

# Human Computer Interaction

## CS449 – CS549

### Week 3-2

What is a good user interface – Affect  
Design Problems  
Fitts's Law

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KÜRSAT ÇAĞILTAY

# Today – Foundational Concepts

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- Affect-Emotions
- Fitts' Law



Contents lists available at ScienceDirect

## Interacting with Computers

journal homepage: [www.elsevier.com/locate/intcom](http://www.elsevier.com/locate/intcom)



- A longer study
- Before use
- After use

Understanding user preferences based on usability and aesthetics before and after actual use

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Aesthetics

Perceived usability

Perceived aesthetics

Actual use

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### ABSTRACT

Designing a highly preferred product or system is a crucial issue for better information-services and product sales. We attempted to understand the process of users' preference-making based on usability and aesthetics. In the present study, we examined the relationships among usability/aesthetics features, perceived usability/aesthetics, and user preference through an experiment using four simulated systems with different levels of usability and aesthetics. The results showed that, before actual use, user preference was significantly affected by the differences in aesthetics but marginally affected by the differences in usability. On the other hand, after actual use, user preference was significantly influenced by the differences in both usability and aesthetics. Regardless of the occurrence of actual use, user preference was highly correlated with both perceived usability and perceived aesthetics, which were strongly interrelated. Finally, actual use had a significant effect on perceived usability, perceived aesthetics, and user preference. The findings emphasize the importance of considering both perceived usability and perceived aesthetics. They also demonstrate the need for discriminating users' interactions before and after actual use, in developing a more preferable computer-based application.

Before actual use User preference	<b>significantly affected by the aesthetics</b>	<b>marginally affected by the usability factor</b>
After actual use User preference	significantly influenced by both the usability and the aesthetics factors	
Before and after actual use	strong interrelationship between perceived usability and perceived aesthetics	

# So

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- Users respond to interface beauty
  - Users do not predict their own performance (process and outcome) accurately
  - Designers cannot usefully predict user response through introspection, any current theory of interaction, or asking their colleagues!
- 
- Does apparent usability correlate with experience in use («true» usability)?



# Affective Interactive Toys



Furby



NeCoRo

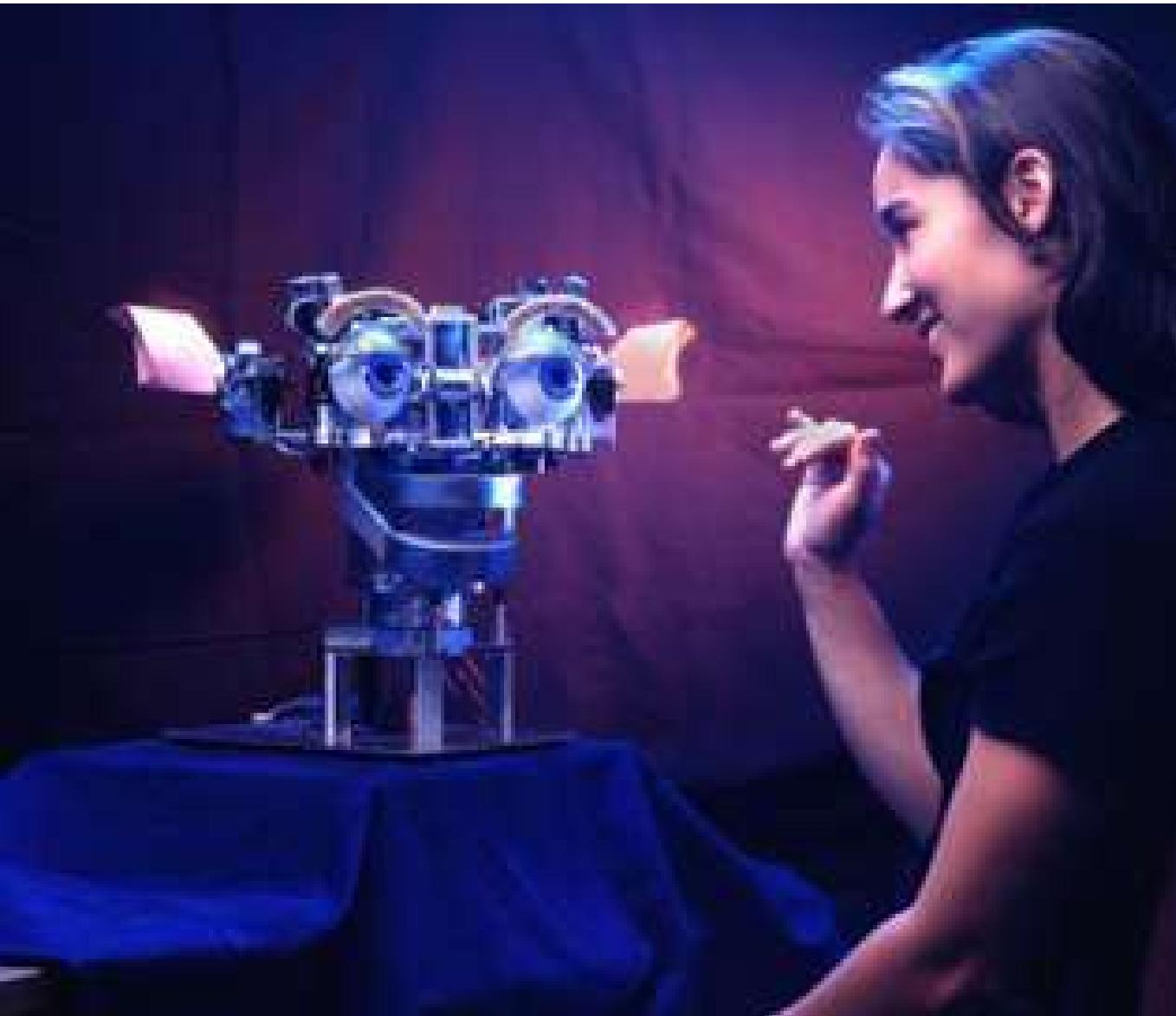


Paro



Aibo

# Kismet – Cynthia Breazeal, MIT



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Sophia & Oğuzhan Uğur



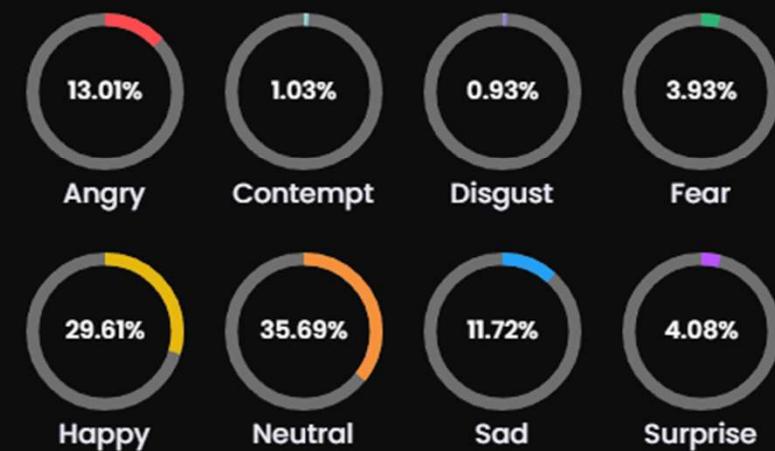
# Affect in CS 449/549

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## Overall emotions

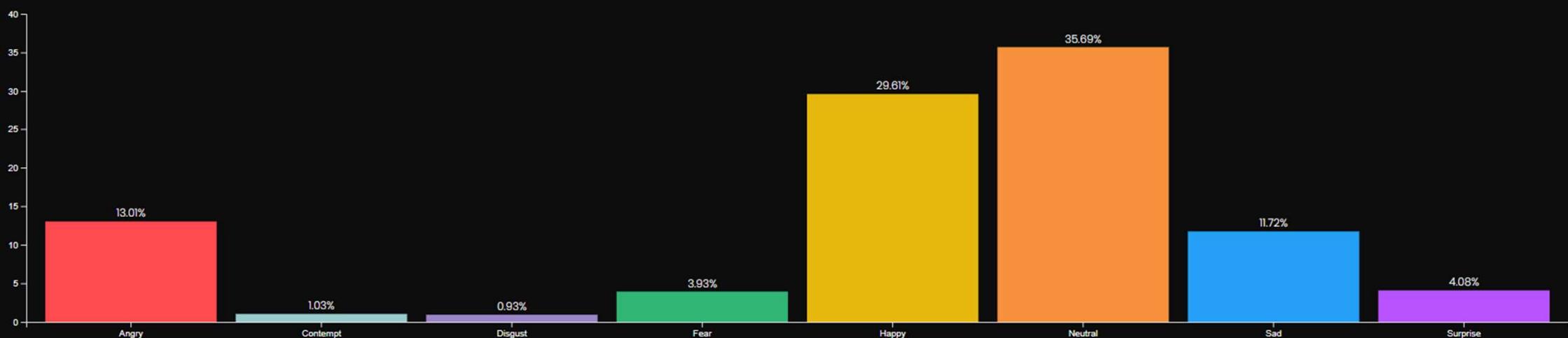


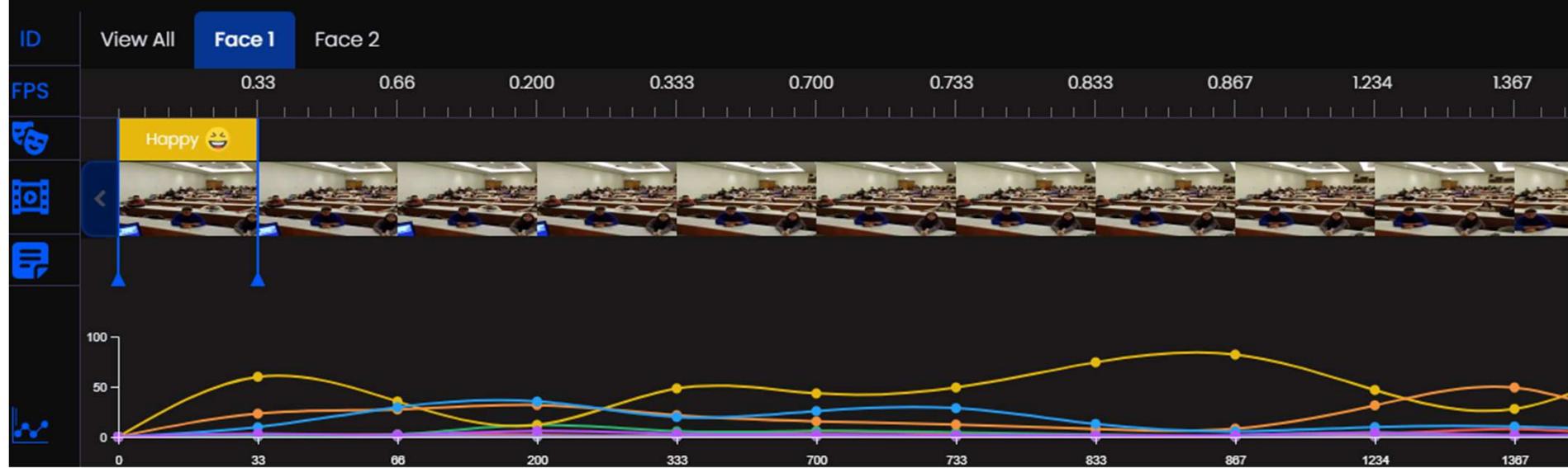
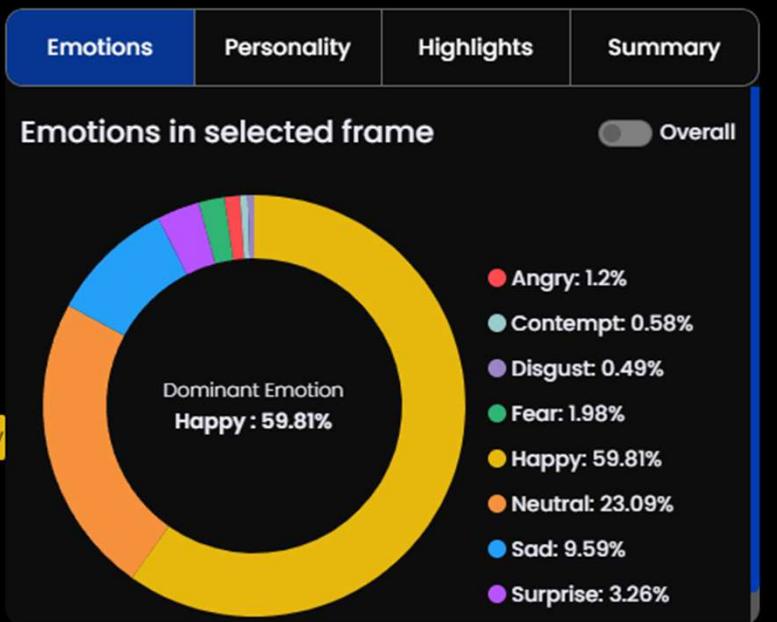


58 Face(s)

Overall Emotional Sentiment: Neutral

### Overall Emotions





- Interaction with Zoom:
- Emotions and eye movements of online learners



Call 2023 Round 2 KA2

KA220-HED - Cooperation partnerships in higher education

Form ID KA220-HED-C314ED56 Deadline (Brussels Time) 04 Oct 2023 12:00:00

## Context

Field	Higher Education
Project Title	Effective Online Teaching Principles via Eye-Movement Analysis of Teachers and Students
Project Acronym	EFOTPE

Project Start Date (dd/mm/yyyy)	Project total Duration (Months)	Project End Date (dd/mm/yyyy)	National Agency of the Applicant Organisation	Language used to fill in the form
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01/01/2024	30 months	30/06/2026	TR01 - THE CENTRE FOR EUROPEAN UNION EDUCATION AND YOUTH PROGRAMMES (TURKISH NATIONAL AGENCY)	English
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Project lump sum	400 000,00 €
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# AFFECTIVE COMPUTING AND INTERACTION

Psychological, Cognitive and  
Neuroscientific Perspectives



DIDEM GÖKÇAY & GÜLSEN YILDIRIM

## Chapter 14

### Bringing Affect to Human Computer Interaction

**Mahir Akgün**

*Pennsylvania State University, USA*

**Göknur Kaplan Akıllı**

*Middle East Technical University, Turkey*

**Kürşat Çağltay**

*Middle East Technical University, Turkey*

For full text book

<https://ocw.metu.edu.tr/course/view.php?id=230>

# Design Problems

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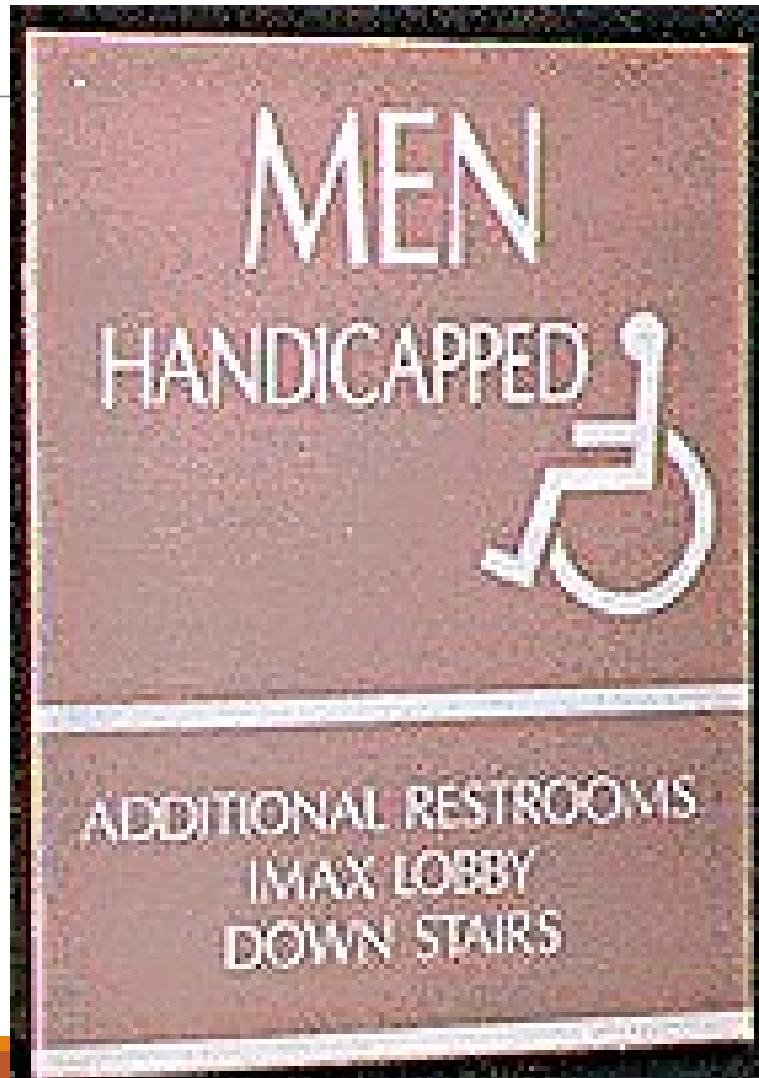
26-11-2006

<http://www.hurriyet.com.tr/gundem/5675530.asp?m=1&gid=112&srid=3430&oid=4>

# Design Problem: Ankara&Gökçek



# Harmless problems



# Harmless problems

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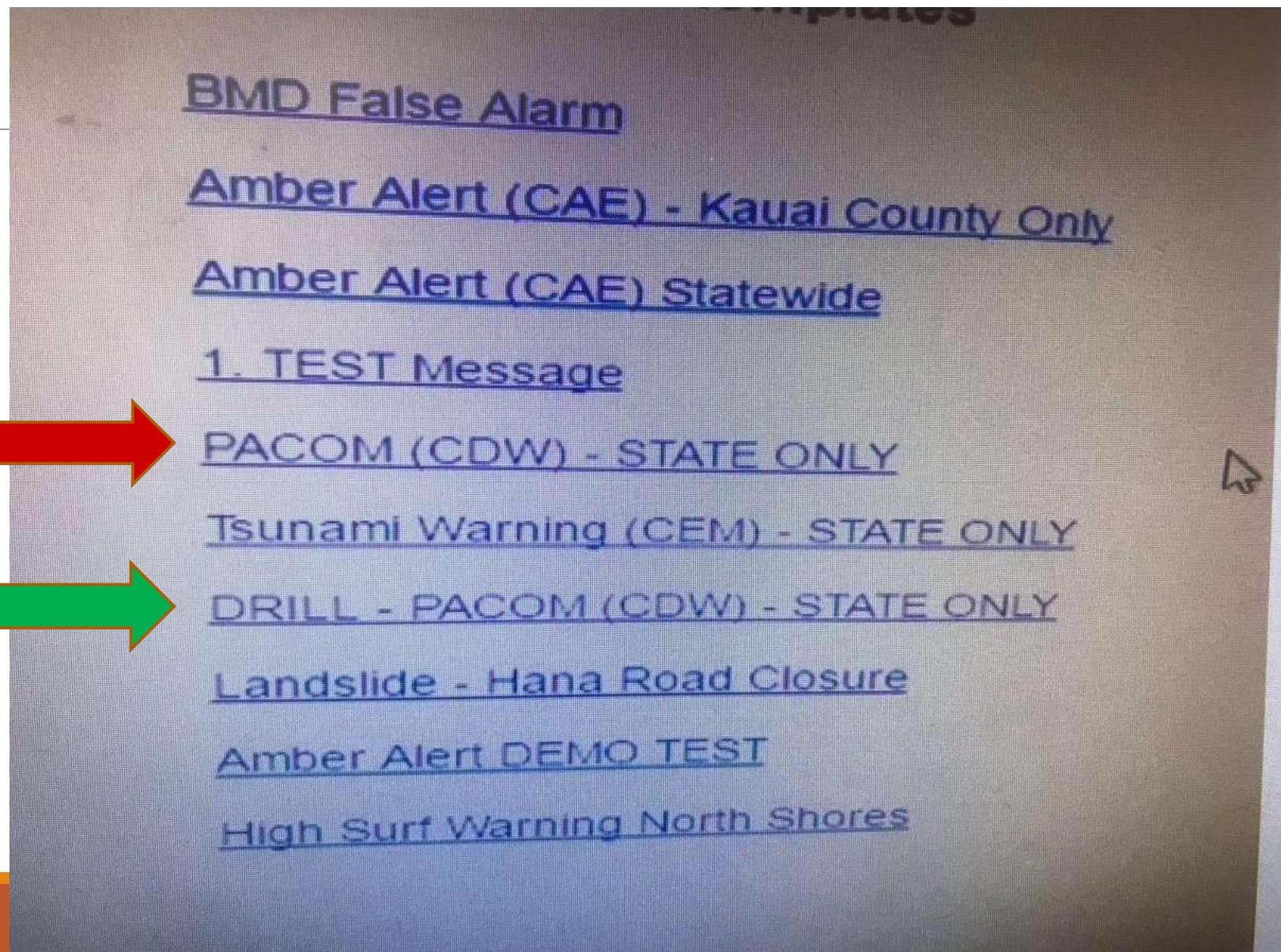
## Hawaii missile false alarm due to badly designed user interface, reports say

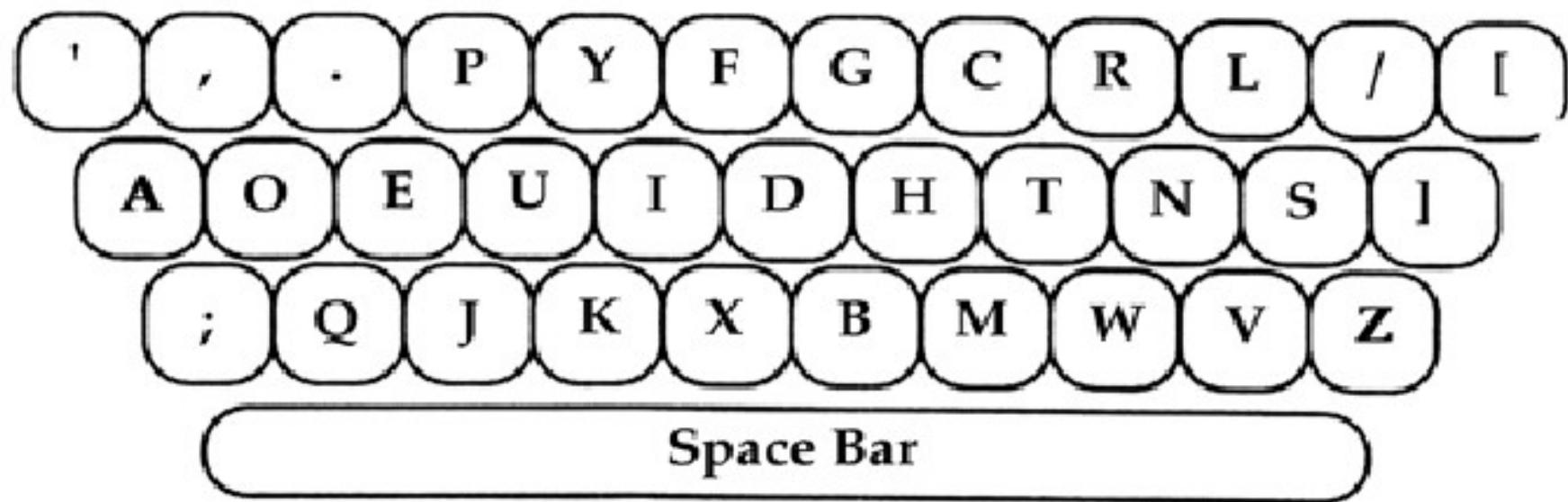
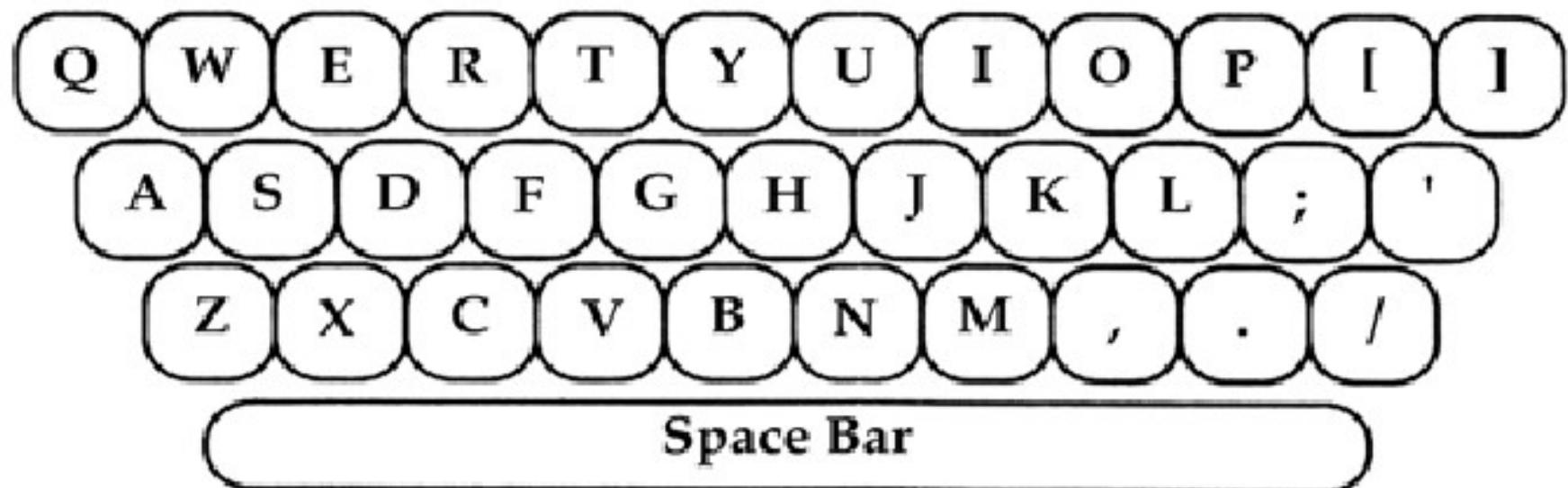
Alert occurred after employer pressed button labelled ‘missile alert’, instead of the one next to it marked ‘test missile alert’

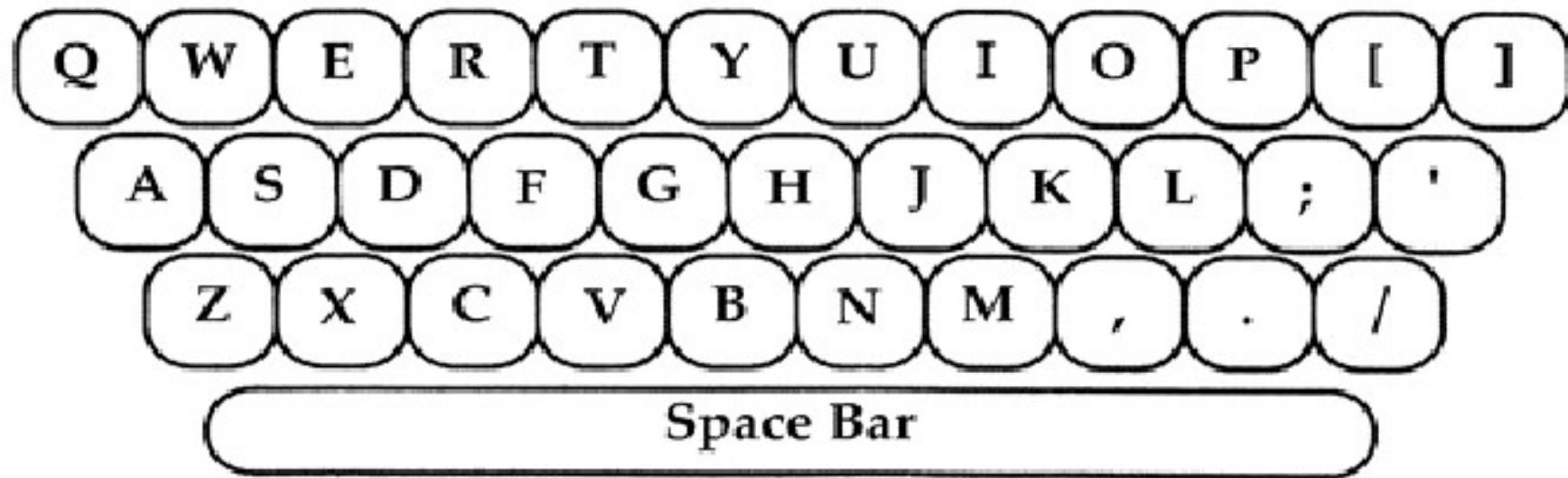




# Operator Screen

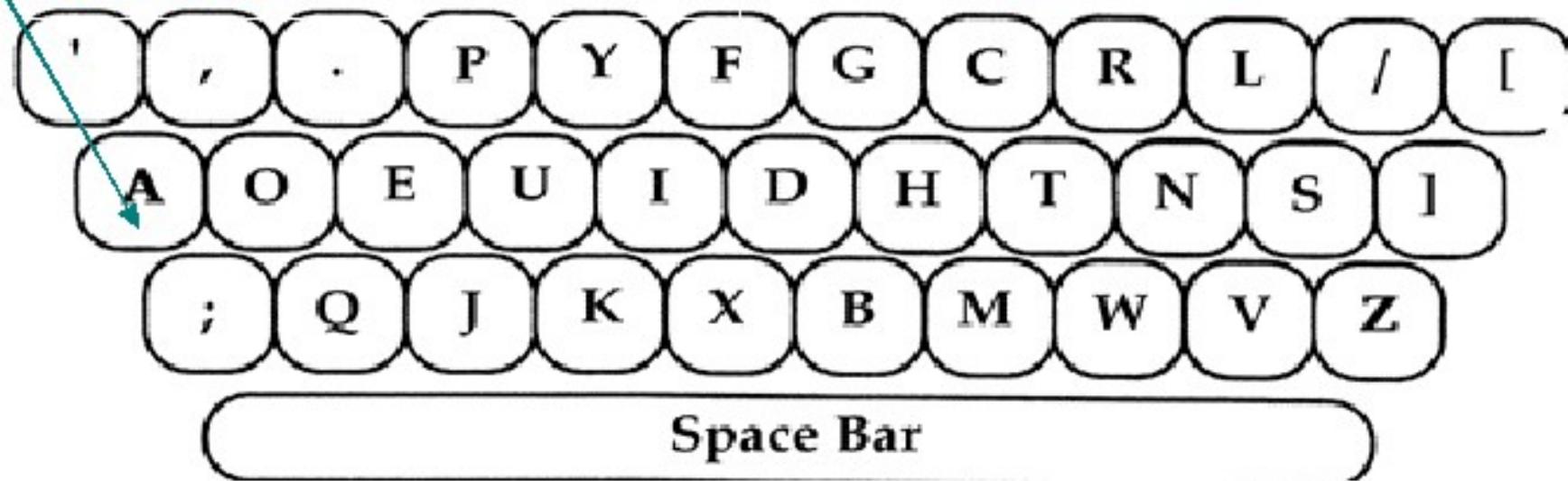






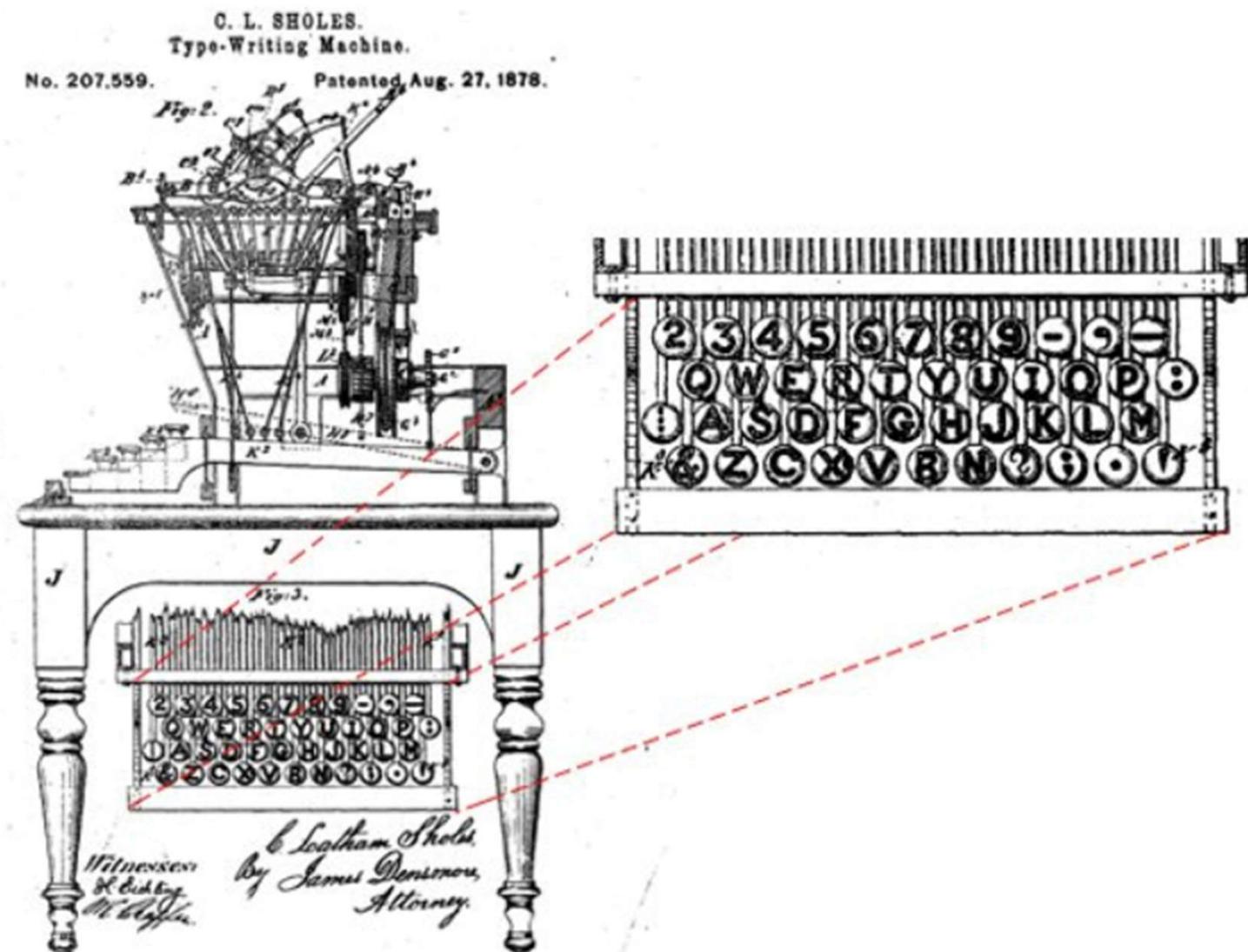
**Vowels and frequently used consonants**

**Better right/left hand symmetry**



**35% of normally used words can be typed on home row**

- 1878 – Patent
- C.L. SHOLES



.S. Patent No. 207,559. The first appearance of the QWERTY keyboard. Google patents

??



Anasayfa > Donanım > Klavye Hızlı Yazma Rekorlarını Neden Hep Türkler Kırıyor?

# Klavye Hızlı Yazma Yarışmalarında Neden Hep Türkler Birinci Oluyor?

Erkan Ceylan — 2 ay önce

10 dk okuma süresi



Klavye hızlı yazma yarışmalarında Türklerin sık sık şampiyon olduğunu mutlaka duymuşsunuzdur. Bunun tek nedeni gerçekten F klavyenin tasarımı mı, yoksa farklı nedenler de bulunuyor mu?



Bu yarışmalar, merkezi İtalya'da bulunan, **Uluslararası Bilgi İşlem**



**Federasyonu(INTERSTENO)** tarafından iki yılda bir çeşitli ülkelerde **Dünya** Bilgisayar Şampiyonaları adı altında düzenleniyor. Futbolda Brezilya neyse bu yarışmada da **Türkiye** o!



22 kez Türkiye, 3'ünde rekor olmak üzere toplamda 9 kez Dünya şampiyonu olan **Celal Aşkın**'a bu işin sırrını sorduk.

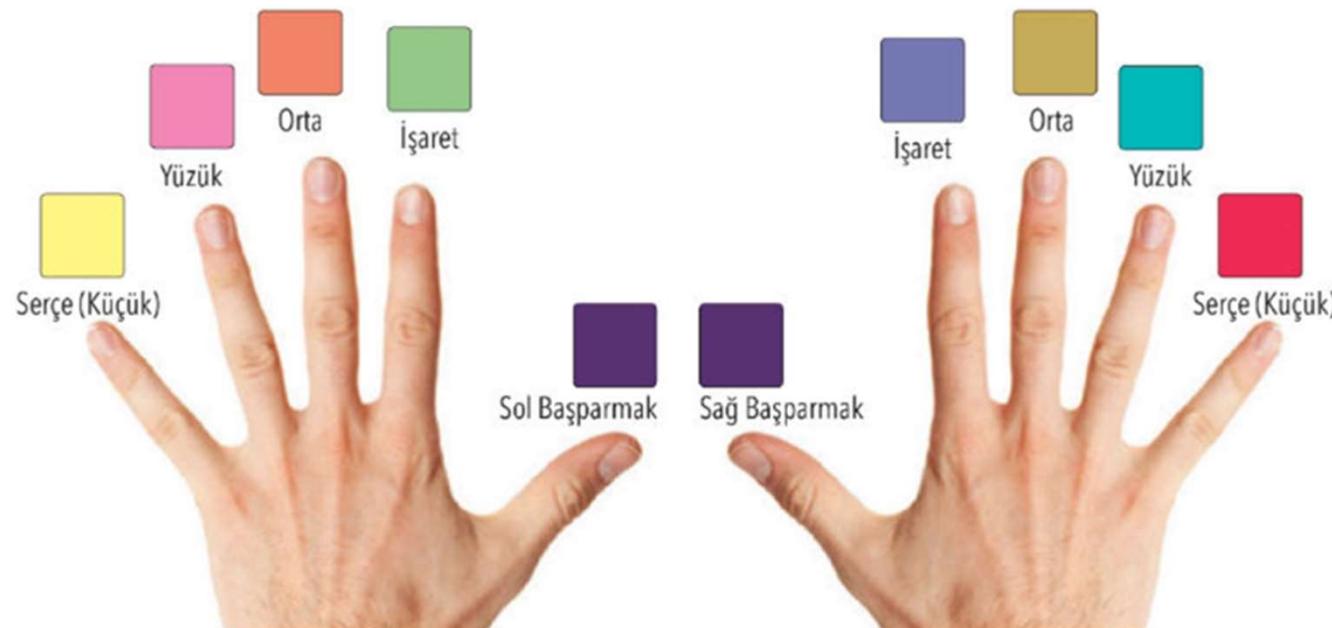
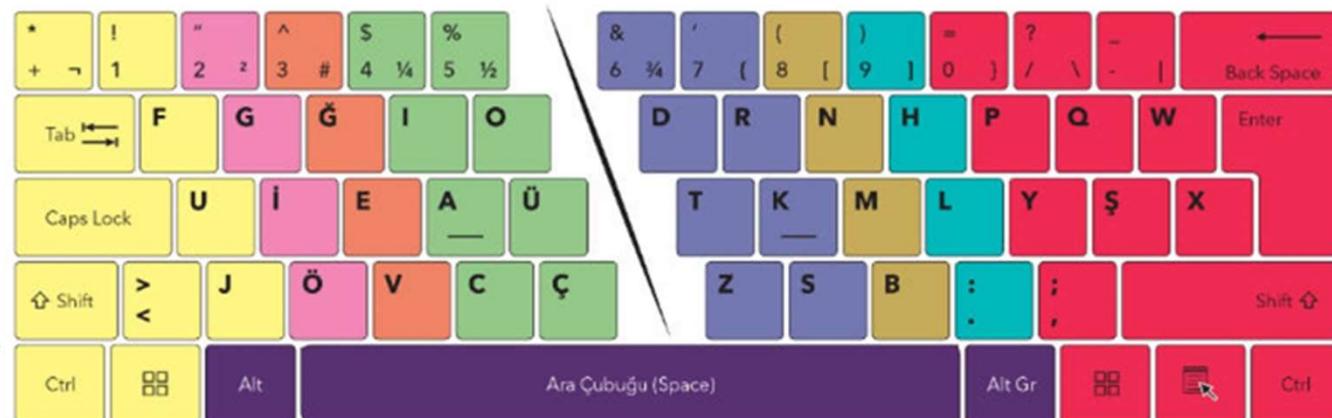


| **Dünya Bilgisayar Şampiyonaları** toplamda 2 varış

# Turkish Words

- a harfi 26.323,
  - e harfi 16.308,
  - k harfi 13.542,
  - i harfi 13.384,
  - m harfi 11.263,
  - I harfi 10.496,
  - t harfi 9.669,
  - r harfi 8.698
  - J harfi 125

• Dr. İhsan Sıtkı Yener



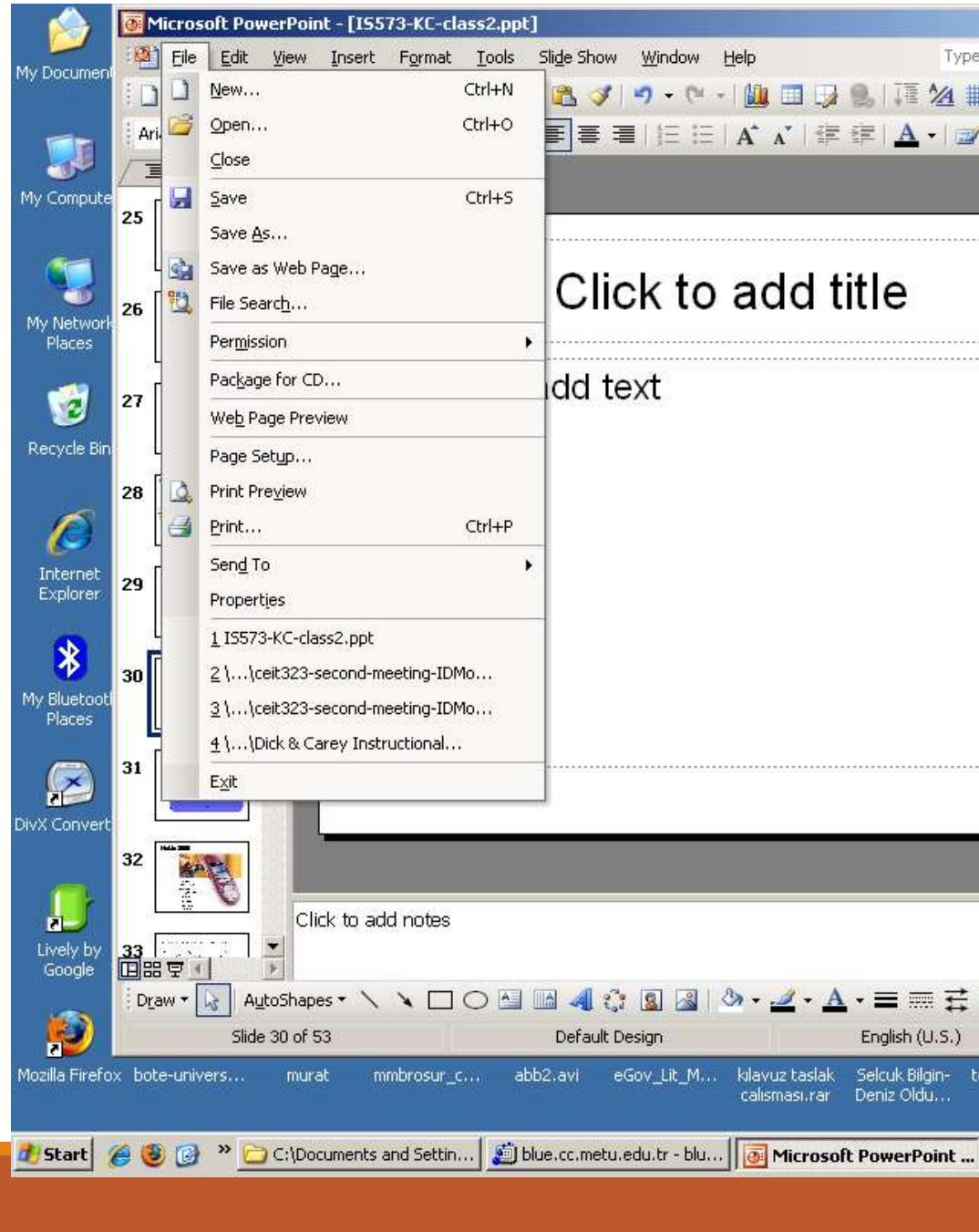
**So....**

*Good Designs do not always  
win!*

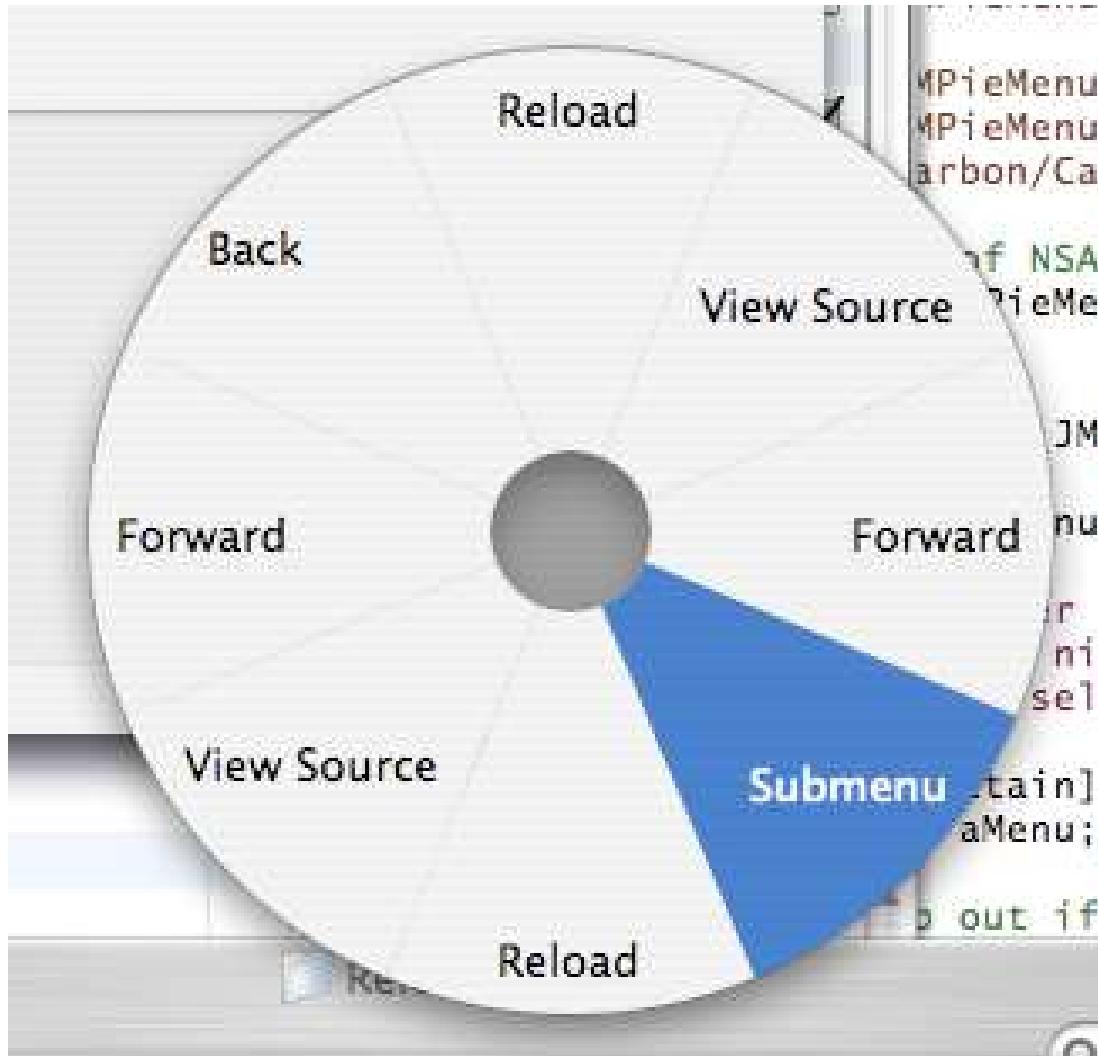
# KALQ Keyboard

- typing with thumbs
  - 34% increase in speed of typing
- 
- Path dependence?
  - "history matters"



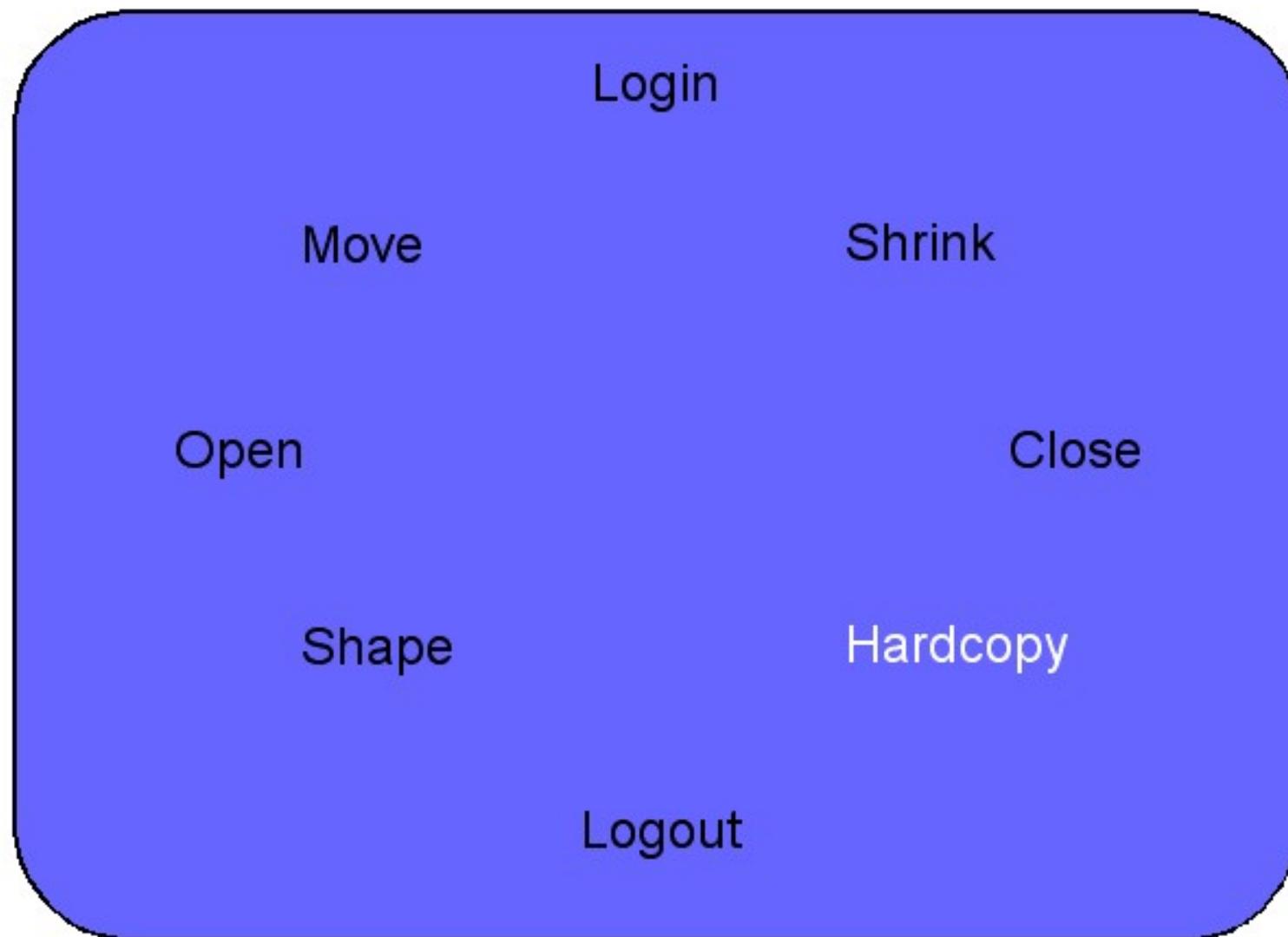


# Only/Best Solution?



How about this one?

*The Pie Menu (see Shneiderman 1993)*



# Nokia 3650



**Everyone  
Has a Story**

**Nokia 3650 Phone:**

- Video capture and playback
- Still imaging
- Multimedia messaging
- Java™ MIDP 1.0
- Bluetooth
- Large color display
- Tri-band world phone

Fuchsia, SKR-323

# Usability of interactive systems:

Ben Shneiderman. Ch-3 Guidelines, Principles, Theories

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## 1. Style Guidelines,

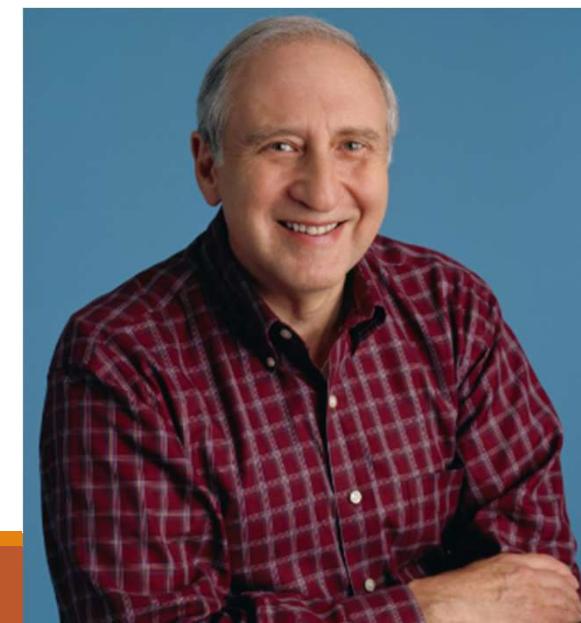
- Low-level focused advice about good practices

## 2. Principles,

- Middle-level strategies or rules to analyze and compare design alternatives

## 3. Theories

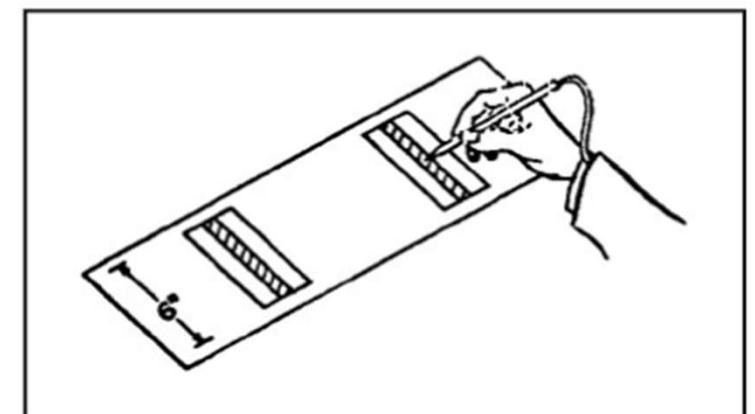
- High-level widely applicable frameworks



# Interaction at Low Level: Fitts' Law

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- 1954, psychologist Paul Fitts
- model of human movement
- time required to move to a target depends on the distance to it yet relates inversely to its size.
- fast movements and small targets result in greater error rates

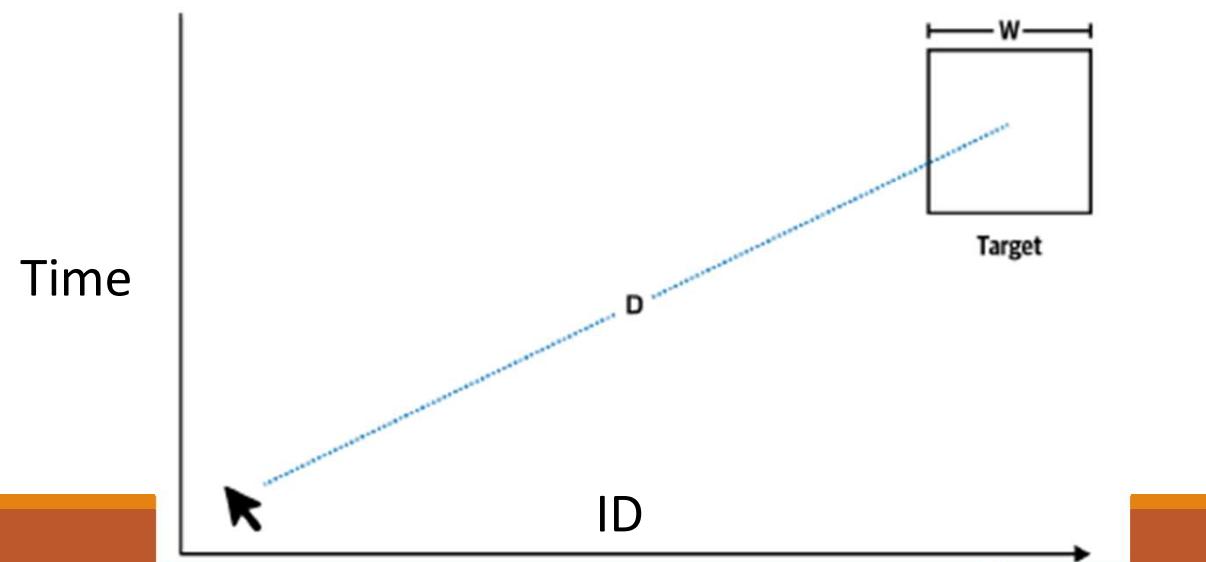


Reciprocal Tapping Apparatus

# Fitts's Law

- Movement task's difficulty is a function of distance to move (D) and width of target (W):
- Index of Difficulty (ID) =  $\log_2 (2D / W)$
- Movement time (MT) is derived from ID for given data sample

- $MT = a + b \log_2 (2D / W)$
- a and b constants for device



# TCDD Train Ticket App (Last year)

**Yolcu Bilgileri**

	Ad / Soyad *	TC Kimlik No / Pasaport No	Cinsiyet	Tarife / Doğum Tarihi(gün/ay/yıl)	Tren Bilgileri	Vagon / Koltuk	Ek Hizmet	Ücret
1. Yolcu	KÜRŞAT ÇAĞILTAY	<input type="text"/> TC vatandaş değilim <input type="checkbox"/>	<input checked="" type="radio"/> Erkek <input type="radio"/> Kadın	TAM (ADULT) <input type="button" value="Doğum Tarihi(gün/ay)"/>	GİDİŞ ANKARA-İSTANBUL 24.10.2022 18:25	Seçilmedi/Seçilmedi StandartBilet Ankara Gar - Gebze	<input type="button" value="Seç"/>	

Değişiklik için Seçilen Biletlerin Toplam Ücreti : ₺ 646,00 TL

**İletişim Bilgileri**

Cep Telefonu E-Posta

kursat.cagiltay@sabanciuniv.edu

Bilet Bilgilerinin Tek Kişiye Gönderilmesini İstiyorum  
 Bilet Bilgilerinin Ayn Ayn Gönderilmesini İstiyorum

Yolcu Bilgileri								
	Ad / Soyad *	TC Kimlik No / Pasaport No	Cinsiyet	Tarife / Doğum Tarihi(gün/ay/yıl)	Tren Bilgileri	Vagon / Koltuk	Ek Hizmet	Ücret
1. Yolcu	KÜRSAT ÇAĞILTAY	<input type="text"/> TC vatandaşlığı değilim <input type="checkbox"/>	<input checked="" type="radio"/> Erkek <input type="radio"/> Kadın	TAM (ADULT) Doğum Tarihi(gün/ay)	GİDİŞ ANKARA-İSTANBUL 24.10.2022 18:25	Seçilmedi/Seçilmedi StandartBilet Ankara Gar - Gebze	<input type="button"/> <b>Seç</b>	

Değişiklik İçin Seçilen Biletlere Toplam Ücreti : ₺ 646,00 TL

İletişim Bilgileri	
Cep Telefonu	E-Posta
<input type="text"/>	<input type="text"/> kursat.cagiltay@sabanciuniv.edu
<input checked="" type="radio"/> Bilet Bilgilerinin Tek Kişiye Gönderilmesini İstiyorum <input type="radio"/> Bilet Bilgilerinin Aynı Aynı Gönderilmesini İstiyorum	
<input type="button"/> Geri	<input type="button"/> Devam

- ID for «Devam» button task?
- D= 22 cm
- W= 2.5 cm
- ID=  $\log_2 (2*22/2.5) = \log_2 (17.6) = 4.13$

Yolcu Bilgileri								
	Ad / Soyad *	TC Kimlik No / Pasaport No	Cinsiyet	Tarife / Doğum Tarihi(gün/ay/yıl)	Tren Bilgileri	Vagon / Koltuk	Ek Hizmet	Ücret
1. Yolcu	KÜRŞAT ÇAĞILTAY	<input type="text"/> TC vatandaşlığı değilim <input type="checkbox"/>	<input checked="" type="radio"/> Erkek <input type="radio"/> Kadın	TAM (ADULT) Doğum Tarihi(gün/ay)	Gidiş ANKARA-İSTANBUL 24.10.2022 18:25	Seçilmedi/Seçilmedi StandartBilet Ankara Gar - Gebze	<input type="button"/> Seç	

**Değişiklik İçin Seçilen Biletlere Toplam Ücreti : ₺ 646,00 TL**

İletişim Bilgileri	
Cep Telefonu	E-Posta
<input type="text"/>	<input type="text"/> kursat.cagiltay@sabanciuniv.edu
<input checked="" type="radio"/> Bilet Bilgilerinin Tek Kişiye Gönderilmesini İstiyorum <input type="radio"/> Bilet Bilgilerinin Aynen Gönderilmesini İstiyorum	
<a href="#" style="border: 1px solid #00AEEF; border-radius: 15px; padding: 5px 15px;">Geri</a> <span style="margin: 0 10px;"></span> <a href="#" style="border: 1px solid #00AEEF; border-radius: 15px; padding: 5px 15px;">Devam</a>	

- ID for «Devam» button?
- D= 3 cm
- W= 2.5 cm
- ID=  $\log_2 (2 \cdot 3 / 2.5) = \log_2 (2.4) = 1.26$

Yolcu Bilgileri								
	Ad / Soyad *	TC Kimlik No / Pasaport No	Cinsiyet	Tarife / Doğum Tarihi(gün/ay/yıl)	Tren Bilgileri	Vagon / Koltuk	Ek Hizmet	Ücret
1. Yolcu	KÜRSAT ÇAĞILTAY	<input type="text"/> TC vatandaşlığı değilim <input type="checkbox"/>	<input checked="" type="radio"/> Erkek <input type="radio"/> Kadın	TAM (ADULT) Doğum Tarihi(gün/ay)	Gidiş ANKARA-İSTANBUL 24.10.2022 18:25	Seçilmedi/Seçilmedi StandartBilet Ankara Gar - Gebze	<input type="button"/> Seç	

Değişiklik İçin Seçilen Biletlere Toplam Ücreti : ₺ 646,00 TL

İletişim Bilgileri	
Cep Telefonu	E-Posta
<input type="text"/>	<input type="text"/> kursat.cagiltay@sabanciuniv.edu
<input checked="" type="radio"/> Bilet Bilgilerinin Tek Kişiye Gönderilmesini İstiyorum <input type="radio"/> Bilet Bilgilerinin Aynı Ayrı Gönderilmesini İstiyorum	
<input type="button"/> Geri <input type="button"/> Devam	

- What if I increase the size of the button?
- D= 22 cm
- W= 5 cm
- ID=  $\log_2 (2*22/5) = \log_2 (8.8) = 3.13$
- Down from 4.13 to 3.13
- Aesthetics?

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Convert

# Low ID, but is it OK?

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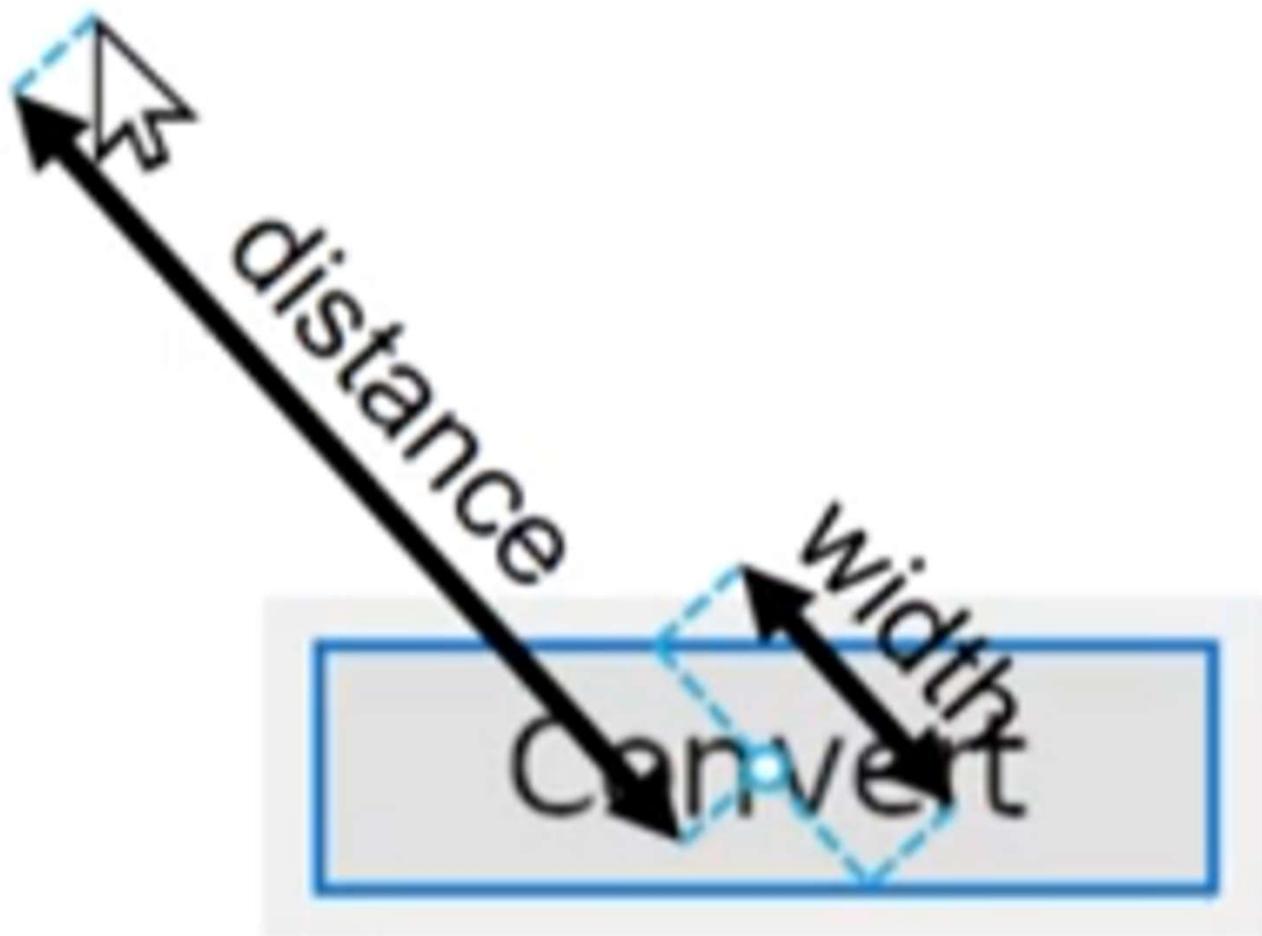


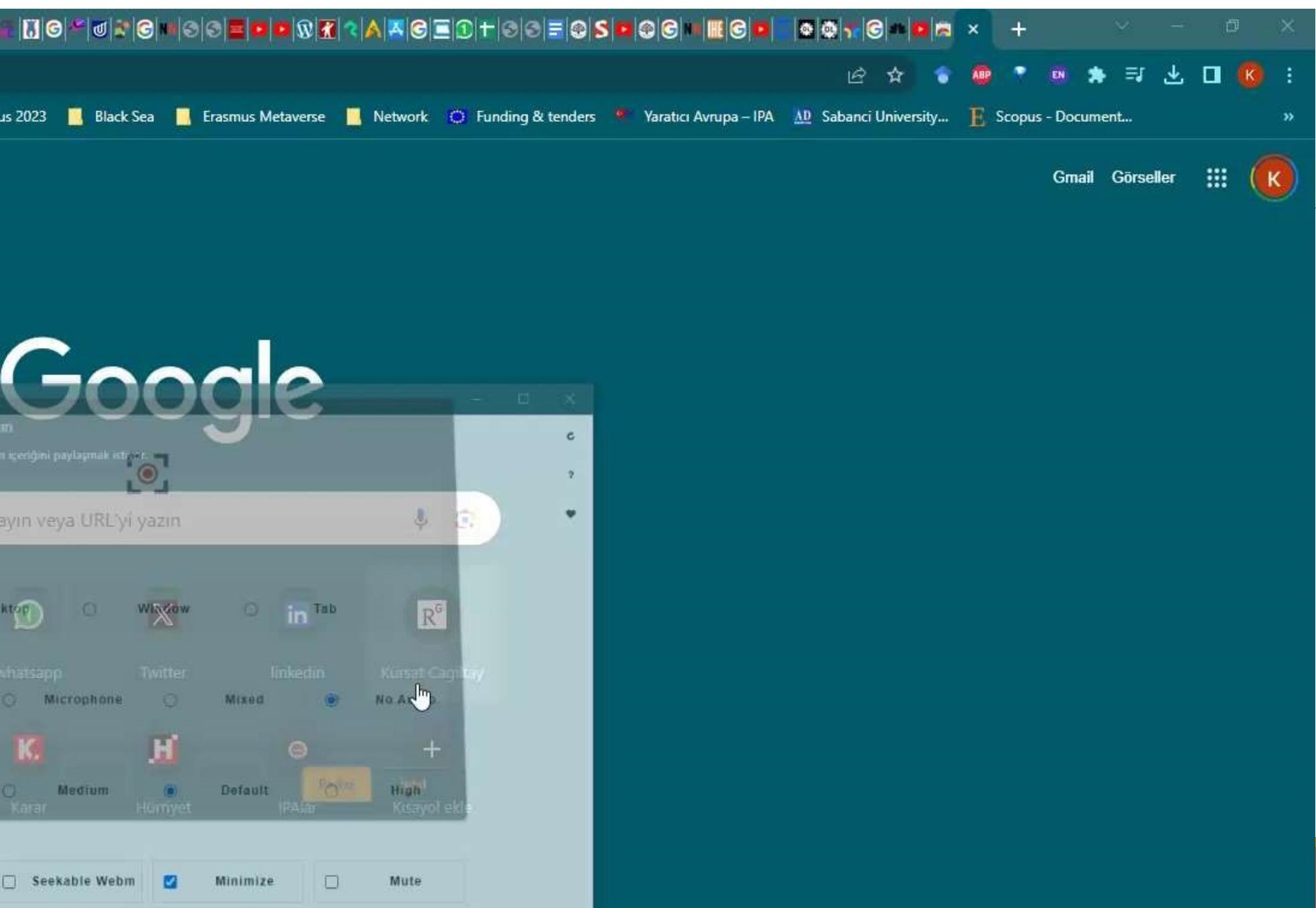
 distance



 Convert

 width

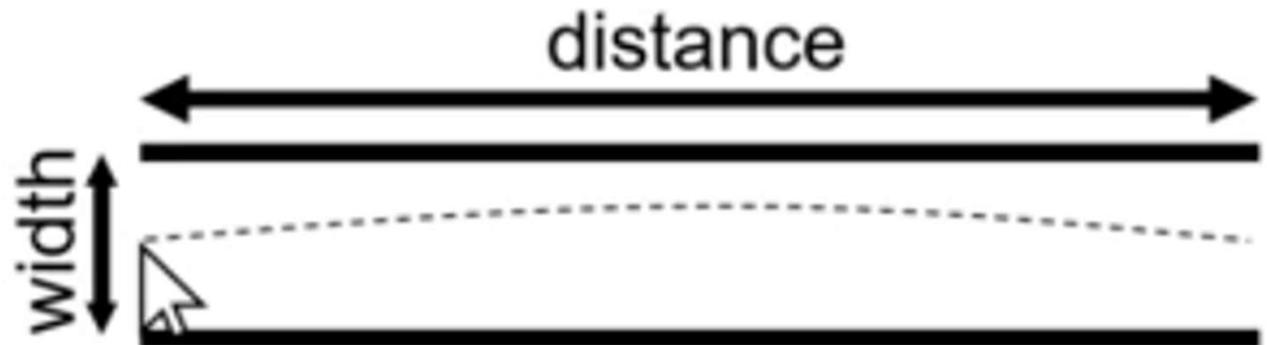




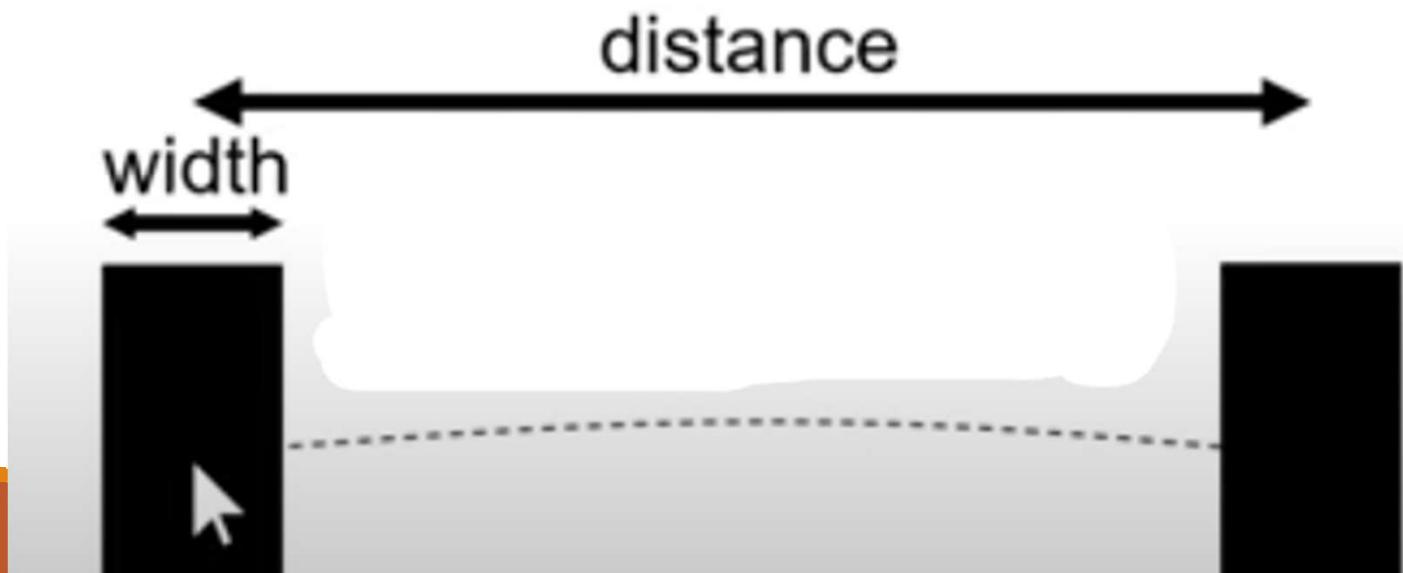
# Steering through Tunnels Law

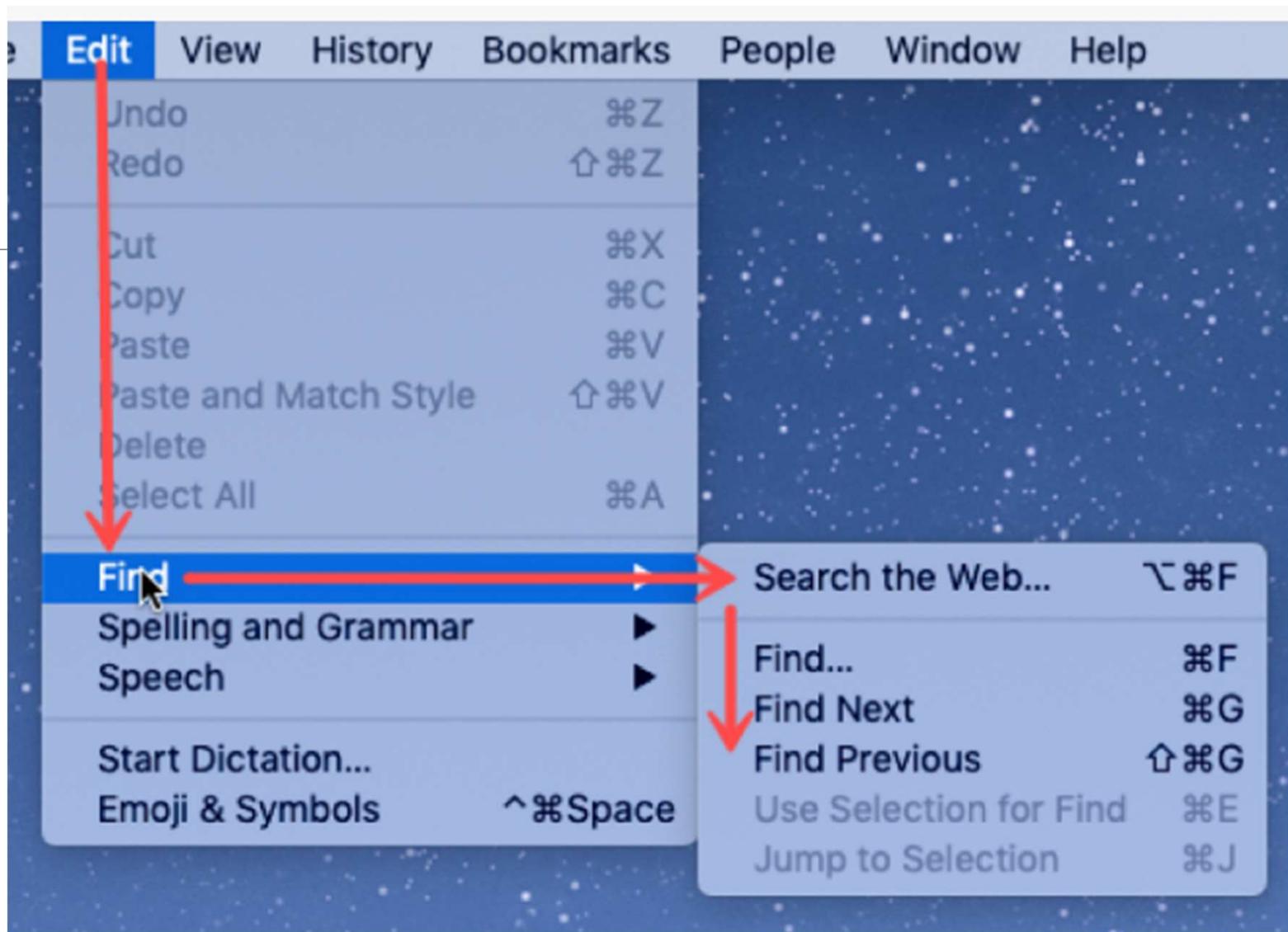
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$$MT = a + b (D / W)$$

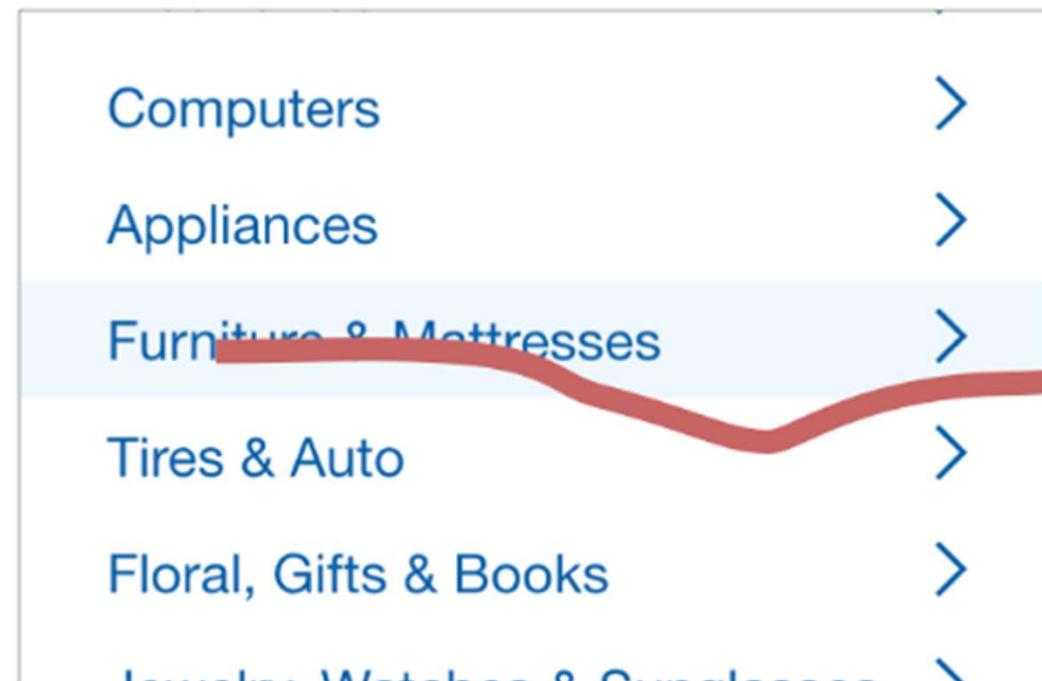


$$MT = a + b \log_2 (2D / W)$$





Shop All Departments	
Electronics	>
Computers	>
Appliances	>
Furniture & Mattresses	>
Tires & Auto	>
Floral, Gifts & Books	>
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Patio, Lawn & Garden	>
Home Improvement	>
Home & Kitchen	>
Office Products	>
Clothing, Luggage & Handbags	>
Health & Beauty	>
Baby, Kids & Toys	>
Grocery & Household	>
Sports & Fitness	>
View More Categories	>



# Where did we use them?

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- Turkish Army – Air Defense Command Control System

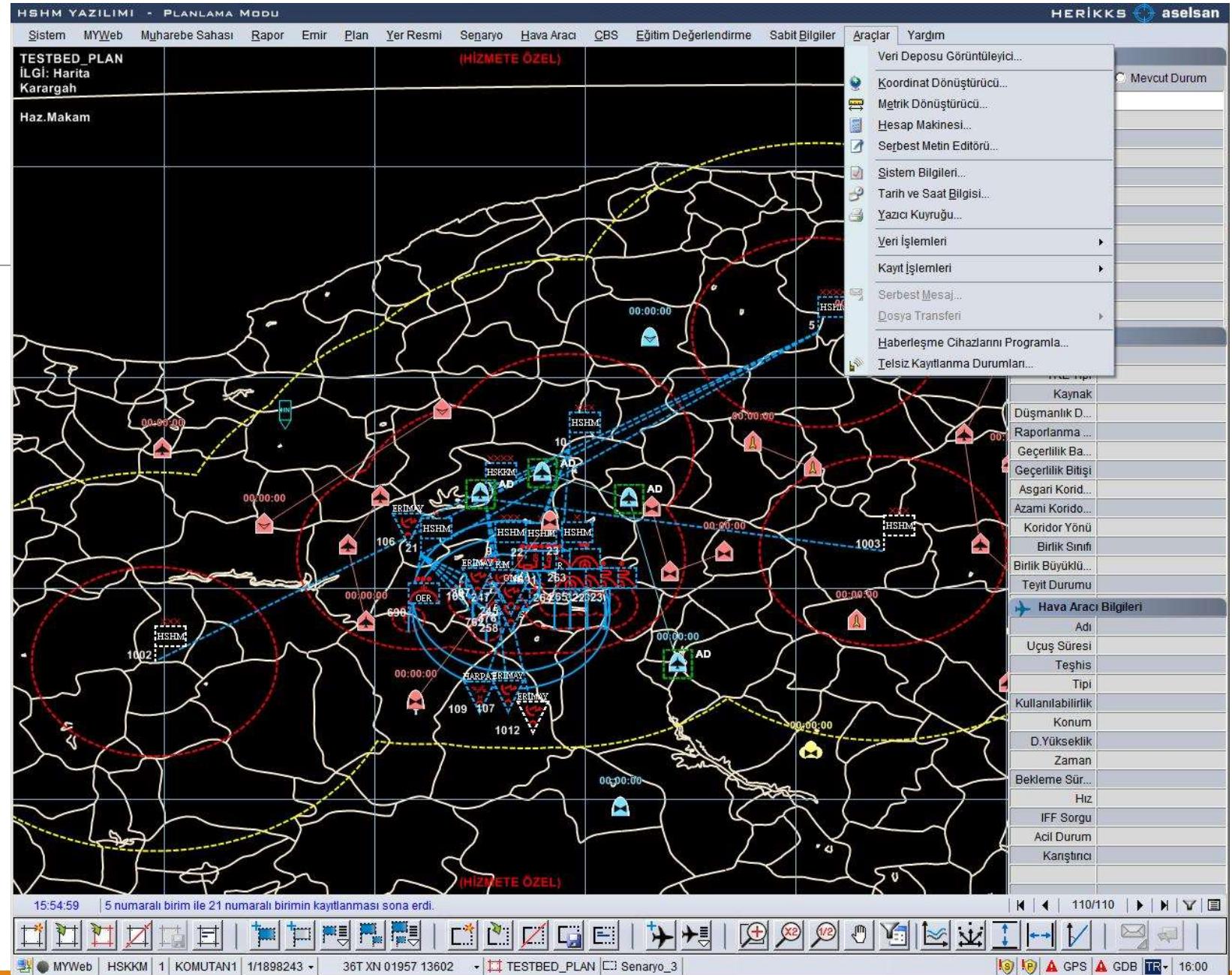
**aselsan**

HAVA SAVUNMA KOMUTA  
KONTROL YAZILIMLARI  
GRAFİKSEL KULLANICI  
ARAYÜZÜ TASARIM  
İYİLEŞTİRME PROJESİ

Mevcut Yazılımların Kullanıcı Arayüzlerinin Uzman  
Temelli Değerlendirilmesi

Proje Çıktısı Tasarım Önerileri Dokümanı

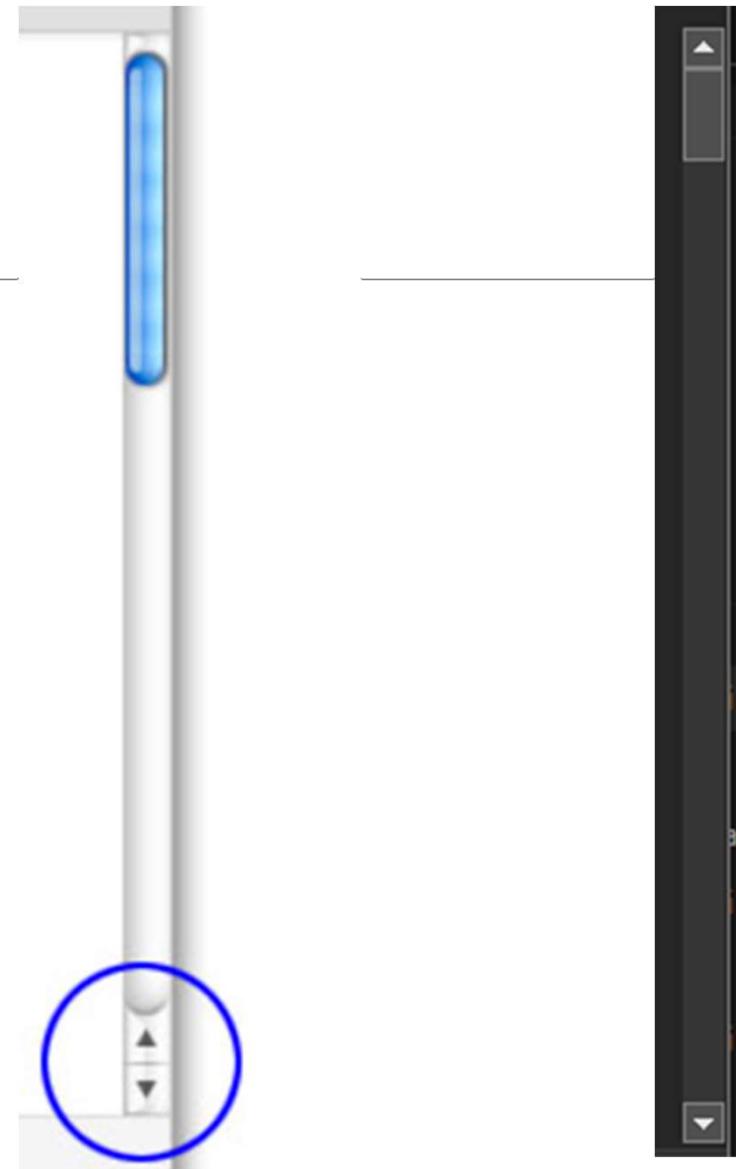
- No shortcuts
- Menu can only be used by mouse



# Case studies e.g.-

## Gray et al (1992)

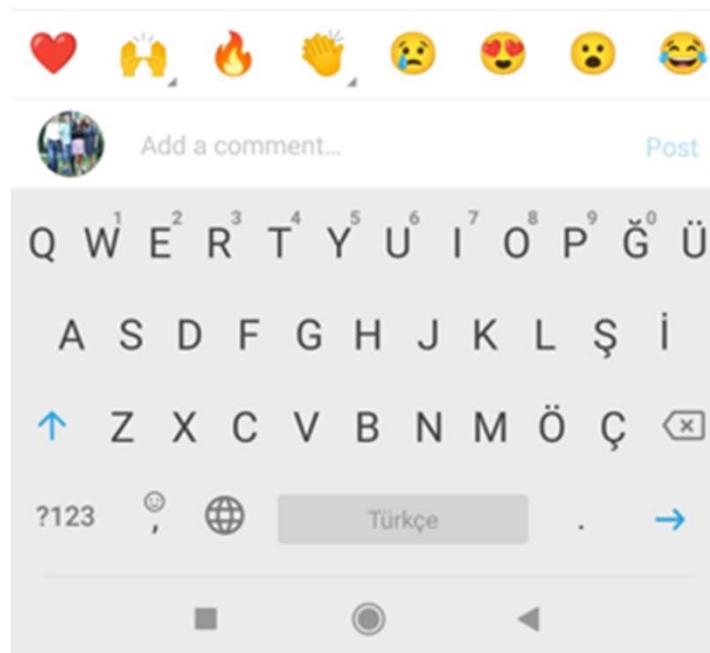
- NYNEX TAO operators and GOMS
- Compared existing with proposed system
- 1 sec delay in use costs \$3million per year
- Real trial = 12 new systems installed for 6 months
- Analysts modeled existing performance from real data, and predicted performance on new system from specification



- Index of Difficulty?

# Can you design an alternative keyboard for Turkish? What do you need?

---



# You need a text corpus...

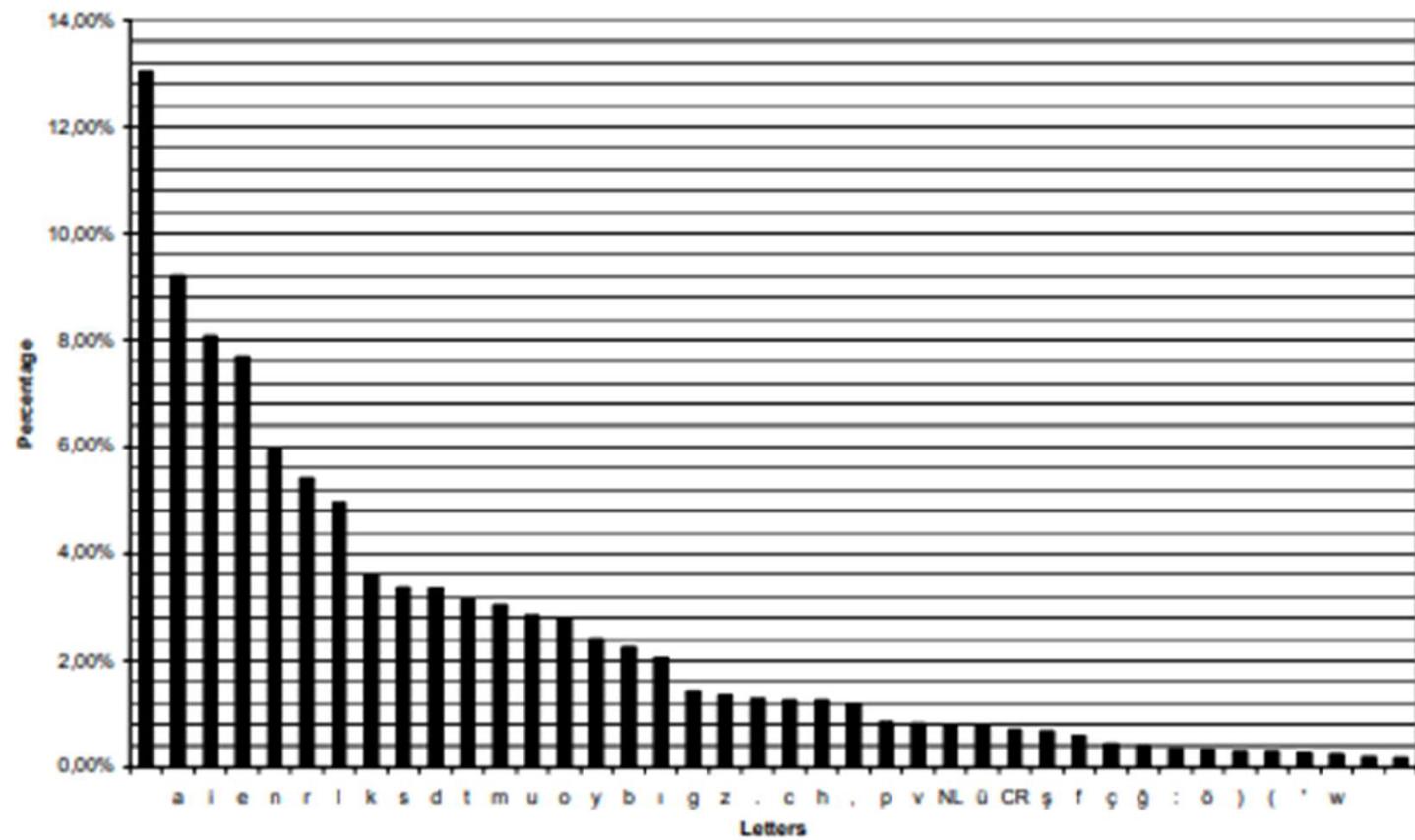
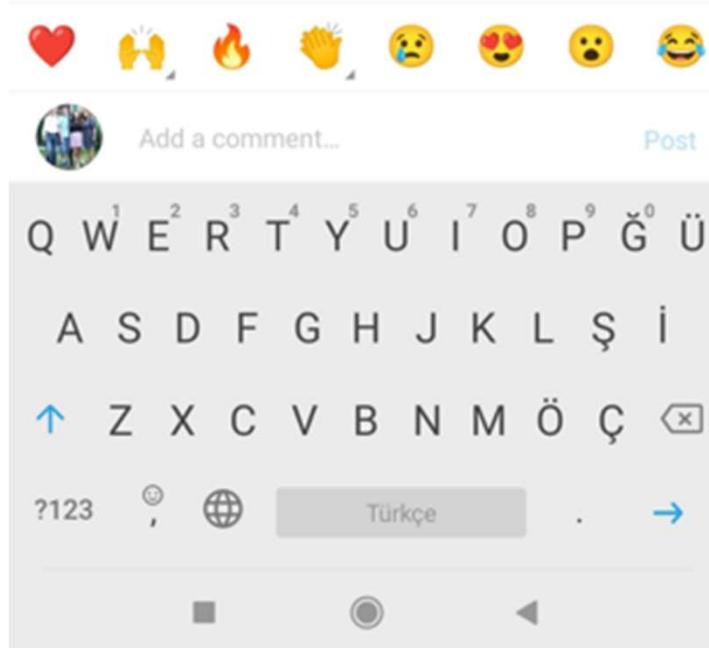
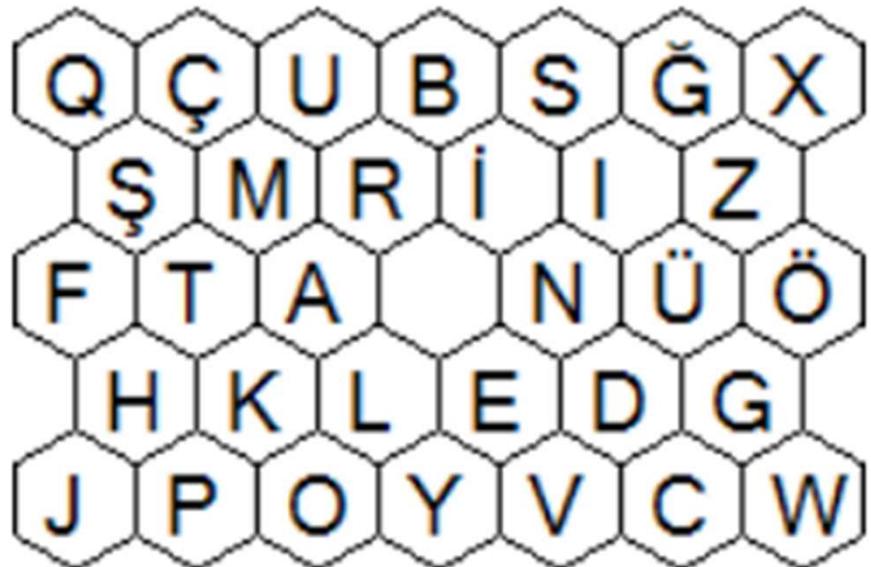


Figure 7 *ekSi sözlük* letter frequencies

# How about this? (2004)

- Turkish Keyboard optimized by using Fitts's Law on Metropolis algorithm and KL heuristic
- 40.95 word per minute (wpm)
- Standard keyboard: 27.24 wpm
- Why don't we use it?



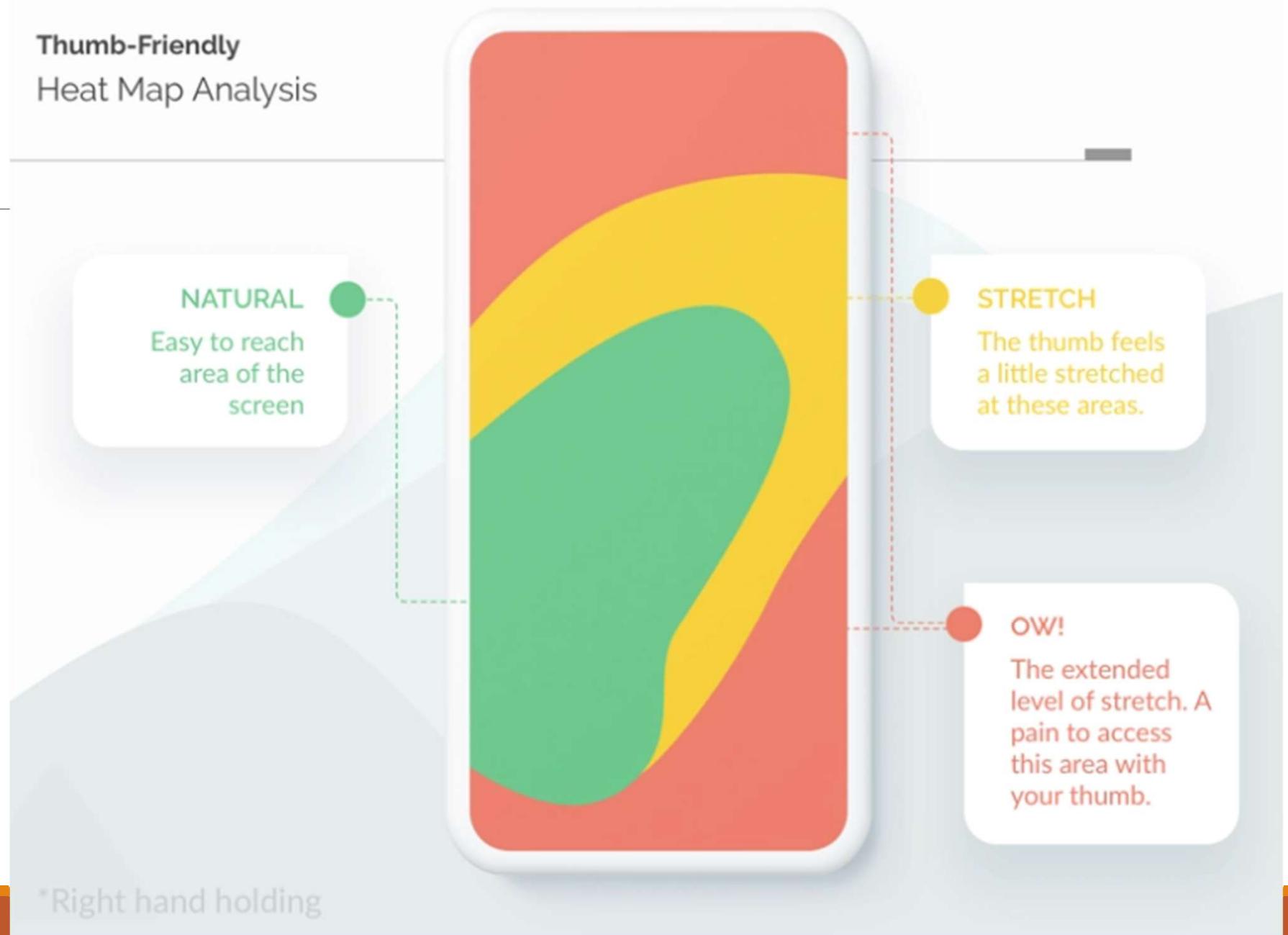
**Sinan Ussakli** · 2nd  
Senior Software Engineer Lead at Microsoft  
Redmond, Washington, United States · [Contact info](#)

# Today

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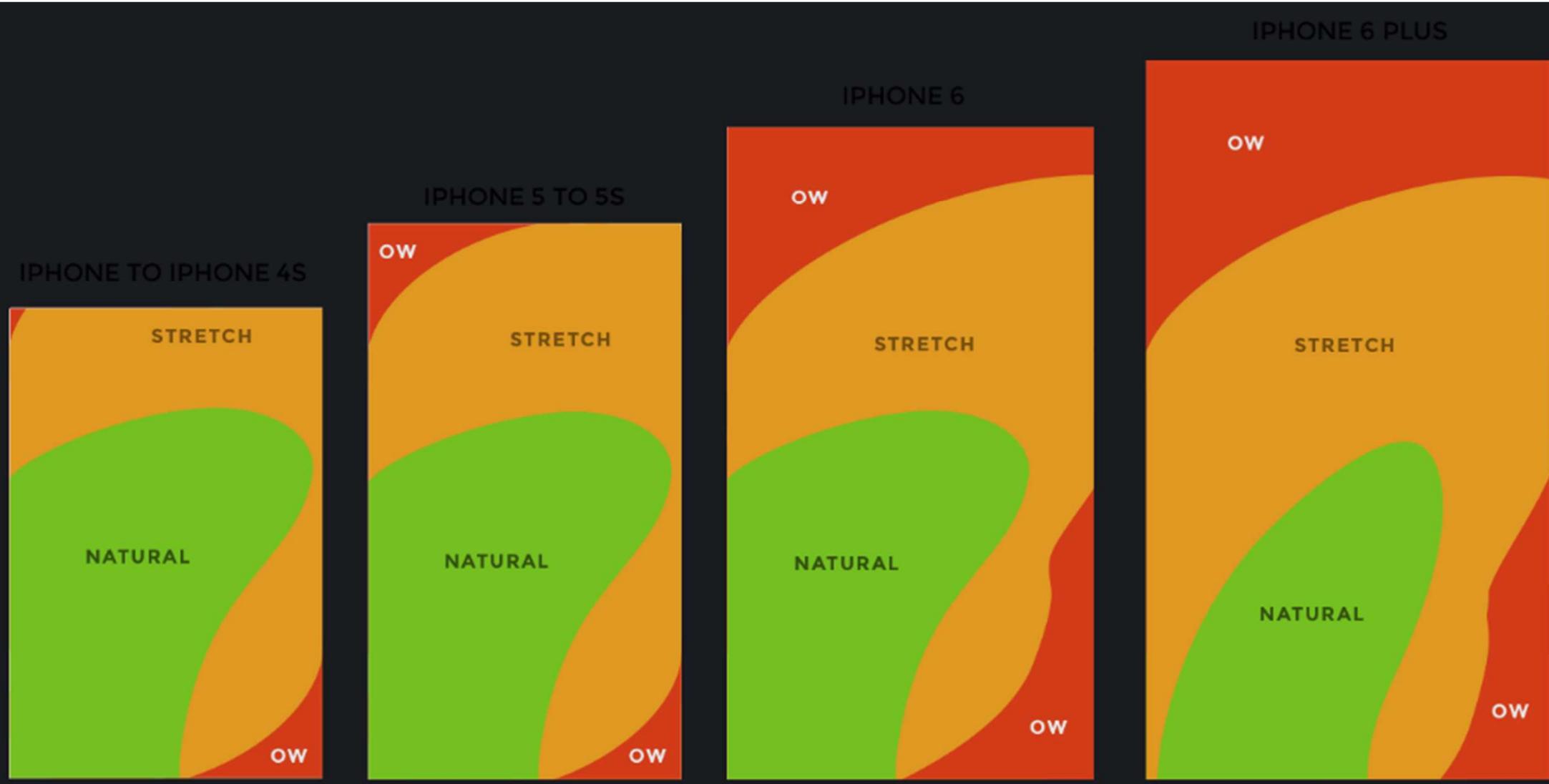
The advertisement features a smartphone displaying the Typewise Keyboard interface. The phone screen shows a hexagonal keyboard layout with letters A through Z and symbols like !, ?, ., and ,. Above the keyboard, a speech bubble contains the text "We got some great press coverage!" and a small camera icon. Below the keyboard, another speech bubble says "You should try Typewise!" with a thumbs-up emoji. To the right of the phone, a green button-like shape contains the text "REALLY?!!! 😱". On the left side of the phone, there's a blue header with the Typewise logo and the text "THE NEXT GENERATION KEYBOARD". Below this, four bullet points are listed: "TYPE 33% FASTER", "4X FEWER TYPOS", "BE SURE EVERYTHING YOU TYPE IS 100% PRIVATE", and "ENJOY 19 COLORFUL THEMES".

## Thumb-Friendly Heat Map Analysis

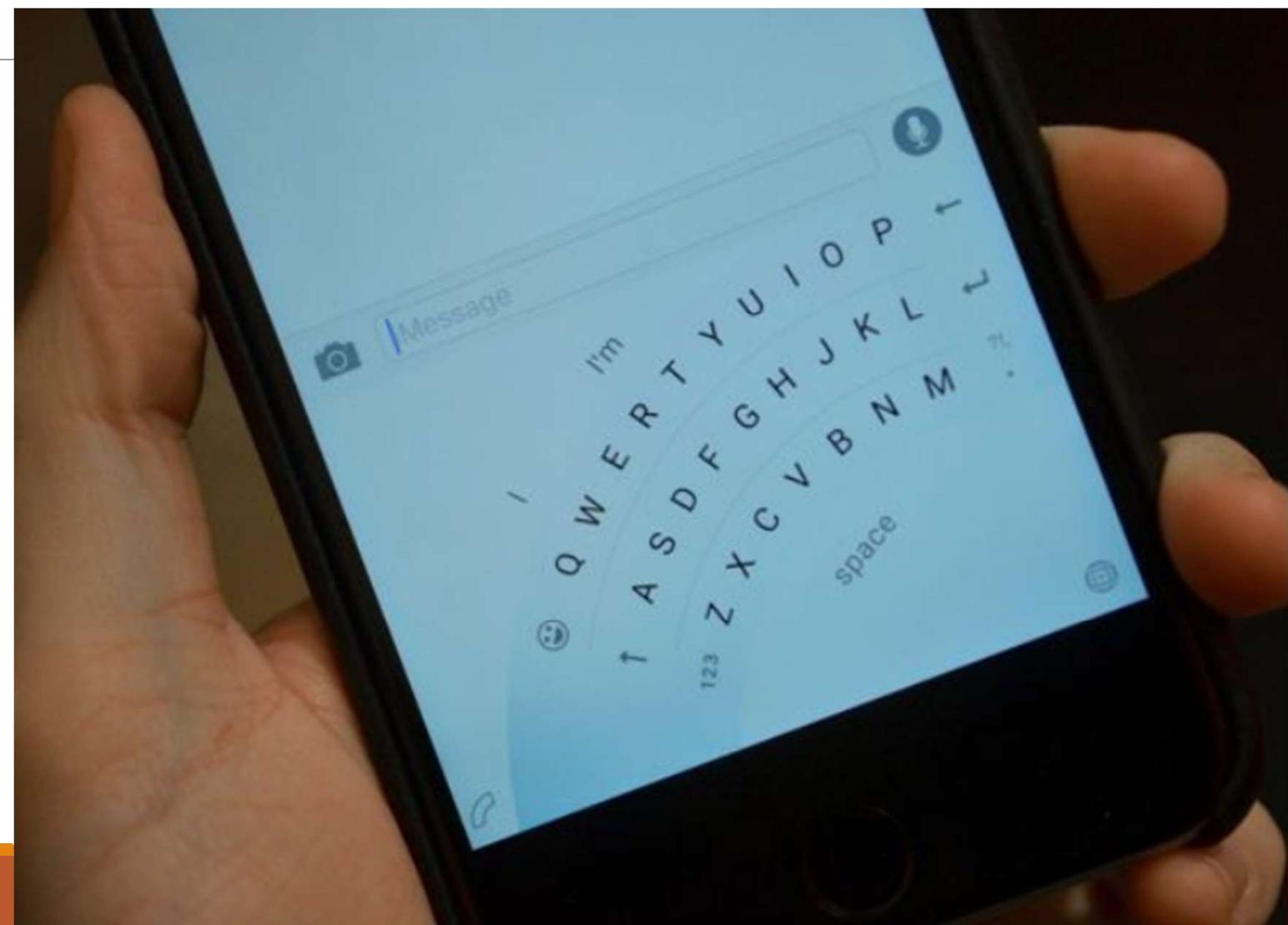
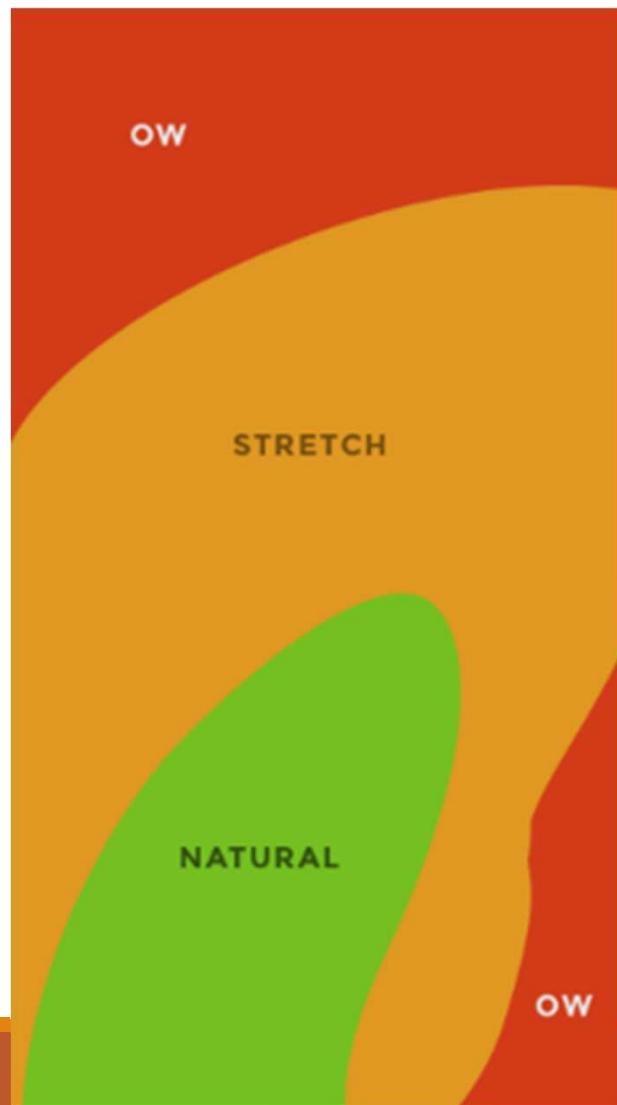




# Thumb Zone heat maps for iPhones: ID is going up



# Microsoft's curved keyboard



## Week-4 Usability Engineering



FILE

Week-4 Usability Engineering -Ch2 What is Usability Jacob Nielsen



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Week-4 ISO 9241-11 Guidance on Usability

