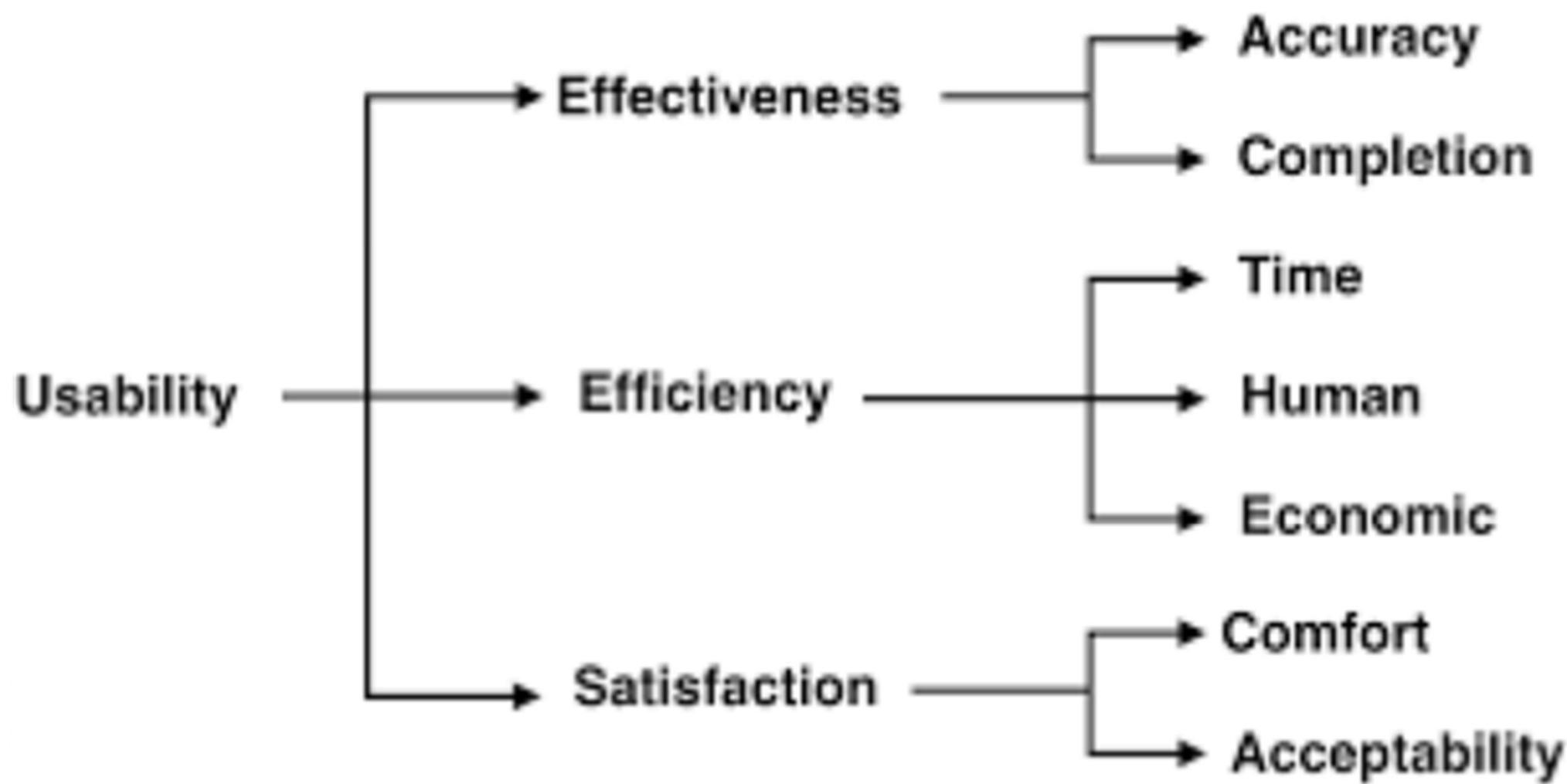
Kadıköy ▼

Departure	Departure
Sabancı	Kadıköy
12:45(2)	07:00(1)
17:00(2)	09:00(1)
20:30(2)	15:00(1)
	23:00(1)
	02:00(3)

1-) The departure point for the Kadıköy shuttle is in front of the bookstore located next to the Rıhtım Hotel. The shuttle departing from Kadıköy then departs from GADA CAFE (formerly Smit Sarayı) across from the exit of the Kozyatağı Carrefour parking lot approximately 20 minutes later.

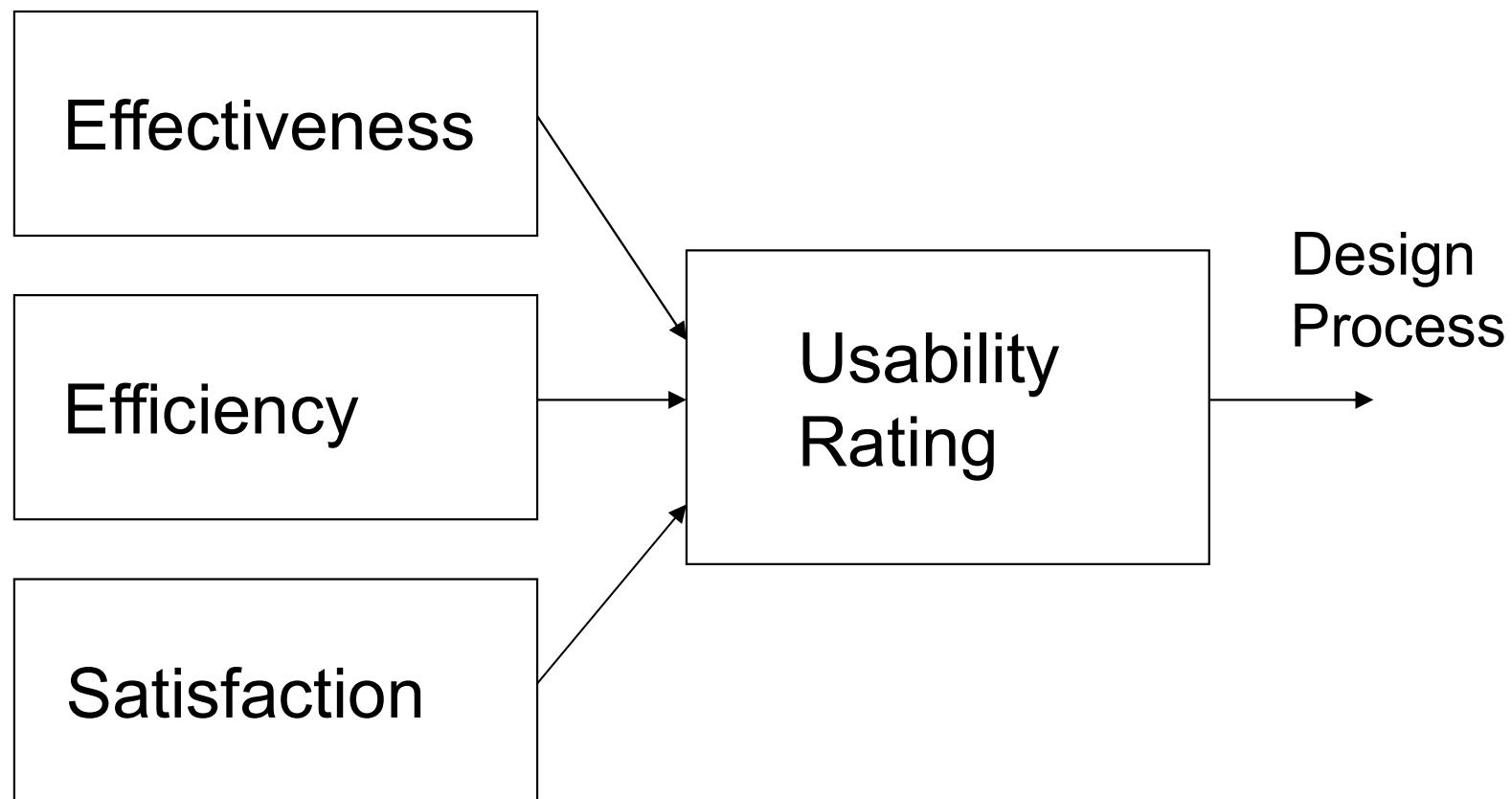
2-) The shuttle makes stops at the "Zübeyde Hanım Öğretmen Evi" IETT bus stop (200 meters past Ataşehir Memorial Hospital) and GADA CAFE across from the exit of the Kozyatağı Carrefour parking lot.

3-) The departure point for the Kadıköy shuttle is in front of the bookstore located next to the Rıhtım Hotel. **Shuttle is only provided on Fridays and Saturdays.** It does not make a stop in Kozyatağı. Reservations must be made.



# Determinants of usability rating

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# Setting usability criteria

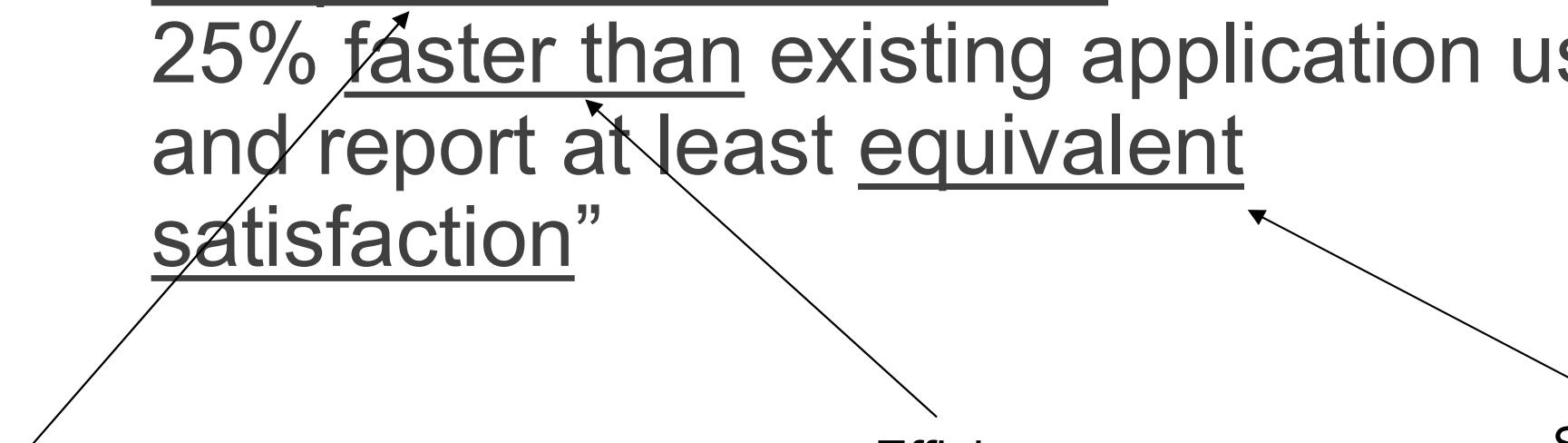
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- “Product X is usable to the extent that 70% of users, with no additional training, can perform all tasks with 95% accuracy, 25% faster than existing application use, and report at least equivalent satisfaction”

Effectiveness

Efficiency

Satisfaction



Or.....

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- “Product X is usable to the extent that 80% of users, with 2 days training, can perform 90% of routine tasks with >90% accuracy, as efficiently as with the existing application, and report increases in satisfaction”

## **6.2. Web Sitesinin Tasarımı, Üretime, Geliştirilmesi**

### **Teknik Kriterler**

- Kullanıcı dostu ve güncel tasarım trendlerine uygun bir tasarıma sahip olması,
  - Gerektiğinde İTO'nun da siteye müdahale edebilmesini sağlayabilecek kullanıcı ara yüzü ve CMS sisteminin var olması, kullanımı kolay bir yönetim paneli oluşturulması,
- 
- To have a «user-friendly» and a design in line with current design trends
  - Creation of an «easy-to-use» admin panel

Or

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- Product Y is usable to the extent that 3/4 of users, after 20 mins of training, can perform all tasks with 100% accuracy, in 2 minutes (or less) per task, and report mean satisfaction levels of 4 on a 5 pt scale.

# Strengths of Usability Engineering

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- Directly coupled to tasks
- Supports iterative design process
- Not tied to one interface style
- Supports trade-offs

# Weaknesses of Usability Engineering

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- Criteria are dynamic, not fixed
- Usability is thus contextually determined
  - and that requires analytic skill....
  - but causes generalization difficult
- Criteria do not determine re-design advice
- Usability does not fully determine use

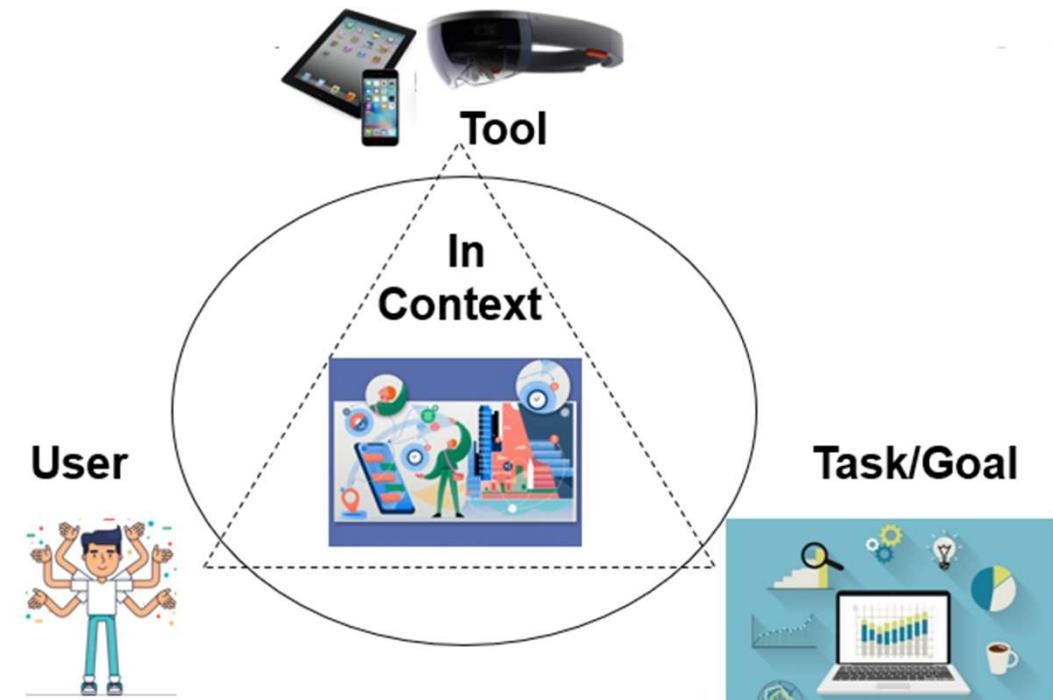
# Who sets the usability criteria?

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- Purchasers
  - can be basis for contract (e.g. ITO example)
- Designers
  - basis for design targets
- Evaluators
  - provide context/limits of generalization for evaluation
- Users
  - Key stakeholders with privileged knowledge

# How are criteria derived?

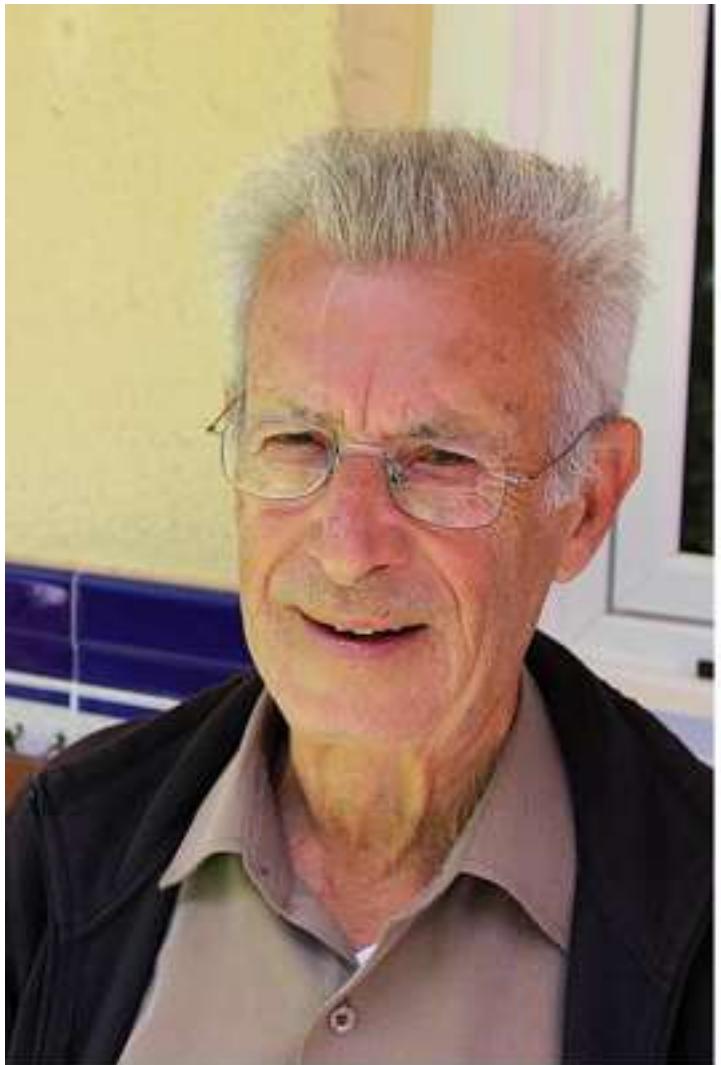
- User analysis
- Task analysis
- Situation/context analysis



# User analysis

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- Determine key variables:
  - work and task skills
  - computing experience
  - training
  - support
  - working practices
  - and many other variables
- Personas... (who used them?)



## Peter Smith

72 years old  
Retired  
Widower  
3 children and 6 grandchildren  
Lives in Manchester

### Skills and knowledge:

Basic training. No university studies  
Construction worker all his working life  
Low level of information literacy

### Likes:

Spending leisure time with his children and grandchildren  
Passionate about football. Close follower of all the national football leagues, the England team and English clubs in the Champions League  
Reading the daily press  
Wants to learn to cook. Loves cooking new recipes  
Likes to takes his grandchildren to the cinema once a month

### Activities:

Doing the daily housework  
Reading the press online each day in the senior citizens' centre  
Likes to meet his friends to play cards in the afternoons in the senior citizens' centre  
Picking up his grandchildren when they come out of school

### Needs:

To know about the latest film releases and what's on at his local cinemas  
To access the press  
Would like to be able to do all his administrative paperwork online to avoid having to travel into the city

### Limitations:

Barely knows how to use the internet – he has not had nor does he have access to any internet training  
Does not have a computer at home or a smart phone with internet access  
Needs glasses to read the computer screen



# Olivia

## ABOUT

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- 10 years old
- Primary Six
- Kinesthetic learner
- Loves being creative

## GOALS

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Olivia has a deaf cousin, and wants to be able to communicate with her without always needing an adult.

## DEVICES

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- iPad
- Laptop
- Desktop Computer (at school)

## PERSONALITY

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Olivia is a 10 year old girl who is always happy and bouncing about. She is confident for her age, loves being creative and performing.

## FRUSTRATIONS

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- Complicated language in apps
- BSL courses are expensive
- BSL courses aren't targeted to children

## UX NEEDS

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- Fun and engaging
- Simple Language
- Colourful
- Memorable



# Anna

## DISABILITY SUPPORT WORKER

*"What is there not to love about my job? It's different everyday and I get to help people. It makes me so happy when I see my customers smile. I also love the flexibility this job offers me. But, I wish there's a way for me to be updated on customer information before my shift starts."*

AGE: 25 YEARS OF SERVICE: 6

LOCATION: Boronia

EMPLOYMENT: Permanent/part time front line shift worker

LANGUAGE: English as a second language

WORK ENVIRONMENT:

Supported Independent Living home, Day & Lifestyle Options Service, Short Term Accommodation home

DEVICES USED:



TECHNOLOGY LITERACY:

Medium

ENGAGEMENT WITH MY JOB:

High

### MAIN ACTIVITIES

- Activity planning for customers
- Support customers in activities within locations and homes (including travel)
- Meal preparation for customers
- Laundry tasks
- Support customers with medication, meals and personal care
- Supporting customers to manage and to attend appointments (e.g. outings, medical appointments)
- General housekeeping (supporting customers to undertake tasks)
- Ensuring information is updated in customer folder and Diary for the next shift of DSWs

### CURRENT TOOLS & SYSTEMS

- Skedulo X (to commence in Feb 2020)
- Email (personal)
- Intranet

Anna arrives at the home a few minutes before her shift starts. She's received her shift information from her Coordinator via a text message.

She has a quick chat with the overnight shift DSW who is about to finish off her shift for any handover information. Shift crossovers don't happen regularly. She also says a quick hello to the three customers she would be supporting for the day. As other DSWs arrive, they take turns to look through the What's New folder. They also initial the appropriate form to acknowledge they've read and understood the changes. Next, they look through the Diary for handover information.

Anna begins to set out materials required for the arts and craft activity planned for the day. They will also be heading out to the local RSL for lunch later in the day. As they've never been to the venue before, they re-review the accessibility facilities to ensure they're prepared for the outing.

Anna often leaves work exhausted but happy she's made a difference in someone's life.

### INFORMATION NEEDS

- Service Delivery Record (SDRs)
- Customer information/notes prior to shift commencing
- Accessibility information of local parks, museums, cafes, cinemas, etc for activity planning
- Common local activities other DSWs plan for their customers
- Policies and procedures (include updated information)
- Forms and templates
- Log hazards/incidents
- Rostering details
- Team contact details
- Posters/signage
- Learning & development programs
- Staff/HR information
- Payslips

### STAFF NUMBERS

DSWs make up 12% of employees

### KEY POINTS OF PAIN

- Limited time available to use network/digital tools
- Connectivity issues make access slow and difficult
- Policies that hinder the service they provide to the customer
- Lack of onboarding process
- Inability to contact other DSWs
- Lots of one way communication, few tools available to chat or collaborate

### STAFF PERSONAS

Co-created with Step Two, Nov 2019



ORTA DOĞU TEKNİK ÜNİVERSİTESİ - BİLGİ İŞLEM DAİRE BAŞKANLIĞI

**İNSAN BİLGİSAYAR ETKİLEŞİMİ ARAŞTIRMA VE UYGULAMA  
LABORATUVARI**



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**PERSONA1**

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**Mehmet Demir**

**Yaş:** 43

**Cinsiyet:** Erkek

**İş:** Teknisyen

**Eğitim Seviyesi:** Lise Mezunu

**Bilgi:** Mehmet 15 yıldır teknisyen olarak çalışıyor. Televizyonda izlediği haberlerden dolayı, e-Devlet sistemine giriş yapmak için kullanılan kimlik bilgileri ve şifresinin güvenlik için yeterli olmayacağı düşündürmektedir. Bilgilerinin korunması için sistem tarafından sağlanacak farklı yöntemlerin güvenlik seviyesini artıracağını düşünüyor.

**Projeden Beklentileri:** Mehmet bankacılık uygulamalarında olduğu gibi mobil cihazıyla e-Devlet sistemini kolayca kullanabilmek istiyor. Bu sebeple, geliştirilecek güvenlik yöntemlerini mobil cihazı ile birlikte kullanmak istiyor. Herhangi bir nedenle mobil cihazını değiştirirse, sistemde kayıtlı bilgilerini veya çipli kimlik kartını kullanarak güvenlik adımlarını tamamlayabilmeyi umuyor. Herhangi bir aşamada zorluk yaşarsa, sistem üzerinden kendisine yardım verilebileceğini düşünüyor.

**Teknolojik Donanımı:**

- Günlük işlerinde kişisel bilgisayar kullanmıyor ama vergi ve trafik cezalarını e-devlet mobil uygulaması üzerinden düzenli olarak kontrol ediyor.
- E-devlet mobil uygulamasını kullanarak sisteme giriş yapıyor ve arama kısmından ilgili işlemlerine erişebiliyor.
- E-devlet sistemi üzerinden verilen hizmetlere erişebilmek için ailesinden yardım alıyor.

- [Turkiye.gov.tr](http://Turkiye.gov.tr)
- Two-factor authentication

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## PERSONA2

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### Ayşe Yılmaz

**Yaş:** 35

**Cinsiyet:** Kadın

**İş:** Sekreter

**Eğitim Seviyesi:** Lisans Mezunu

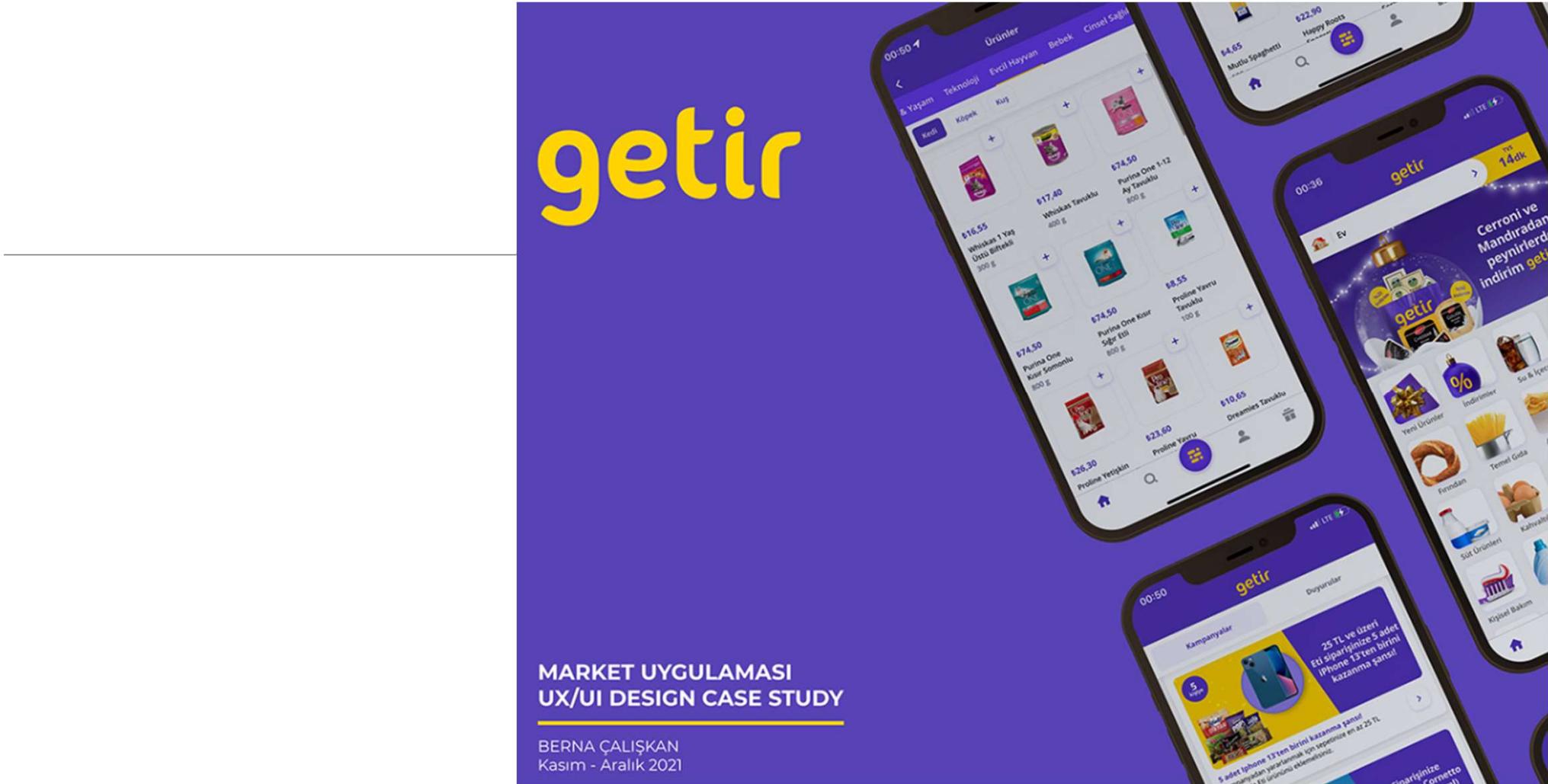
**Bilgi:** Ayşe 8 yıldır sekreter olarak çalışıyor. Sorulama, başvuru ve ödeme hizmetlerine e-Devlet sistemi üzerinden ulaşabiliyor. Kişisel bilgilerinin dijital ortamda çalınmasından endişeli. Bir cihazının daha sisteme giriş için kaydedilmesiyle güvenliğinin artacağını tahmin ediyor.

**Projeden Beklentileri:** Mobil cihazını çipli kimlik kartı ile e-Devlet sistemine kaydetmeyi hedefliyor. Kaydedilen mobil cihaz ile iki aşamalı giriş yöntemlerini kullanarak e-Devlet sistemine daha güvenli bir şekilde giriş yapabilme umuyor. Ayrıca, e-Devlet sisteminde mobil cihazının ona ait olduğunu kısa ve güvenilir yolla kanıtlayabilmek istiyor.

**Teknolojik Donanımı:**

- İş yerindeki günlük işlerinden dolayı sıkılıkla kişisel bilgisayar ve mobil cihaz kullanıyor.
- E-devlet mobil uygulamasını ve web sitesini kullanarak sisteme giriş yapabiliyor. Arama kısmından ilgili hizmete erişip bilgi almak için gerekli adımları tamamlayabiliyor.





- <https://www.behance.net/gallery/134533111/Getir-UXUI-Case-Study/modules/761324777>

# Task analysis

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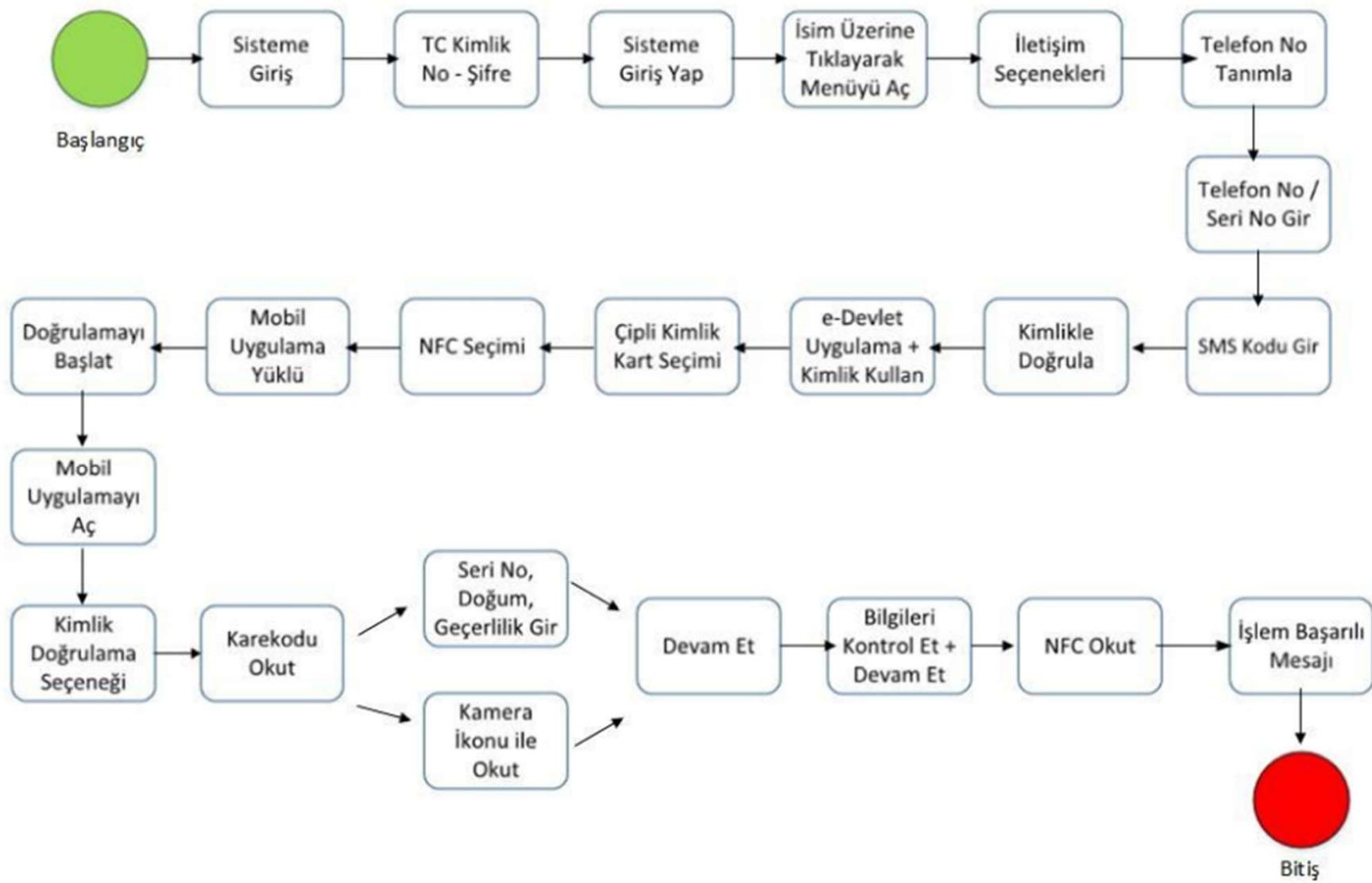
- The process of observing, describing, and decomposing tasks into their constituent components
- analyzing the human, technological and environmental resources required for the completion of each component.

# Task analysis questions

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- What does the user see?
- What decisions does a user make?
- What must a user know?
- How does a user get help?
- How does a user recover from errors?
- What physical acts must be accomplished?

### Görev 3: Çipli Kimlik Kart ile Telefon Numarası Doğrulama



Resim 6 – Çipli Kimlik Kartı ile e-Devlet Kapısı Web Sitesi Üzerinden Telefon Numarası Doğrulama Adımları

# UX Design

## Affinity Map

Persona

Journey Map  
Çözüm Yolu

İletişim ve Yardım	Sipariş	Teslimat	Ödeme	Fiyatlandırma	Kampanya	Konum	Ürün
"Problem yaşadığında müşteri temsilcilerinden herhangi bir geri dönüş olmadığından teknik destek istemiyorum."	"Sipariş onay işlem hizmeti gerekçesiyle bu yüzden bir kere indirimi ekleyemedem yanlışlıkla elin butona tıklayıp satın alımlı olduğum ve iptal edemedim."	"Haritala getirme süresi 8 dakika yaşarken önceden eline ulaşması 45 dakika sürüyor."	"Ödeme aşamasında tedişnik yapıyorum. Yapılaşacak indirim sepete neden otomatik olmuyor anlıyorum."	"Ürünlerin fiyatları diğer uygulamalara ve marketlere göre çok pahalı."	"İndirim kodunu kullanmayı çalşırken önce kullanmadan önce vermediğimde sonradan sepetimi 50 TL'ye tamamlamam istedim."	"Adres ekrandan zorlu yapıyorum. Konumdan adresi doğru ayarlamak çok zor."	"Ürünlerin favorilere ekleyebiliyor olman gerekiyor. Uygunlukta bunlar var."
"Numaramı değiştirdim fakat uygulama içerisinde eski numaramı gözüküyor. Müşteri hizmetlerini arayıp değiştirdim ve sonra uygulamada eski numaramı silmek istiyorum. Uygulama içerisinde böyle bir işlem kolayca halledilebilsem gerekiyor."	"Sipariş verdikten sonra hazırlanan aşamasındayken, en azından belli bir süre sıparış ek yapılmıyor."	"Sadece poşete ekleyip çıkaracaksın önceli 1 saat 15 dakika da teslim ettler."	"Neden nakit ödeme olmazsa arıltmadığım uygulama, kartını kaydetmek sorunda mym arkadığ."	"Minimum sepet ücreti daha az olmalı."	"Sepete ürün eklemeden indirimleri öğreniyorum, kampanyaları öğreniyorum, fakturamın ben sürekli uygulamayı kullanın biri olarak yeni fare elim."	"Sipariş takip haritası düzgün çalışmıyor. Depoda gizlilenen sipariş kapda oluyor."	"İstediğim ürünü bulamamak bana zorlu yapılıyor."
"Uyelikimi iptal etmek istiyorum fakat böyle bir seçenek yok bir türlü yapamıyorum."	"Sipariş notlarına yazdıklarına dikkat edilmiyor."	"Ekstra ürün getiriliyor."	"Telefonumdan yanılsıkça sipariş verdim, evet bunu başardım çünkü, ne tutar diye sepet oluştururken, etim sipariş ver butonuna tıklaşıp sipariş vermişken sifir onay olduğunu kişi, tek diye sipariş kartından pekişti."	"2 parça küçük ürün alıyorum ve bunun için 2 tane poset ücreti alıyorum."	"İndirim kuponlarını kullanırken tedişnik yapıyorum为什么会 net değil, daha önce indirim almış gerekken indirimli ürün aldım."		"Search'ı aktif olarak kullanamıyorum. Aradığım ürünü search'e yazdığında doğru kategoride geçerlemez bulunur."
"Siparişimi alıp ayrıca eklemek yerine şu an da bütün kuryeleriniz mesul olduğu sonra benenizi bilmediğimi düşünüyorum."		"Ürünlerin bayat geldi."	"Ödeme yaparken bazı tedişnikler yaşlıyorum. Ödeme aşamasında direkt onaya yönlendiriliyor, bu kartta mi ödeme yapısızlığından diye soruyor."				"Aldığım manav ürünlerinin bazları taze değil."
"Sipariş verdim ve 1 saatte boyunca hazırlıyor bile gözükmed. Sipariş iptali seçenekinin olması gerekiyor."	"Sipariş haritası yanlış göstermesi o an ki planını aksatıyor."		"Ödeme kısmına gelindiğinde ön tıklaşımda sipariş vermek isteyenlerin sık sık sıkıştırılmış tıkla şekilde çalışıyor. Ürün otomatik olmasının istememiz."				
"Eduan ekmeden alışveriş yapamam bekleyen uygulamı, 2 saat boyunca sipariş vermemi çöktürün sonrasında da hatalı bildirim adom ve beni sayfadan attı."			"Kredi kartını neden kaydetmem, sorundan olduğumu anlamadığım yaşlıyorum."				
"Geçmiş siparişlerimi tekrarlayamıyorum."			"Her defasında kredi kartı bilgilerini girmek istiyorum ancak bu nasıl bir çareci ki kredi kartını kaydetmemesem online ödeme yapamıyorum."				

- <https://www.behance.net/gallery/134533111/Getir-UXUI-Case-Study/modules/761324791>

# Task analysis methods

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- Observation
- Interview
- Verbal protocol analysis
- Self trial
- Formal description (e.g. GOMS analysis)
- Hierarchical tasks analysis (HTA)

# Situation-Context analysis

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- Outlines the physical and social context of use:
  - Location
    - Home, office, shop, car, street etc.
  - Relationship to other users
    - Collaboration, recipient, passive/active
  - Socio-technical environment
    - Seattle port
    - Sabancı: different departments/faculties

# Output

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- These analyses provide guidance to determining the required levels of:
  - Effectiveness
  - Efficiency
  - Satisfaction
- And the training, tasks, and environment in which the tool will be used

# EcoRent Case

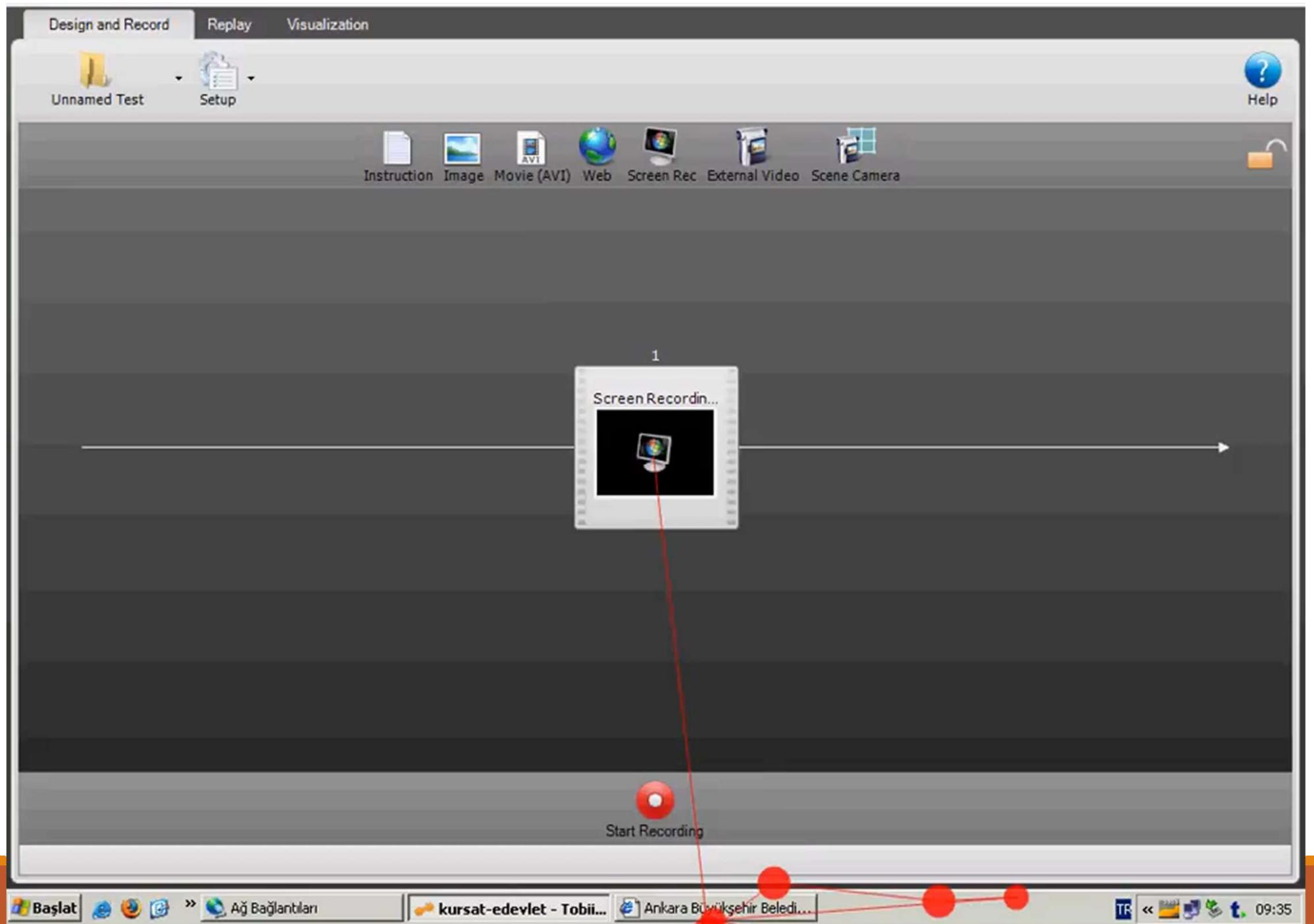
EcoRent

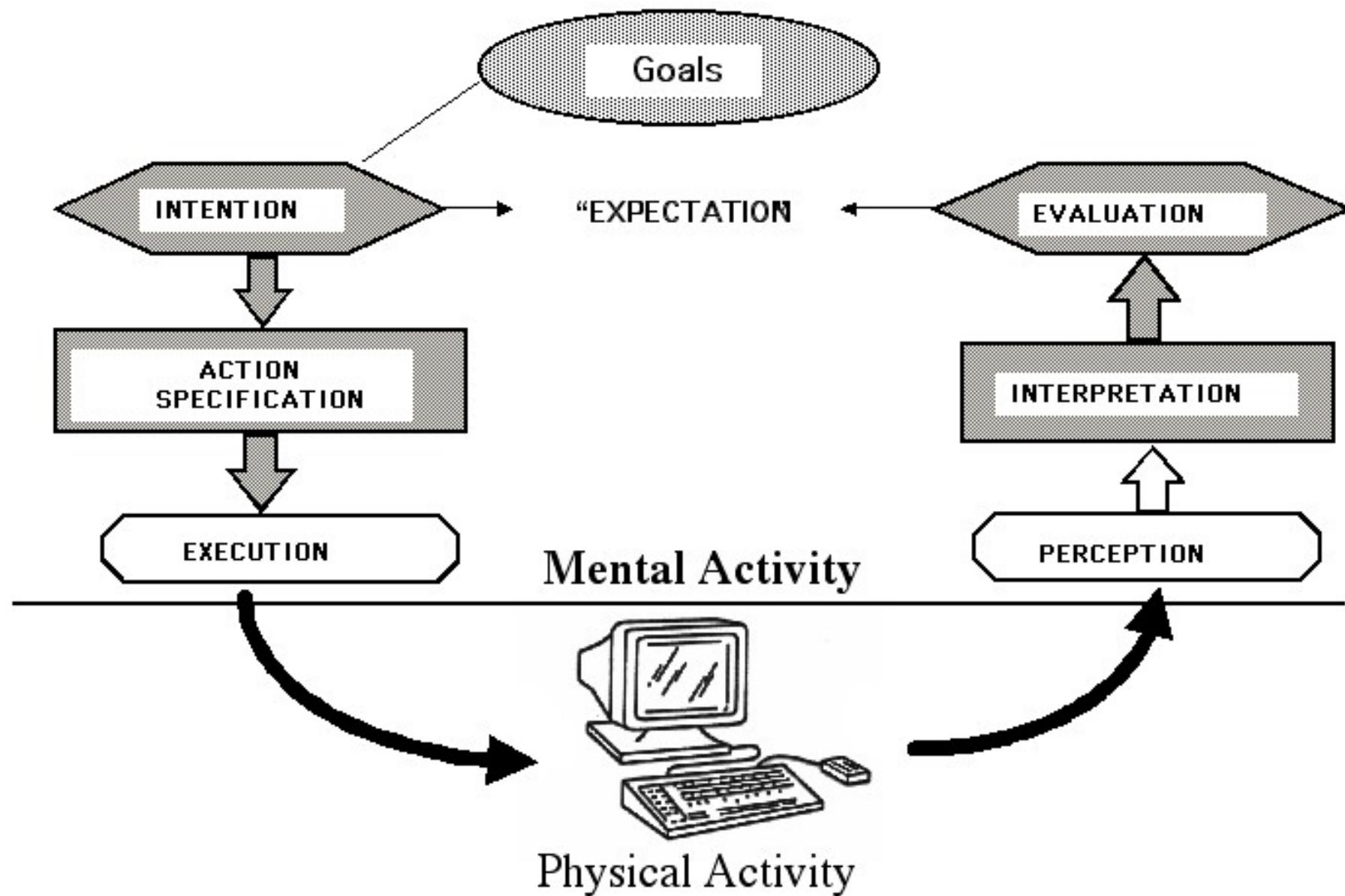
2023

# UX / UI Case Study

Role	Duration	Platform	Screens
UX / UI Designer	5 Months	Mobile	50+ Screens

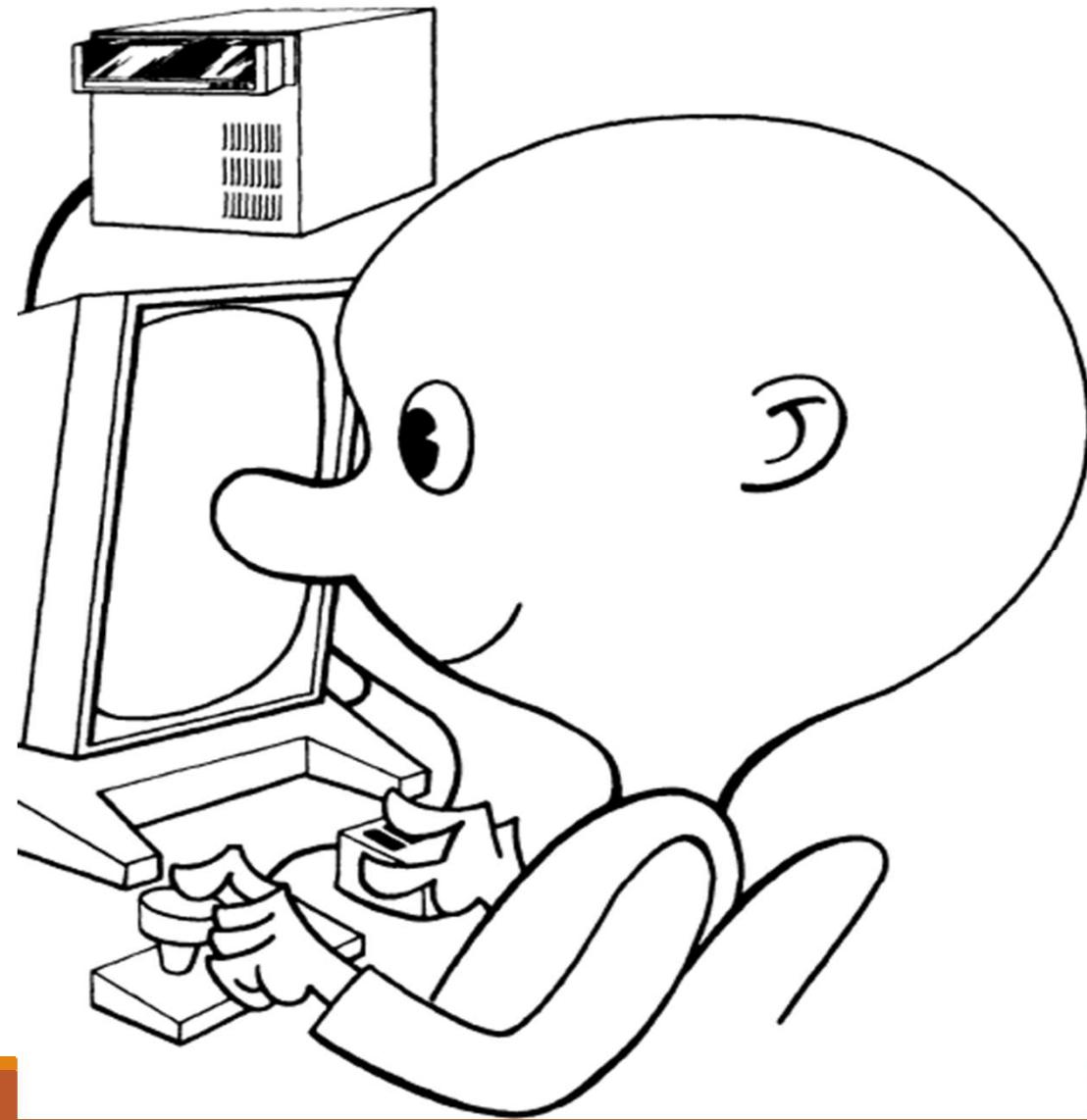
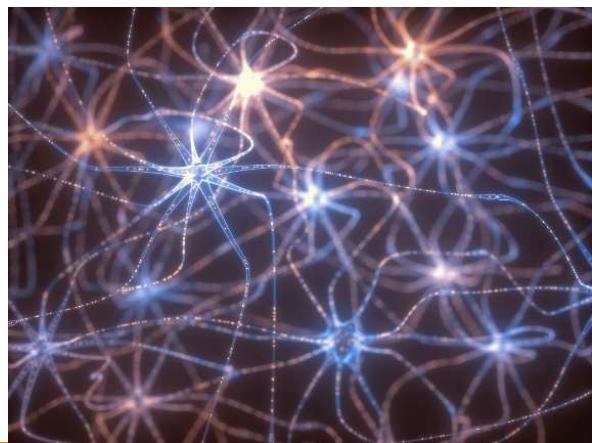
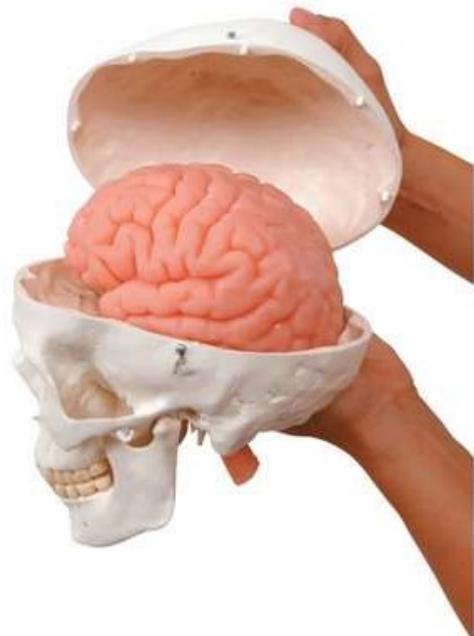
- <https://www.behance.net/gallery/175512581/EcoRent-UXUI-Case-study-Rental-Dispose-App>





Seven stages of user activities involved in task performance  
Don Norman *The Design of Everyday Things*.

# Psychology of HCI



## LONG-TERM MEMORY

$$\delta_{LTM} = \infty$$

$$\mu_{LTM} = \infty$$

$\kappa_{LTM}$  = semantic

## WORKING MEMORY

### VISUAL IMAGE STORE

$\delta_{VIS} = 200 [70-1000]$  msec  
 $\mu_{VIS} = 17 [7-17]$  letters  
 $\kappa_{VIS}$  = Physical

### AUDITORY IMAGE STORE

$\delta_{AIS} = 1500 [900-3500]$  msec  
 $\mu_{AIS} = 5 [4.4-6.2]$  letters  
 $\kappa_{AIS}$  = Physical

$$\mu_{WM} = 3 [2.5-4.1] \text{ chunks}$$

$$\mu_{WM^*} = 7 [5-9] \text{ chunks}$$

$$\delta_{WM} = 7 [5-226] \text{ sec}$$

$$\delta_{WM} (1 \text{ chunk}) = 73 [73-226] \text{ sec}$$

$$\delta_{WM} (3 \text{ chunks}) = 7 [5-34] \text{ sec}$$

$\kappa_{WM}$  = Acoustic or Visual

Eye movement = 230 [70-700] msec



Perceptual Processor  
 $\tau_p = 100 [50-200]$  msec



Motor Processor  
 $\tau_m = 70 [30-100]$  msec

Cognitive Processor  
 $\tau_c = 70 [25-170]$  msec

# LONG-TERM MEMORY

$$\delta_{LTM} = \infty$$

$$\mu_{LTM} = \infty$$

$\kappa_{LTM}$  = semantic

# WORKING MEMORY

## VISUAL IMAGE STORE

$\delta_{VIS} = 200$  [70~1000] msec  
 $\mu_{VIS} = 17$  [7~17] letters  
 $\kappa_{VIS}$  = Physical

## AUDITORY IMAGE STORE

$\delta_{AIS} = 1500$  [900~3500] msec  
 $\mu_{AIS} = 5$  [4.4~6.2] letters  
 $\kappa_{AIS}$  = Physical

$$\mu_{WM} = 3$$
 [2.5~4.1] chunks

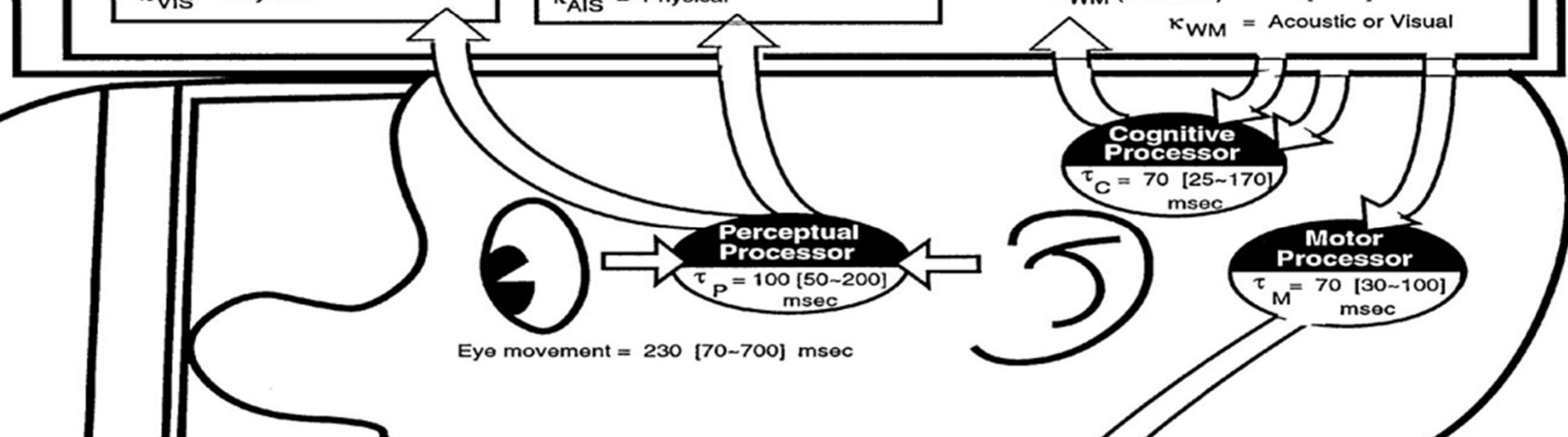
$$\mu_{WM^*} = 7$$
 [5~9] chunks

$$\delta_{WM} = 7$$
 [5~226] sec

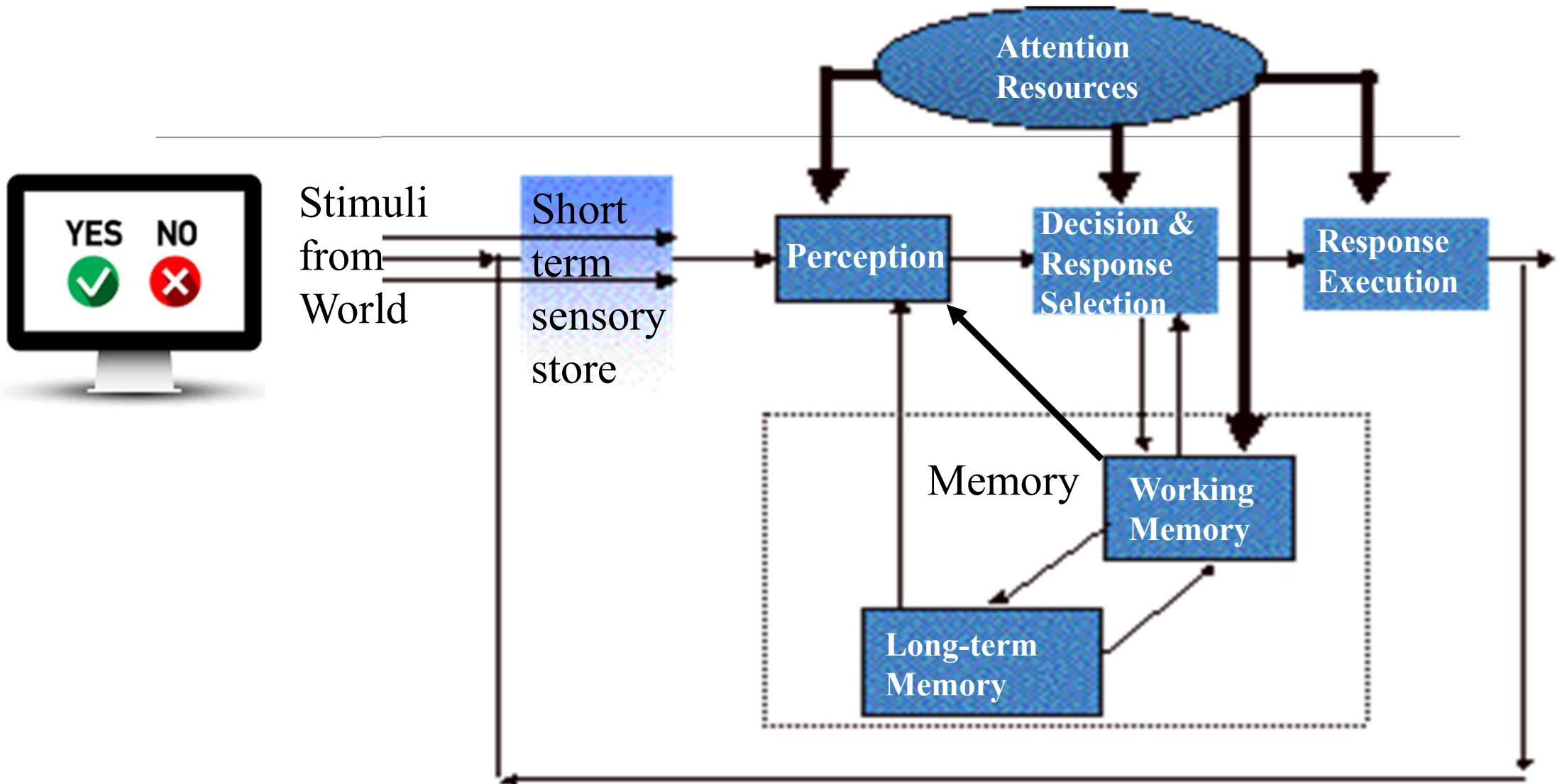
$$\delta_{WM}$$
 (1 chunk) = 73 [73~226] sec

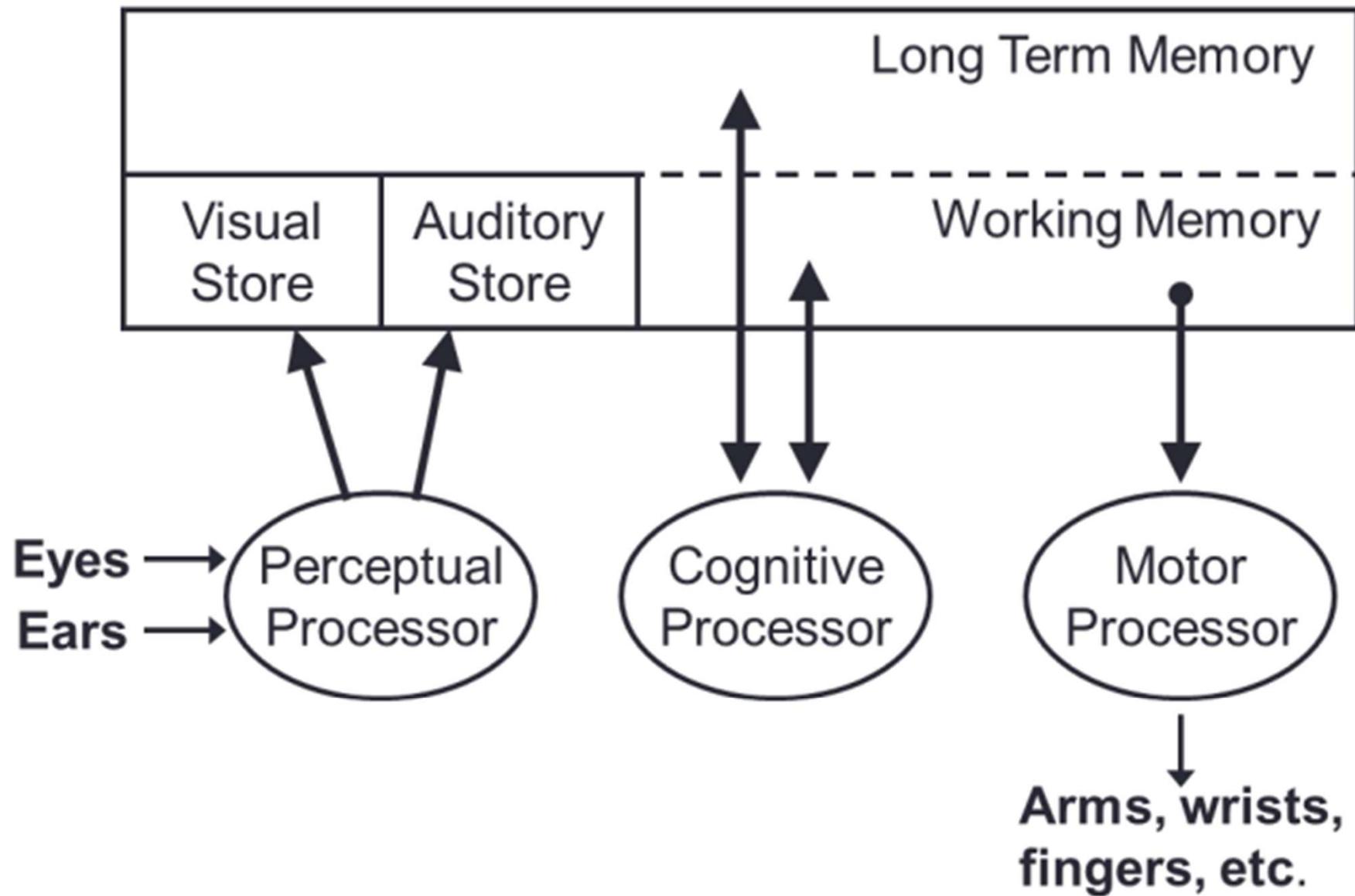
$$\delta_{WM}$$
 (3 chunks) = 7 [5~34] sec

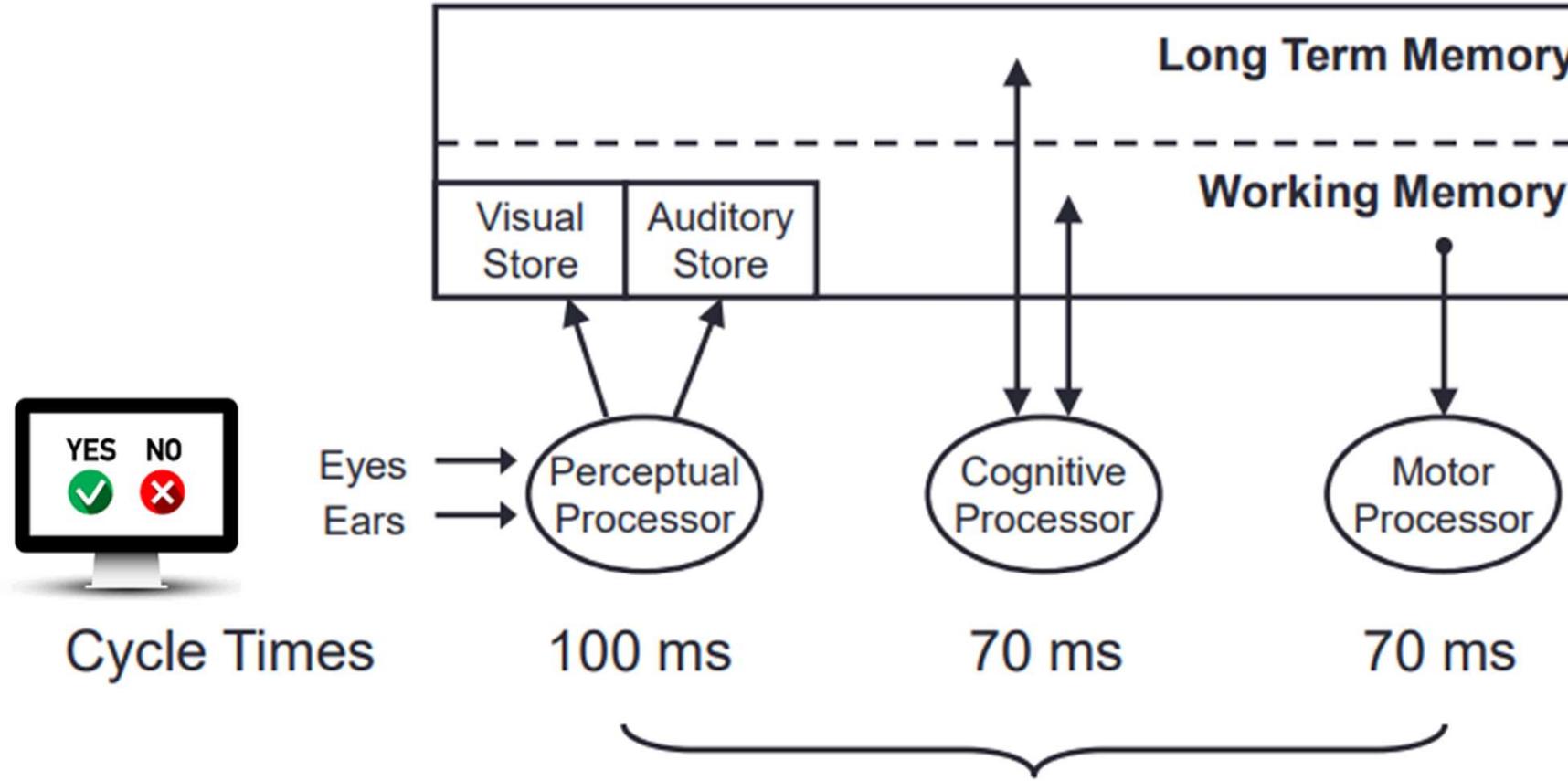
$\kappa_{WM}$  = Acoustic or Visual



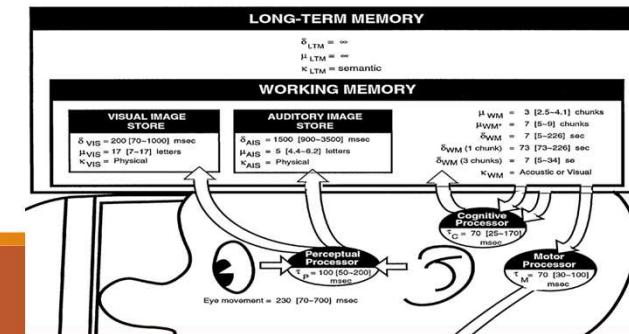
# Wickens (1992)







**Perceive-Recognize-Act cycle  $\approx 240$  ms**



# Basic properties of all users

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- Changes with experience
- Actively learns
- Limited attention (esp. Children)
- Makes mistakes
- Models the system in their mind
- Remains unique
- Goal oriented

# Basic attributes

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- Human cognitive system consists of structures
  - memory (short and long term), schemata, etc.
- and processes
  - encoding, retrieval, assimilation etc.
- Human cognition is active:
  - we seek meaning and regularity



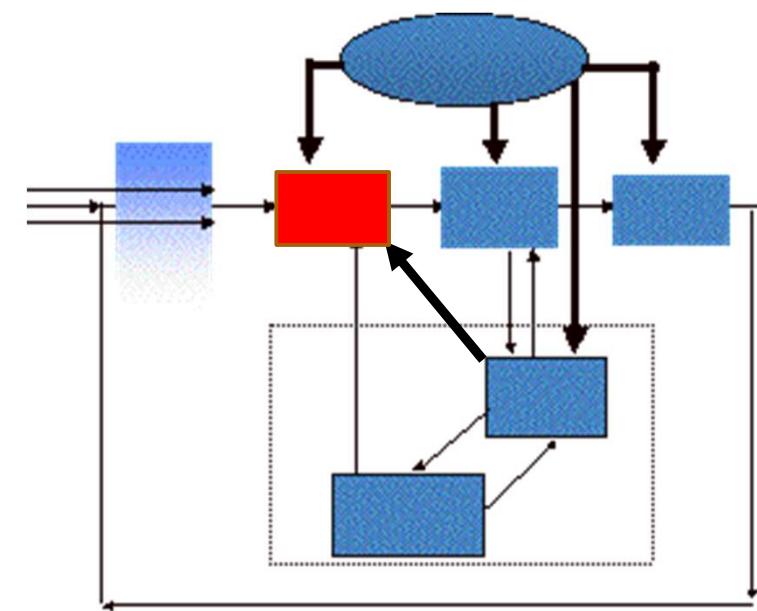
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# Cognition is fast & orderly

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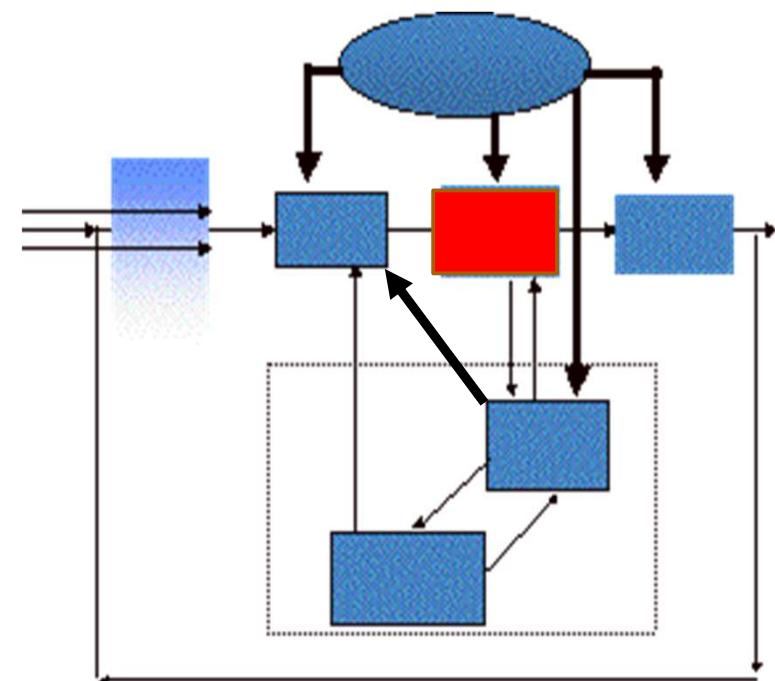
- Short-term sensory store (STSS)
  - rapidly decays (<1sec)
  - sensitive to physical characteristics of signal
  - Pre-attentive (unconscious)
- Perception
  - many-to-one category mapping
  - detection, recognition, categorization cycle
  - stimulus is consciously attended to here



# And then....

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- Decision and Response selection
  - Once encoded, human must react
  - Can be automatic or controlled response
- Response execution
  - Sequence of behavior follows,
- Feedback
  - We monitor events and our actions
- Attention is usually required after STSS



# <https://www.cogtool.org/>

CogTool — Predictive human performance modeling for UI design

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**CogTool is a general purpose UI prototyping tool with a difference – it automatically evaluates your design with a predictive human performance model (a “cognitive crash dummy”).**

[Download for Windows](#)

[Download for macOS](#)

## Week-5 Beyond usability engineering

### Understanding the user (part 1) Human Cognition

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Week-5 The Human, Ch1 - Human Computer Interaction, Dix et.al

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Week-5 (Focus on Section 2.1) The Psychology of Human Computer Interaction - Ch2

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