

Módulo 7

DESENHAR PARA A USABILIDADE



Exemplo...

The screenshot shows a web-based voting system interface. At the top, there's a navigation bar with links for 'OS MEUS PROCESSOS ELEITORAIS', 'DADOS PESSOAIS', 'MENSAGENS (8)', and 'HISTÓRICO'. The main content area is titled 'CONSULTA DAS REFERÊNCIAS DE VOTO' (Vote Reference Inquiry). It contains a text input field with the placeholder 'Insira a sua referência de voto e valide se o seu voto foi contabilizado.' (Insert your vote reference and validate if your vote was counted.) and a blue 'VALIDAR' (Validate) button with a magnifying glass icon. Below this, a section titled 'Lista de referências de voto' (List of vote references) displays a list of vote references, each preceded by a small blue square icon containing a white question mark. The references listed are:

- 13d4d4b87661c8e7f2f83d74aced3f93a8ee63e4fb3236b6b96f4021e48a4e⁷⁶
- 13d4d4b87661c8e7f2f83d74aced3f93a8ee63e4fb3236b6b96f4021e48a4e²³
- 13d4d4b87661c8e7f2f83d74aced3f93a8ee63e4fb3236b6b96f4021e48a4e⁶⁷
- 13d4d4b87661c8e7f2f83d74aced3f93a8ee63e4fb3236b6b96f4021e48a4e⁶⁷

Exemplo...

The screenshot shows a web-based voting system interface. At the top, there's a navigation bar with links for 'OS MEUS PROCESSOS ELEITORAIS', 'DADOS PESSOAIS', 'MENSAGENS (8)', and 'HISTÓRICO'. The main content area is titled 'CONSULTA DAS REFERÊNCIAS DE VOTO' (Vote Reference Inquiry). It includes a note: 'Insira a sua referência de voto e valide se o seu voto foi contabilizado.' Below this is a search input field containing the reference code '13d4d4b87661c8e7f2f83d74aced3f93a8ee63e4fb3236b6b96f4021e48a4e76' and a blue 'VALIDAR' (Validate) button with a magnifying glass icon. Below the search area, a section titled 'Lista de referências de voto' (List of vote references) displays four rows of reference codes, each ending with a superscripted character: '23', 'e7', and 'e7'. The reference codes are: '13d4d4b87661c8e7f2f83d74aced3f93a8ee63e4fb3236b6b96f4021e48a4e76', '13d4d4b87661c8e7f2f83d74aced3f93a8ee63e4fb3236b6b96f4021e48a4e²³', '13d4d4b87661c8e7f2f83d74aced3f93a8ee63e4fb3236b6b96f4021e48a4e^{e7}', and '13d4d4b87661c8e7f2f83d74aced3f93a8ee63e4fb3236b6b96f4021e48a4e^{e7}'.

Exemplo...

The image shows two screenshots of the e-votUM voting system interface. Both screenshots are identical, displaying the 'Consulta das referências de voto' (Vote Reference Inquiry) page.

The top navigation bar includes links for 'OS MEUS PROCESSOS ELEITORAIS', 'DADOS PESSOAIS', 'MENSAGENS (8)', and 'HISTÓRICO'. The user's name, 'José Francisco Grela da Freitas Campos', is displayed at the top right.

The main content area has a heading 'CONSULTA DAS REFERÊNCIAS DE VOTO' and a note: 'Insira a sua referência de voto e valide se o seu voto foi contabilizado.' Below this is a text input field containing the reference code '13d4d4b87661c8e7f2f83d74aced3f93a8ee63e4fb3236b6b96f4021e48a4e76'. To the right of the input field is a blue button labeled 'VALIDAR' with a magnifying glass icon.

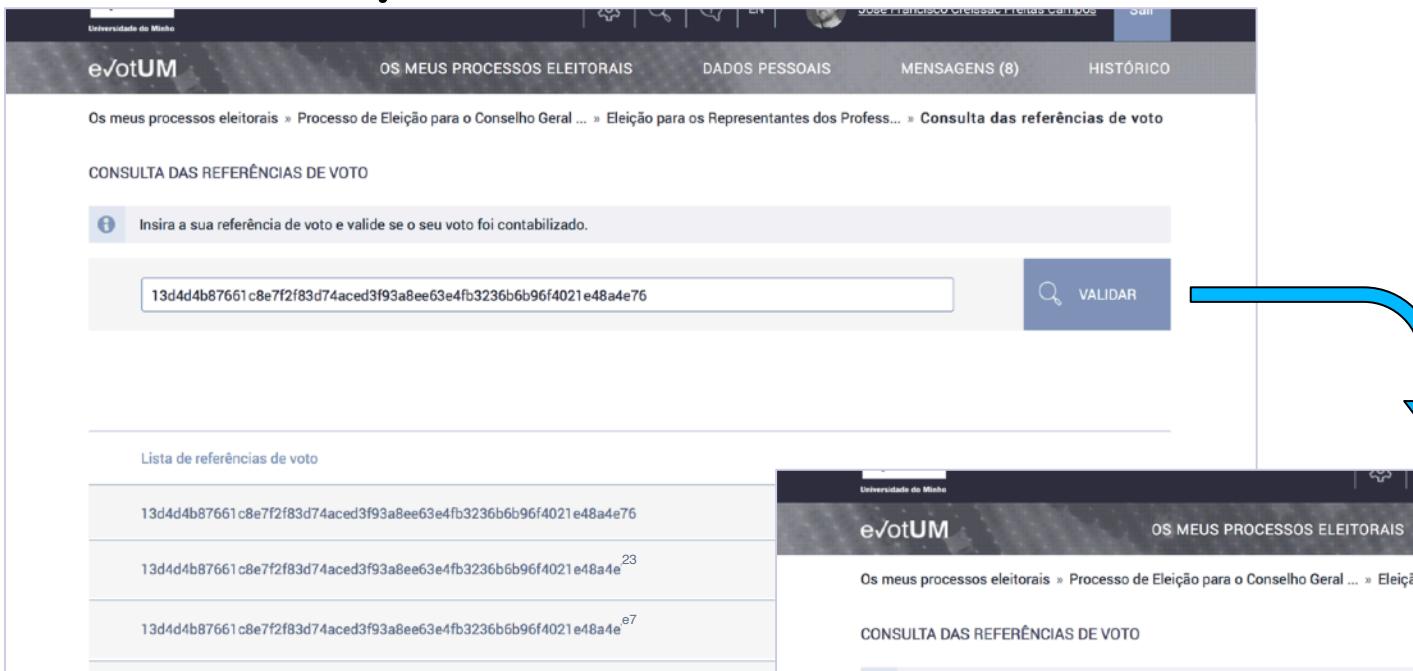
A large blue arrow points from the input field in the first screenshot to the same input field in the second screenshot, highlighting the comparison between the two instances.

The bottom section displays a table titled 'Lista de referências de voto' (List of vote references) with one row:

13d4d4b87661c8e7f2f83d74aced3f93a8ee63e4fb3236b6b96f4021e48a4e ²³
--

The second screenshot shows the same interface and data, with the blue arrow pointing from the input field to the input field.

Exemplo...



Universidade do Minho

e-votUM OS MEUS PROCESSOS ELEITORAIS DADOS PESSOAIS MENSAGENS (8) HISTÓRICO

Os meus processos eleitorais » Processo de Eleição para o Conselho Geral ... » Eleição para os Representantes dos Profess... » Consulta das referências de voto

CONSULTA DAS REFERÊNCIAS DE VOTO

Insira a sua referência de voto e valide se o seu voto foi contabilizado.

13d4d4b87661c8e7f2f83d74aced3f93a8ee63e4fb3236b6b96f4021e48a4e76

VALIDAR

Lista de referências de voto

13d4d4b87661c8e7f2f83d74aced3f93a8ee63e4fb3236b6b96f4021e48a4e²³

13d4d4b87661c8e7f2f83d74aced3f93a8ee63e4fb3236b6b96f4021e48a4e²⁷

13d4d4b87661c8e7f2f83d74aced3f93a8ee63e4fb3236b6b96f4021e48a4e²⁷

O seu voto foi contabilizado com sucesso!

Universidade do Minho

e-votUM OS MEUS PROCESSOS ELEITORAIS DADOS PESSOAIS MENSAGENS (8) HISTÓRICO

Os meus processos eleitorais » Processo de Eleição para o Conselho Geral ... » Eleição para os Representantes dos Profess... » Consulta das referências de voto

CONSULTA DAS REFERÊNCIAS DE VOTO

Insira a sua referência de voto e valide se o seu voto foi contabilizado.

13d4d4b87661c8e7f2f83d74aced3f93a8ee63e4fb3236b6b96f4021e48a4e76

VALIDAR

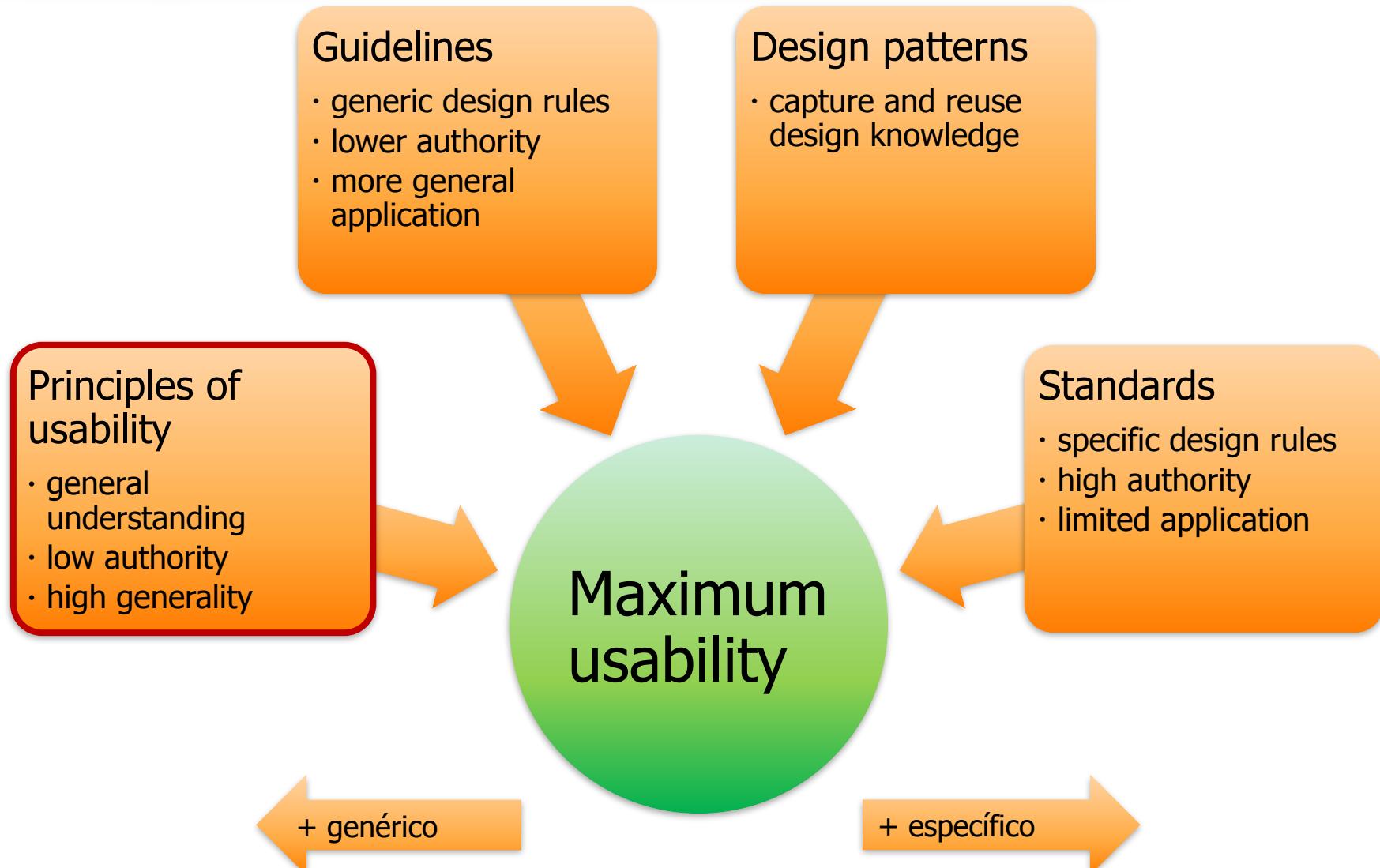
Lista de referências de voto

13d4d4b87661c8e7f2f83d74aced3f93a8ee63e4fb3236b6b96f4021e48a4e76

Mestrado Integrado em Engenharia Informática – Universidade do Minho



Designing for maximum usability



Principles for usability

Learnability

- the ease with which new users can begin effective interaction and achieve maximal performance

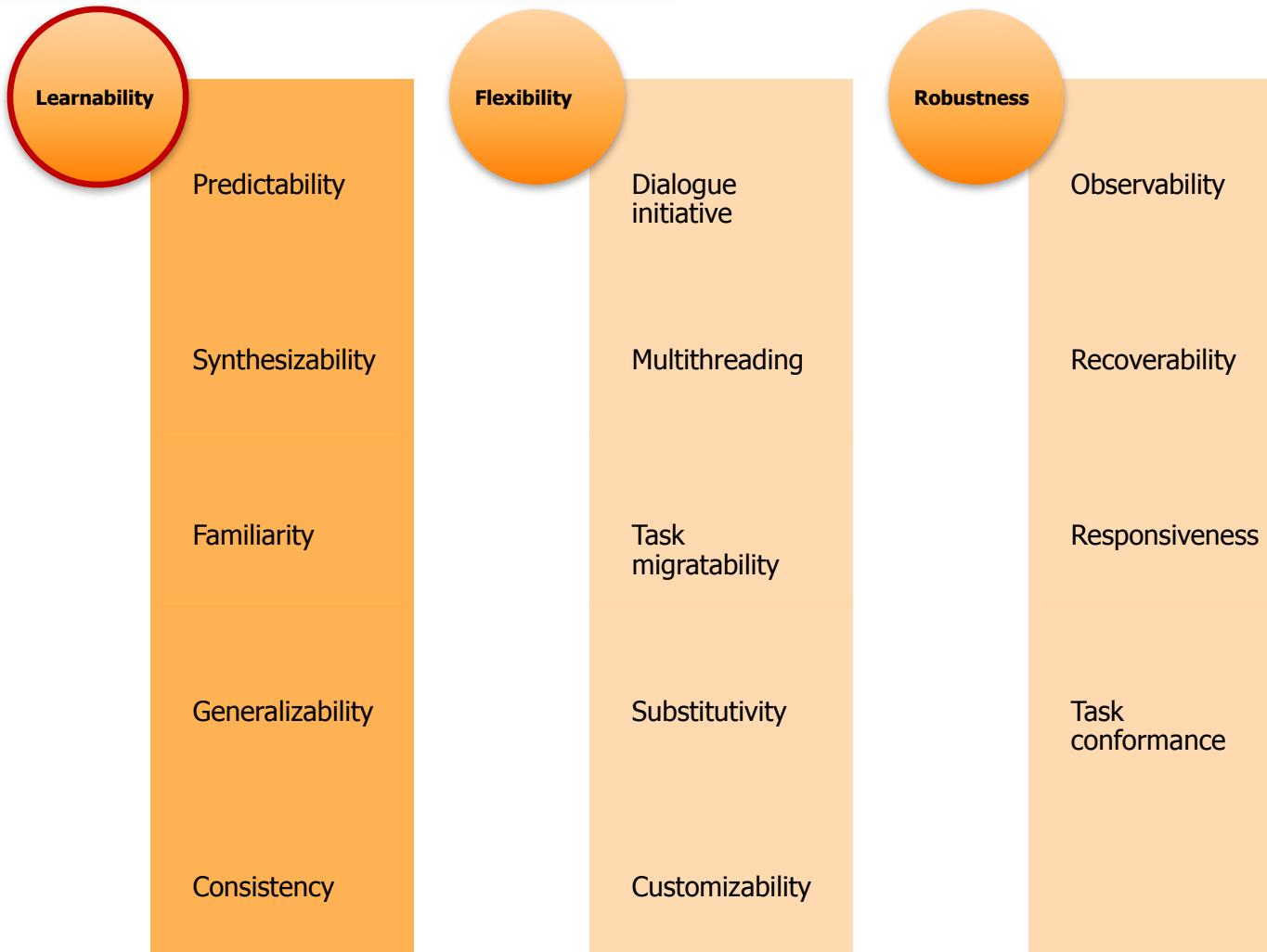
Flexibility

- the multiplicity of ways the user and system exchange information

Robustness

- the level of support provided to the user in determining successful achievement and assessment of goal-directed behaviour

Principles of usability



Principles of learnability 1/5

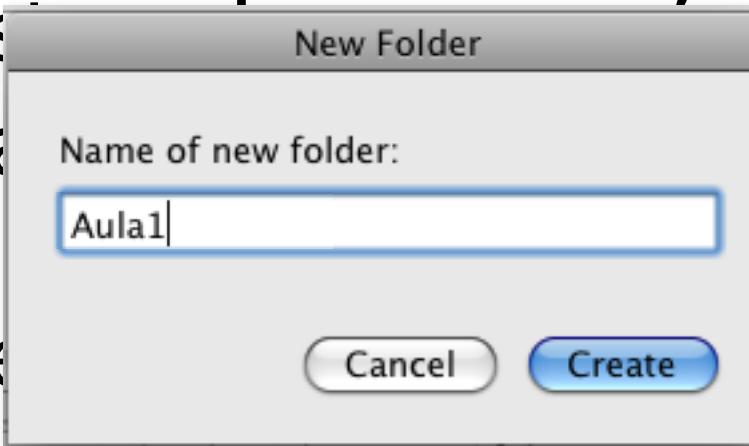
Predictability

- Ability to determine the effect of actions on the system
- Non-determinism:
 - System view vs. user's view
 - Available information enough?
- Ex.: Criar uma nova pasta no diálogo 'Save As...' (Mac)

Principles of learnability 1/5

Predictability

- Ability to determine the effect of actions on the system
- Non-determinism:

- Systematic approach
 - Available options
 - Examples
- 'Save' dialog box example:
- 
- view
ough?
no diálogo

Principles of learnability 1/5

Predictability

- Ability to determine the effect of actions on the system
- Non-determinism:

- System provides feedback
 - Available options
 - Examples
- 'Save' button
-
- New Folder
- Name of new folder:
Aula1
- Cancel Create
- New Folder
- Name of new folder:
Aula1
- This name is already taken.
- Cancel Create

Principles of learnability 1/5

Predictability

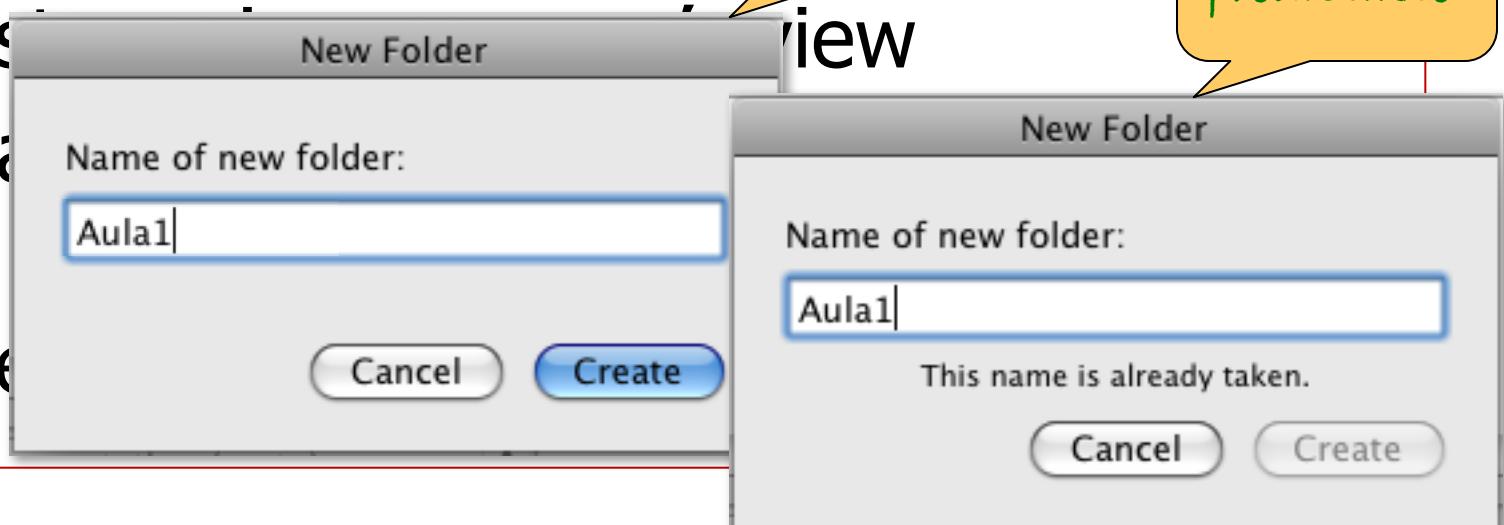
- Ability to determine the effect of actions on the system
- Non-determinism:

- System provides feedback

- Available options

- Ex.: 'Save' dialog

- 'Save' dialog



Principles of learnability 2/5

Synthesizability (of mental model)

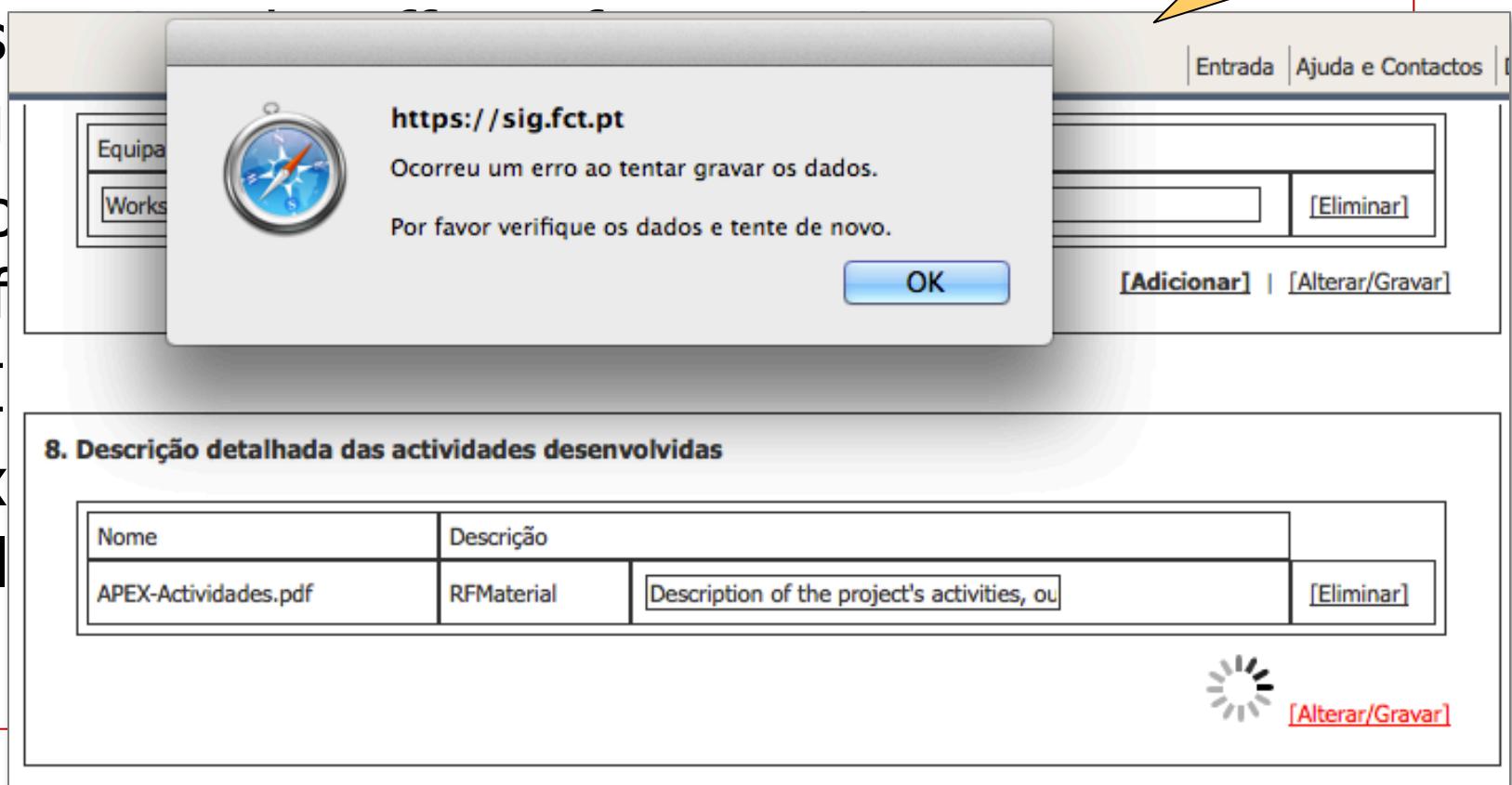
- Assessing the effect of past actions on current state
- Honesty: ability of user interface to provide information about state changes
 - Immediate vs. Eventual honesty
- Ex.: Notificação de envio de SMS num telemóvel.

Principles of learnability 2/5

Synthesizability (of mental mode)

negative example!

- Asks questions that can be answered by the user
- Has clear and consistent feedback
- Is forgiving of errors
- Extends the user's mental model



Principles of learnability 2/5

Synthesizability (of mental mode)

negative example!

- Assessing the effect of past actions on current state
- How to infer information
- Implementation
- Example: telephone system

The screenshot shows a software interface with two main sections. The top section is a table for equipment management:

Equipamento	Nº Recibo	Data	Observações
Workstation Base Valor € 250.00 €	ID-005/2011	09-06-2011	[Empty]

Buttons at the bottom right of this section are [Adicionar] and [Alterar/Gravar].

The bottom section is a table for detailed activity descriptions:

8. Descrição detalhada das actividades desenvolvidas	
Nome	Descrição
APEX-Actividades.pdf	RFMaterial Description of the activities, outputs and

Buttons at the bottom right of this section are [Alterar/Gravar] and [Eliminar]. A red message at the bottom right says "Dados Gravados com sucesso!".

Principles of learnability 3/5

Familiarity

- How prior knowledge applies to a new system
 - about the world
 - about other systems
- Use of **metaphors** can help
- Examples:
 - Timetables
 - Lack of adoption of Open Source software?

Principles of learnability 3/5

Familiarity

imprimir

Nome: José Francisco Creissac Campos 1076

30/03/2015 - 02/04/2015

	segunda-feira	terça-feira
14:00	Programação Orientada aos Objetos [EEUM_G - DI-1.04]	Sistemas Interactivos [EEUM_G - DI-0.05]
15:00	PL2	Sistemas Interactivos [EEUM_G - DI-0.05]
16:00		TP1
17:00		
18:00	Programação Orientada aos Objetos [EEUM_G - DI-0.11]	Programação Orientada aos Objetos [EEUM_G - DI-0.11]
19:00	PL6	PL5

more familiar

new system

less familiar

O meu Horário					
Disciplina	Dia da Semana	Ano Lectivo	Horas	Tipo aula	
530807 - Desenvolvimento de Sistemas Informação	ter	02/03	11h-13h	teórica	
530807 - Desenvolvimento de Sistemas Informação	ter	02/03	18h-20h	teórica-prática	
7008N8 - Desenvolvimento de Sistemas Informação	ter	02/03	11h-13h	teórica	
530405 - Paradigmas da Programação IV	qua	02/03	09h-11h	teórica-prática	
530405 - Paradigmas da Programação IV	qui	02/03	09h-11h	teórica-prática	
530405 - Paradigmas da Programação IV	qui	02/03	15h-17h	teórica-prática	
001011 - Interacção Humano-Computador	sab	02/03	11h-13h	teórica	

[Imprimir](#)

Principles of learnability 4/5

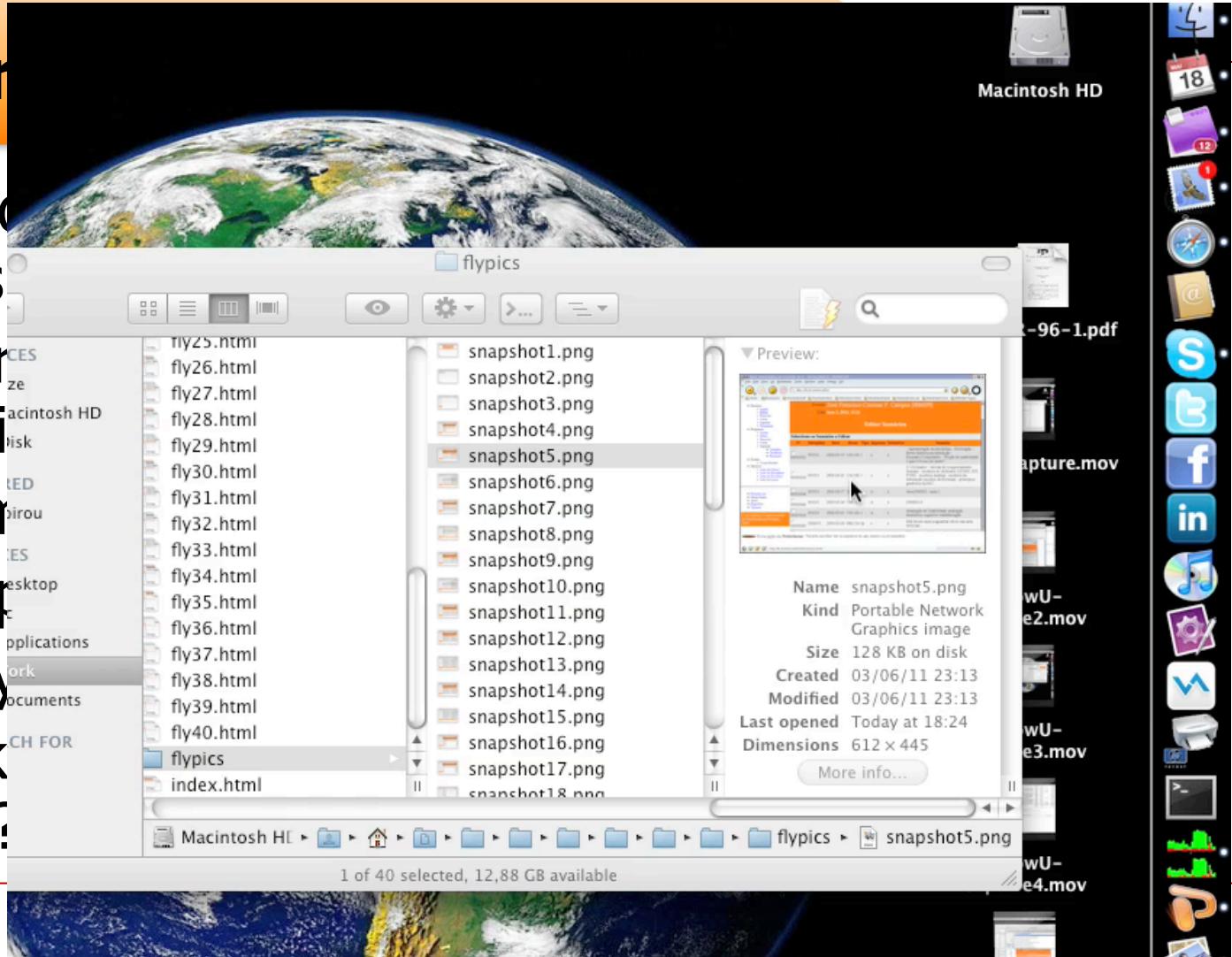
Generalizability

- Extending specific interaction knowledge to new situations
- Explores users' ability to compare similar situations
- A form of **consistency**
- Examples:
 - Copy&Paste services
 - Lack of Drag&Drop to Apps on some Mac OSs?

Principles of learnability 4/5

General

- Extended knowledge through new situations
- Exploration of situations
- A form of trial and error
- Examples:
 - Copying
 - Lack of OS support for OSs?



Principles of learnability 5/5

Consistency

- Probably the **most mentioned principle!**
- Likeness in input/output behaviour in similar situations or task objectives
- Internal consistency
 - Inside the application
 - Example: Toyota AC
- External consistency
 - Between one application and the rest of the system
 - Example: Mac apps menu

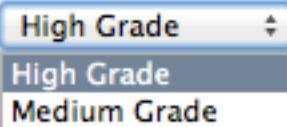
Principles of learnability 5/5

Consistency

- Probably the **most mentioned principle!**
- Likeness in input/output behaviour in similar situations or task objectives
- Internal consistency

*Lack of
internal consistency!*

A seguinte caixa permite selecionar a força criptográfica da sua chave. Aconselhamos que selecione 1024 por ser a mais segura e, simultaneamente, não comprometer a compatibilidade com sistemas de correio dos destinatários com quem se vai corresponder.



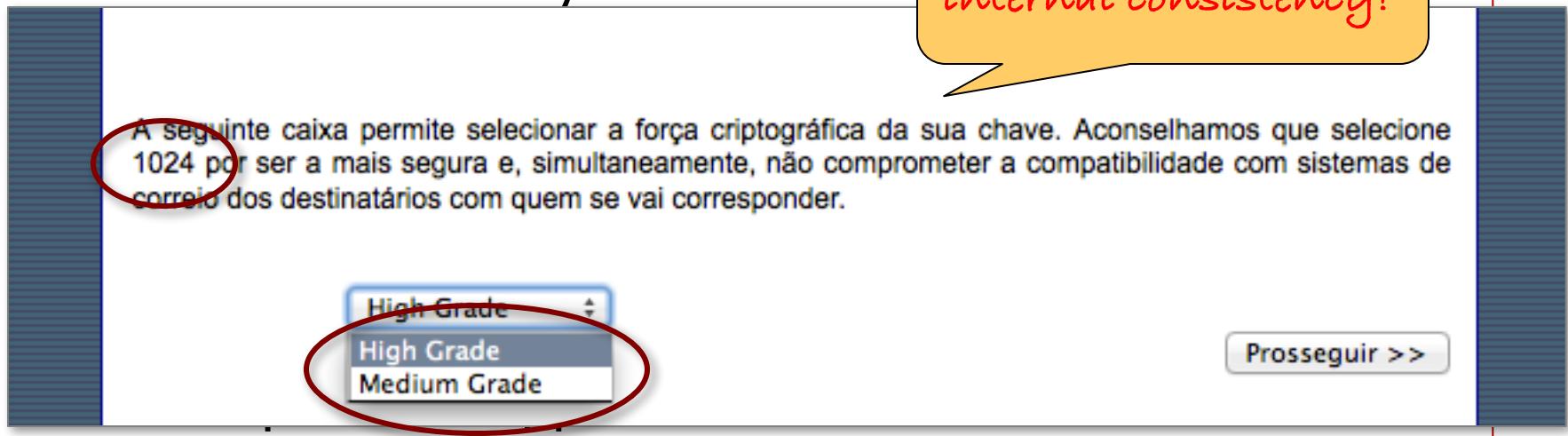
[Prosseguir >>](#)

Principles of learnability 5/5

Consistency

- Probably the **most mentioned principle!**
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*Lack of
internal consistency!*



Principles of learnability 5/5

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Lack of
internal consistency!
(five identical buttons, five
different behaviours)



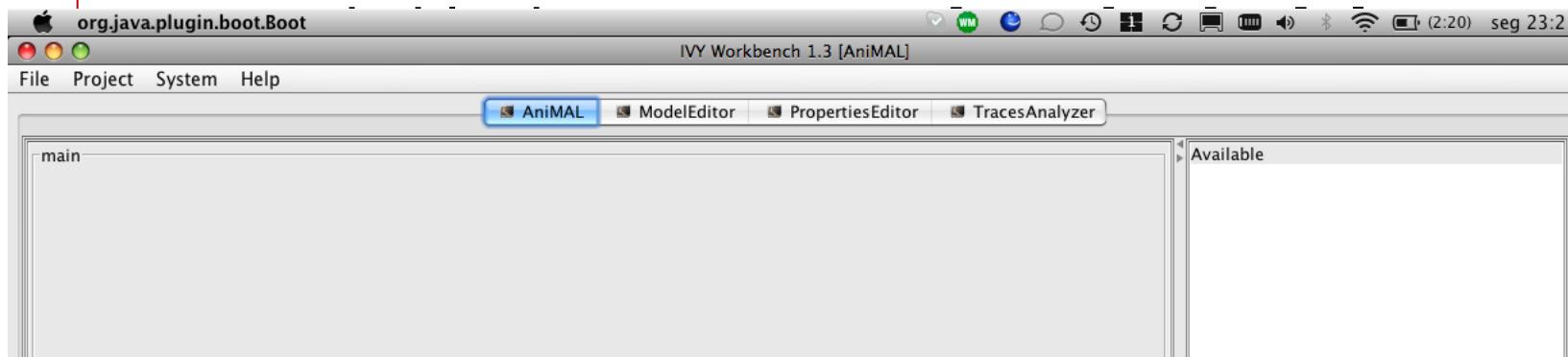
Principles of learnability 5/5

Consistency

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 - Example: Mac apps menu

Principles of learnability 5/5

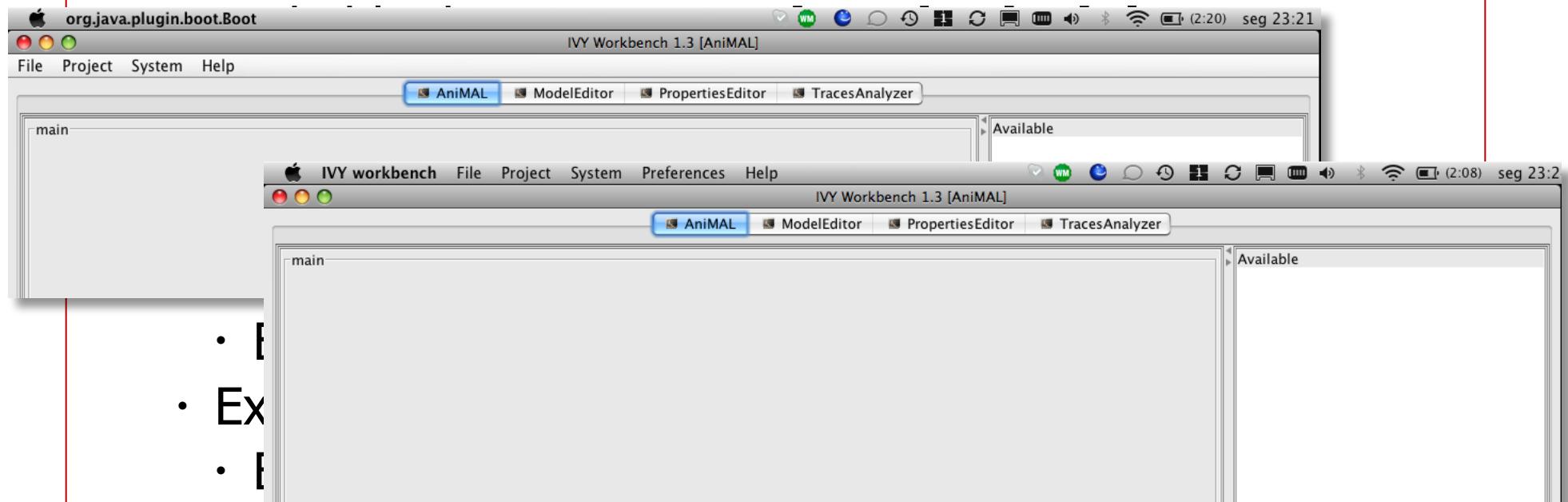
Consistency



- Example: Toyota AC
- External consistency
 - Between one application and the rest of the system
 - Example: Mac apps menu

Principles of learnability 5/5

Consistency



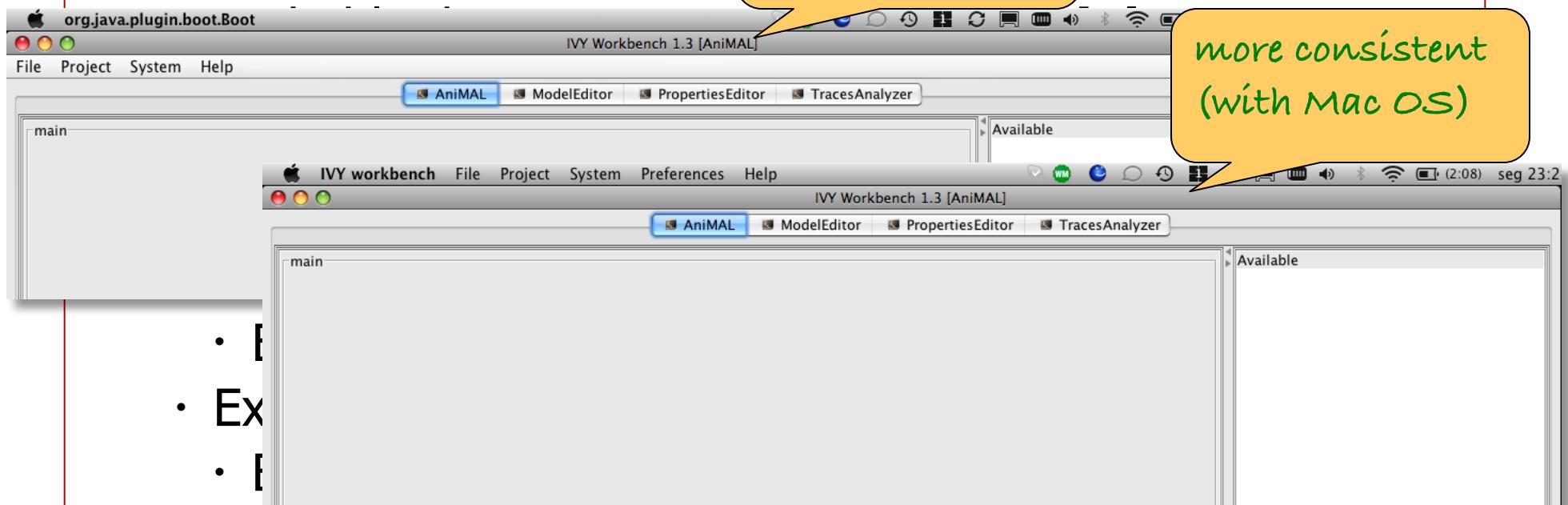
- [
- Example
- [
- system
- Example: Mac apps menu

Principles of learnability 5/5

Consistency

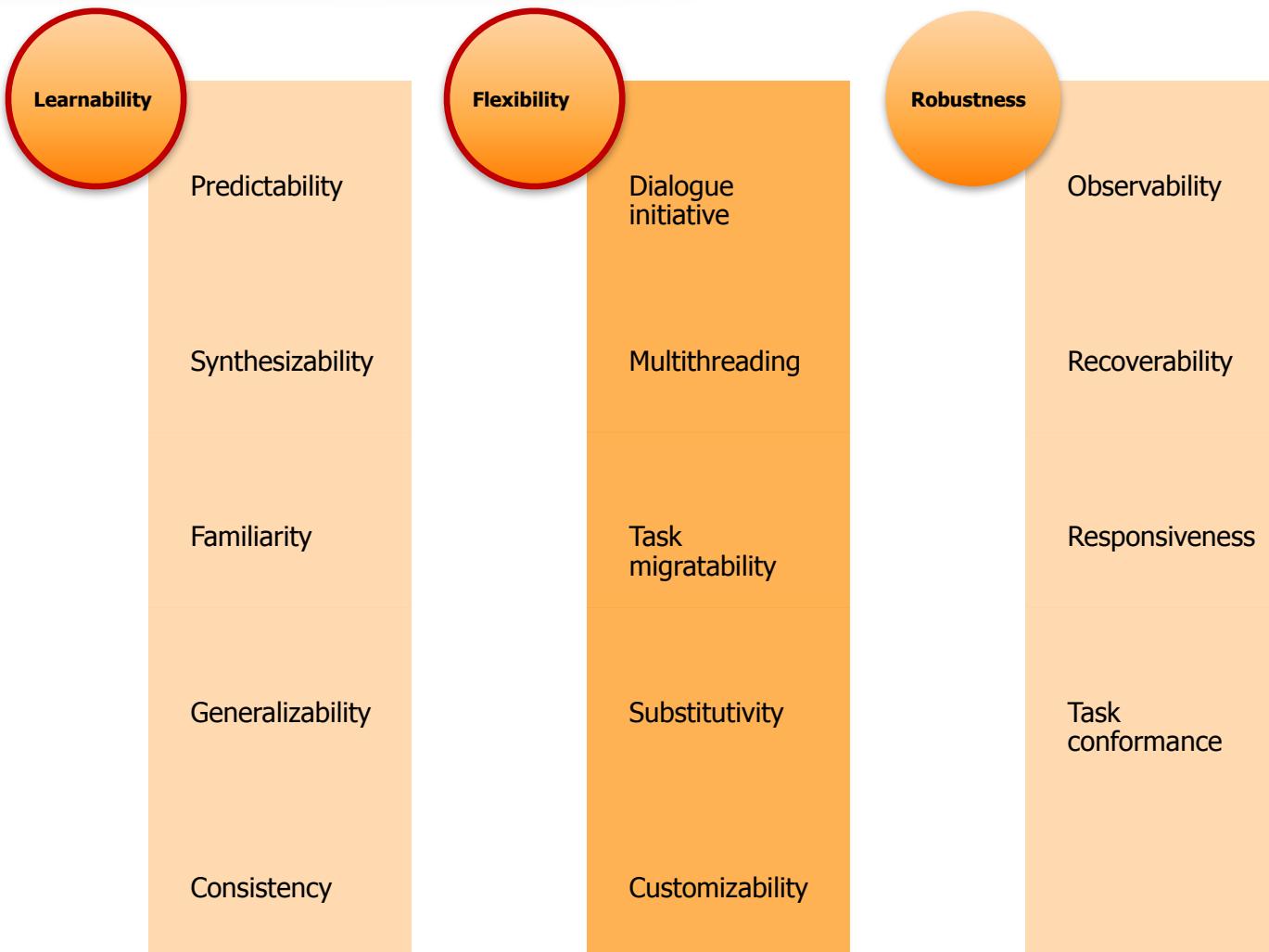
less consistent
(with Mac OS)

more consistent
(with Mac OS)



- []
- Example
- []
- system
- Example: Mac apps menu

Principles of usability



Principles of flexibility 1/5

Dialogue initiative

- System control (less flexibility)
 - Ex.: modal dialogue; wizard; deep menu structures
- User control (more flexibility)
 - Ex.: toolboxes; navigating the web; direct manipulation
- Goal is to maximize user control(?!)
 - Sometimes we want/need to guide users...
 - Good knowledge of tasks will help create feeling of user control
 - Ex. : making search available in input fields

Principles of flexibility 1/5

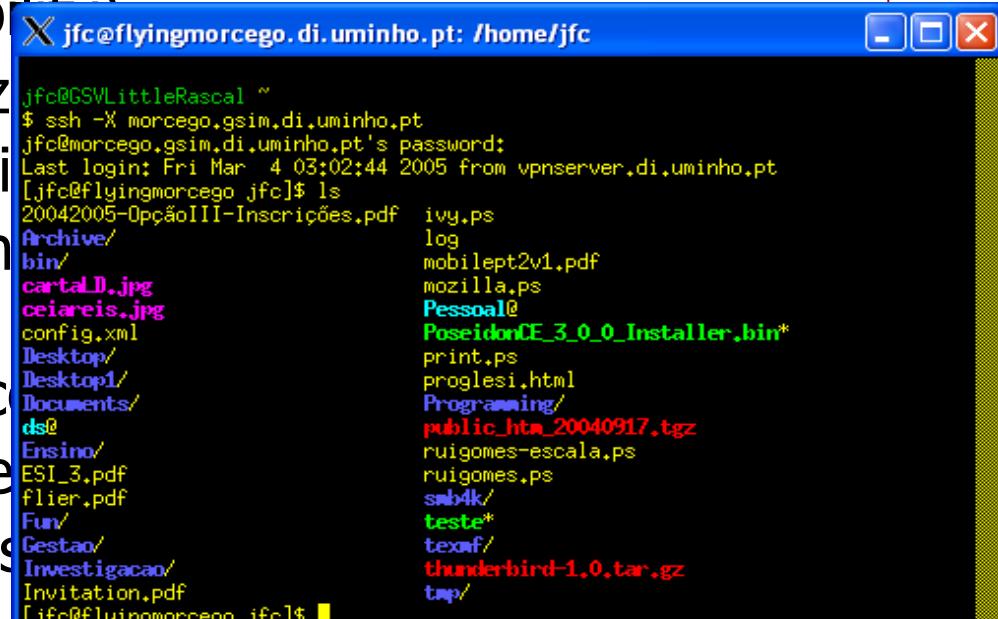
D

more system control
(too much for most people!)

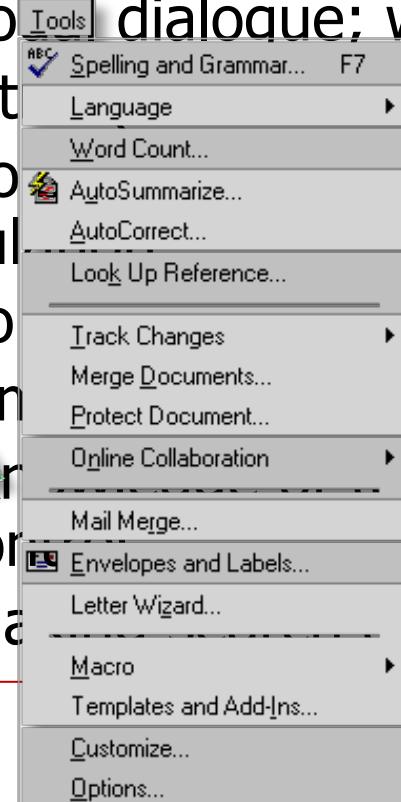
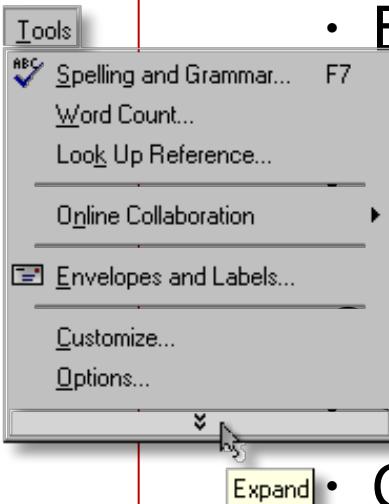
- Ex.: modal dialogue; wizard
- Ex.: too many controls
- Ex.: too many manipulations
- Ex.: modal dialogues are to blame is to say something is wrong
- Good knowledge of user control
- Ex. : modal dialogues are available in input fields

more user control

(too much for some people?)



```
jfc@flyingmorcego.di.uminho.pt: /home/jfc
jfc@flyingmorcego ~
$ ssh -X morcego.gsim.di.uminho.pt
jfc@morcego.gsim.di.uminho.pt's password:
Last login: Fri Mar  4 03:02:44 2005 from vpnserver.di.uminho.pt
[jfc@flyingmorcego jfc]$ ls
20042005-OpcãoIII-Inscrições.pdf  ivy.ps
Archive/
bin/
cartalD.jpg
ceiareis.jpg
config.xml
Desktop/
Desktop1/
Documents/
ds@
Ensino/
ESI_3.pdf
flier.pdf
Fun/
Gestao/
Investigacao/
Invitation.pdf
[jfc@flyingmorcego jfc]$
```



Principles of flexibility 2/5

Multithreading

- The ability of system to support user interaction for more than one task at a time
- Interleaved multithreading
 - Ex.: windowing system (input)
- Concurrent multithreading
 - Ex. 1: multimodality with fusion ("copy that to there")
 - Ex. 2: windowing system (output)

Pr

Google Maps

https://maps.google.com

Work Read Later Import to Mendeley Cool Text: L...cs Generator Author Reviewer Apple YepShot Sapo Google Maps YouTube

+You Search Images Maps Play YouTube News Gmail Drive Calendar More

Sign in

Get directions My place

United States
Not your current location

Put your business on Google Maps

Experience MapsGL

Maps Labs - Help

Google Maps - ©2013 Google - Terms of Use - Privacy

Imagery ©2013 TerraMetrics, Map data ©2013 Google, INEGI

Braga

Bragança Paulista - São Paulo, Brazil
Braga, Portugal
Bragaw Street, Anchorage, AK, United States
Bragadiru, Ilfov, Romania
Bragança - Para, Brazil

Map Traffic

Principles of flexibility 3/5

Task migrability

- Passing responsibility for task control between user and system
- A task can be internal to user, internal to system, or shared
 - Ex. 1: Spell checking of a text document
 - Ex. 2: Cruise control
 - Mudança de “modo” cria complicações

Principles of flexibility 4/5

Substitutivity

- Allowing equivalent values to be substituted for each other (typically input)
 - Good alternative to error messages
 - Can minimize user errors and cognitive effort
- Representation multiplicity
 - Substitutivity also at the output
 - Ex.: Different views in a word processor
- Equal opportunity
 - Eliminating distinction between input and output
 - Ex.: input de datas; conversões

Principles of flexibility 4/5

Substitutivity

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Principles of flexibility 4/5

high substitutivity
(in due date)

The image shows five separate windows of a software application, likely a project management tool, demonstrating the concept of high substitutivity in due dates. Each window has a title bar 'Action' and contains the following fields:

- Project:** Aulas : POO
- Context:** Mac
- Estimated Time:** 1 hour
- Start:** None
- Due:** (varies by window: 2009/05/15 17:00, next friday, 1 week, 1w, 2009/06/01 17:00)
- Completed:** None
- Added:** 2009/05/06 12:00
- Changed:** 2009/05/13 11:00
- Repeat Every:** 1 week (checkbox checked)
- Repeat from:** Assigned date (radio button selected)
- Next Start:** None
- Next Due:** (varies by window: 2009/05/22 17:00, 2009/05/22 17:00, 2009/05/29 17:00, 2009/06/08 17:00, 2009/06/08 17:00)

A red box highlights the 'Due' field in the third window, which is set to 'next friday'. A yellow speech bubble points to this window with the text 'high substitutivity (in due date)'.

- Ex.: input de datas; conver

Principles of flexibility 4/5

Substitutivity

- Allowing equivalent values to be substituted for each other (typically input)
 - Good alternative to error messages
 - Can minimize user errors and cognitive effort
- Representation multiplicity
 - Substitutivity also at the output
 - Ex.: Different views in a word processor
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 - Eliminating distinction between input and output
 - Ex.: input de datas; conversões

Principles of flexibility 4/5

Substitutivity

- Allowing equivalent values to be substituted for each other (typically input)
 - Good alternative to error messages
 - Can minimize user errors and cognitive effort
- Representation multiplicity
 - Substitutivity also at the output



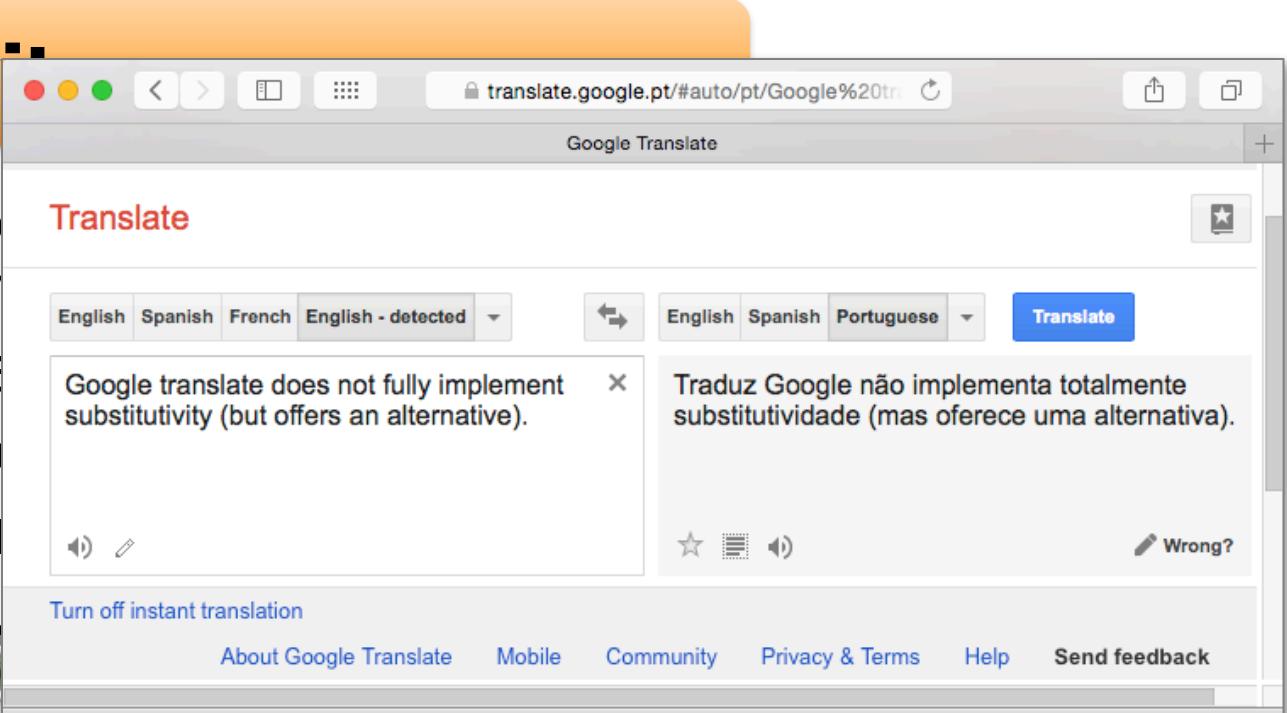
a word processor

between input and output
conversões

Principles of flexibility 4/5

Substitutivity

- Allowing equivalent representations to each other (typical of AI)
- Good alternative to equivalence
- Can minimize search space
- Representation independence
- Substitutivity



between input and output
representations

Principles of flexibility 4/5

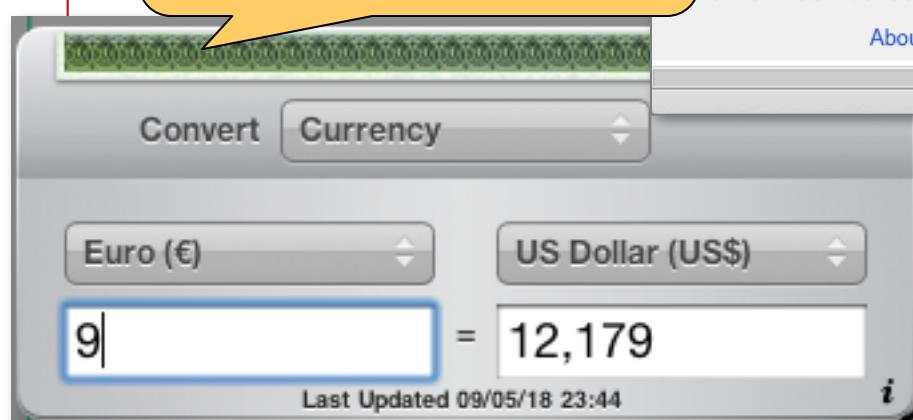
less substitutivity
(no equal opportunity;
alternative implemented)

Substitutivity

- Allowing equivalent each other (typical)
- Good alternative

Can minimize

more substitutivity
(equal opportunity)



between input and output
conversões

Principles of flexibility 5/5

Customizability

- Modifiability of the user interface
- Adaptability (Adaptabilidade)
 - Modified by the user
 - Ex.: toolbars; user interface scripting
 - Adaptivity (Adaptação)
 - Automatically modified by the system
 - Based on knowledge about the user – tricky!
 - Ex.: MS Windows™ adaptive menus
 - Based on knowledge about the device
 - Ex.: Responsive Web Design

Principles of flexibility 5/5

Adaptability
(user changes the system)

Customizability

- Modifiability of the system
- Adaptability (Adaptability)

Modifiability

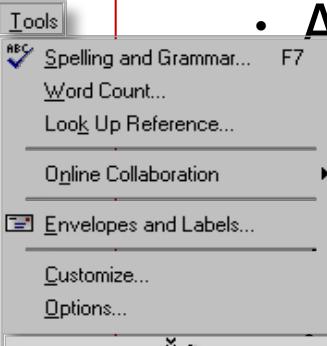
Ex.: tools

Adaptability

Automation

Based on user needs

• Based on user needs



Adaptivity
(system changes
itself)

The screenshot shows the homepage of the Portuguese news website Público.pt. At the top, there's a navigation bar with links like 'EDIÇÃO IMPRESSA', 'LOJA', 'IMOBILIÁRIO', 'SERVIÇOS', 'CLASSIFICADOS', 'Iniciar sessão', and 'Registar'. A search bar is also present. Below the header, there's a main news article titled 'Julgamento de activistas angolanos chega ao fim com nova acusação' with a photo of people holding portraits. To the right, there's an advertisement for Comboios de Portugal (CP) featuring a green train ticket for a trip from Lisbon to Porto.

adaptivity
(to the device)

interface
(e)

Modified by the user

- Ex.: toolbars; user interface scripting
- Adaptivity (Adaptação)
 - Automatically modified by the system
 - Based on knowledge about the user – tricky!
 - Ex.: MS Windows™ adaptive menus
 - Based on knowledge about the device
 - Ex.: Responsive Web Design

Julgamento de activistas angolanos chega ao fim com nova acusação

Feriados voltam para mostrar que "há valores permanentes acima das conveniências conjunturais"

MARIA JOÃO LOPEZ

Costa repõe feriados não por populismo: há datas que não podem ser perdidas

Julgamento de activistas angolanos chega ao fim com nova acusação

ANA DIAS CORDEIRO Luaty Beirão

Luaty Beirão e outros 16 activistas saberão nesta segunda-feira se ficam presos ou em liberdade.

- Basicamente
- Ex.: responsividade
- Basicamente
- Ex.: Responsive Web

adaptivity
(to the device)

interface
(e)

ipting

Julgamento de activistas angolanos chega ao fim com nova acusação

ANA DIAS CORDEIRO Luaty Beirão

Luaty Beirão e outros 16 activistas saberão nesta segunda-feira se ficam presos ou em liberdade. Nas alegações finais, foram acusados de um novo crime, de associação de malfeiteiros, que pode ir até 12 anos de prisão.

Particulares fogem do risco dos fundos e apostam em certificados e depósitos

PEDRO CRISÓSTOMO

O montante investido em unidades de participação era, há dois anos, o dobro do dinheiro aplicado em produtos de poupança públicos.

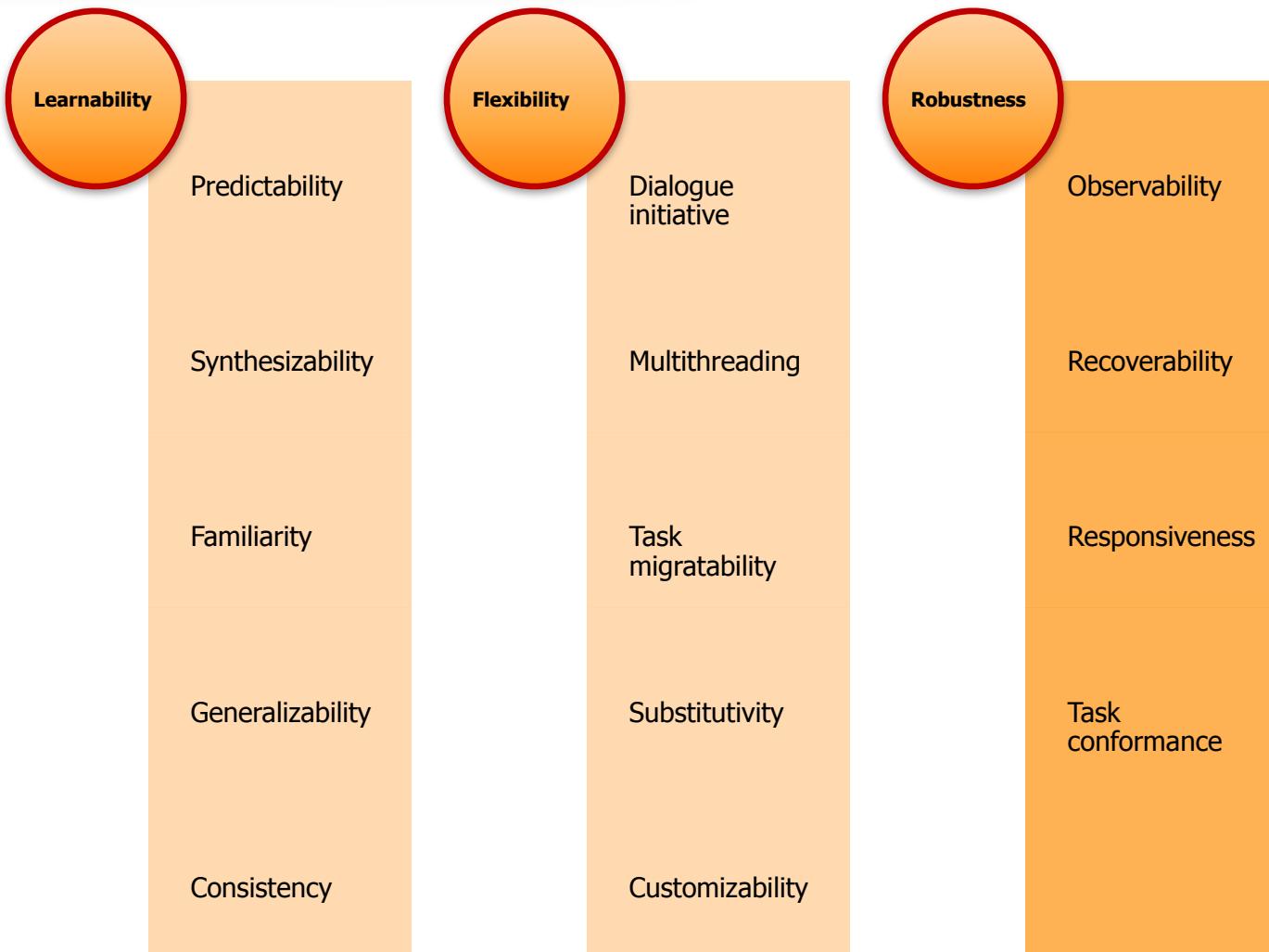
Julgamento de activistas angolanos chega ao fim com nova acusação

ANA DIAS CORDEIRO Luaty Beirão

Luaty Beirão e outros 16 activistas saberão nesta segunda-feira se ficam presos ou em liberdade. Nas alegações finais, foram acusados de um novo crime, de associação de malfeiteiros, que pode ir até 12 anos de prisão.

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Principles of usability



Principles of robustness 1/4

Observability

- Ability of user to evaluate the internal state of the system from its perceivable representation – c.f. Predictability
- Five aspects
 - browsability – possibility of user to explore current state (limited screen real-estate)
 - defaults – static vs. dynamic; passive recall
 - reachability – possibility of user to navigate observable states
 - persistence – sound vs. icon for notifications
 - operation visibility – what can be done is clear
- Ex.: Showing available slots on a Timetabling system

Principles of robustness 1/4

Observability

- Ability of user to evaluate the information from its perceivable representation
- Five aspects
 - browsability – possibility of users navigating through the system (limited screen real-estate)
 - defaults – static vs. dynamic;
 - reachability – possibility of users interacting with the system states
 - persistence – sound vs. icon for notifications
 - operation visibility – what can be done is clear
- Ex.: Showing available slots on a Timetabling system



Principles of robustness 1/4

Observability

- Ability of users to understand what is happening from its perspective
- Five aspects of observability:
 - browsability – how easy it is to find information (limited screen space)
 - defaults – what is the system's state when it starts up
 - reachability – what states can be reached from what states
 - persistence – sound vs. icon for each item
 - operation visibility – what can be done to each item
- Ex.: Showing available slots on a timetabling system

	Prototipagem	Soares Dias .		2016
Trabalho	Aula 4 - Análise de Tarefas	Ana Luisa da Cruz Pinheiro Coutinho .	15 de Março de 2016 17:04:01 ATRASADO	11 de Março de 2016
Trabalho	Aula 5 - Prototipagem	João Paulo Rodrigues Mano da Silva .	15 de Março de 2016 17:05:56	15 de Março de 2016
Trabalho	Aula 5 - Prototipagem	Jose Luis enes Ribeiro .	15 de Março de 2016 20:48:33 ATRASADO	
Trabalho	Aula 5 - Prototipagem	Sérgio Manuel Pereira Simões .	15 de Março de 2016 21:23:30 ATRASADO	2016

browsability

observability

flexibility/
customizability

Principles of robustness 1/4

Obs:

- Ability to recover from errors
- Five levels of robustness
- breaking (links)
- defining
- reading state
- performing
- operating
- Ex.: ...

The screenshot shows a web interface for the UMinho Intranet. At the top, there's a navigation bar with links for Pesquisar Contactos, Braga, weather for Hoje (8-16), Amanhã (10-14), Sábado (12-13), Área Pessoal, Área de Trabalho, Qualidade, Relatórios, and Sair. Below the navigation is a logo for INTRANET - UMINHO and a menu with ENSINO & ID, INFORMAÇÃO PROFISSIONAL, VIDA NOS CAMPUS, COMUNICAÇÃO, and SUGESTÕES & RECLAMAÇÕES.

The main content area is titled "AS MINHAS PAUTAS". It shows a message: "O ficheiro foi importado com sucesso. Para gravar as classificações importadas, por favor, clique no botão "gravar pauta".

A table lists student information:

Número	Aluno	Reg	Classificação
60988	Agostinho Abilio Cardoso Fernandes	ORD	R
38620	Alexandre Filipe Vilaça Fernandes	ORD	F
64307	André David Gomes Monteiro oliveira	ORD	13
64322	André Diogo Ribeiro Assunção Pereira	ORD	12
57758	André Fafe Fernandes Ferreira de Melo	ORD	F
61018	André Sá Silva	ORD	13
42949	António Carlos de Almeida Brandão Capelo	T-E	18
19671	António César Monteiro da Silva	ORD	F

A yellow callout bubble on the right side contains the text: "how to save marks? Lack of operation visibility".

Principles of robustness 1/4

Obs:

- Ability to recover from errors
- Five levels of robustness
- breaking (links)
- defining
- reading state
- persistency
- operation
- Example: ...

The screenshot shows a web interface for managing student grades. At the top, there's a navigation bar with links for Pesquisar Contactos, Braga, weather forecasts for Hoje (8-16), Amanhã (10-14), and Sábado (12-13), and menu items like ÁREA PESSOAL, ÁREA DE TRABALHO, QUALIDADE, RELATÓRIOS, and SAIR. Below the navigation is the INTRANET - UMINHO logo and a menu with ENSINO & ID, INFORMAÇÃO PROFISSIONAL, VIDA NOS CAMPUS, COMUNICAÇÃO, and SUGESTÕES & RECLAMAÇÕES.

The main content area is titled "AS MINHAS PAUTAS". It shows a message: "O ficheiro foi importado com sucesso. Para gravar as classificações importadas, por favor, clique no botão "gravar pauta".

Below this, a table lists student grades for the course "Licenciatura em Engenharia Informática" in the "Desenvolvimento de Sistemas de Software" unit. The table includes columns for Número (Student Number), Aluno (Student Name), Reg (Grade), Classificação (Classification), and a small grid for handwritten marks. A large yellow callout bubble with red text points to the right side of the table, containing the text: "how to save marks? lack of operation visibility".

Número	Aluno	Reg	Classificação
60988	Agostinho Abilio Cardoso Fernandes	ORD	R
38620	Alexandre Filipe Vilaça Fernandes	ORD	F
64307	André David Gomes Monteiro oliveira	ORD	13
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42949	António Carlos de Almeida Brandão Capelo	T-E	18
19671	António César Monteiro da Silva	ORD	F

Principles of robustness 1/4

Obs

- Ability to handle missing values from the database
- Five ways to handle missing values
- breaking ties (linear order)
- dealing with outliers
- readability of results
- stability of results
- performance
- options
- Examples

57779	Sérgio Manuel Rodrigues Caldas	T-E	11
57799	Tarcísio Júnio Lima Malheiro	ORD	10
60030	Tiago Alexandre Rocha Gomes Miranda da Silva	MEL	14
64352	Tiago Fernando dos Santos Braga Fernandes	ORD	13
54713	Tiago Filipe Alves Fonseca da Silva Augusto	T-E	R
55171	Tiago João Ferreira da Conceição	ORD	15
64346	Tiago Luís Santos Loureiro	ORD	14
64381	Tiago Manuel da Silva Santos	ORD	12
61083	Tiago Manuel Monteiro Ferreira de oliveira	ORD	R

how to save marks?

PREENCHIMENTO AUTOMÁTICO
PREENCHER AS CLASSIFICAÇÕES RESTANTES COM O VALOR SELECIONADO

classificação

EXPORTAÇÃO E IMPORTAÇÃO
PARA A IMPORTAÇÃO DO FICHEIRO, TERÁ QUE MANTER A EXTENSÃO .CSV

O ficheiro foi importado com sucesso

ficheiro no file selected

LEGENDA

10 a 20 valores

D Desistiu

F Faltou

NA Não Admitido

R Reprovado

SF Sem Frequência

Principles of robustness 1/4

Obs

- Ability to handle missing values from user input
- Five ways to handle missing values
- breaking down the logic (linear)
- defining the rules
- reading the data and starting again
- performing validation
- open ended
- Example:

57779	Sérgio Manuel Rodrigues Caldas	T-E	11
57799	Tarcísio Júnio Lima Malheiro	ORD	10
60030	Tiago Alexandre Rocha Gomes Miranda da Silva	MEL	14
64352	Tiago Fernando dos Santos Braga Fernandes	ORD	13
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how to save marks?

PREENCHIMENTO AUTOMÁTICO
PREENCHER AS CLASSIFICAÇÕES RESTANTES COM O VALOR SELECIONADO

classificação

EXPORTAÇÃO E IMPORTAÇÃO
PARA A IMPORTAÇÃO DO FICHEIRO, TERÁ QUE MANTER A EXTENSÃO .CSV

O ficheiro foi importado com sucesso

ficheiro no file selected

LEGENDA

10 a 20 valores

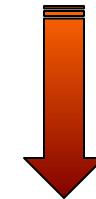
D Desistiu

F Faltou

NA Não Admitido

R Reprovado

SF Sem Frequência



Principles of robustness 1/4

Observability

- Ability to observe what's happening from outside the system
- Five types of observability:
 - breaking down (line by line)
 - defining what's important
 - reading state
 - reading status
 - performance
 - operations
- Ex.: System status

The screenshot shows a software application window with several functional areas:

- PREENCHIMENTO AUTOMÁTICO:** A section for automatically filling remaining fields based on selected values. It includes a dropdown menu labeled "classificação" with the placeholder "escolha uma opção" and a "PREENCHER" button.
- EXPORTAÇÃO E IMPORTAÇÃO:** A section for exporting and importing data. It shows a green success message "O ficheiro foi importado com sucesso", a "ficheiro" input field with "Choose File" and "no file selected", and "EXPORTAR" and "IMPORTAR" buttons.
- LEGENDA:** A legend table mapping codes to descriptions:

Código	Descrição
10 a 20 valores	
D Desistiu	
F Faltou	
NA Não Admitido	
R Reprovado	
SF Sem Frequência	
- GRAVAR:** A "GRAVAR" button located at the bottom right of the main area.

A large orange speech bubble on the right side contains the text: "Lack of observability (operation visibility)".

At the bottom of the screen, there are logos for COMPETE, QREN, and the European Union, along with the text "COPRIGHT 2013 UNIVERSIDADE DO MINHO".

Principles of robustness 2/4

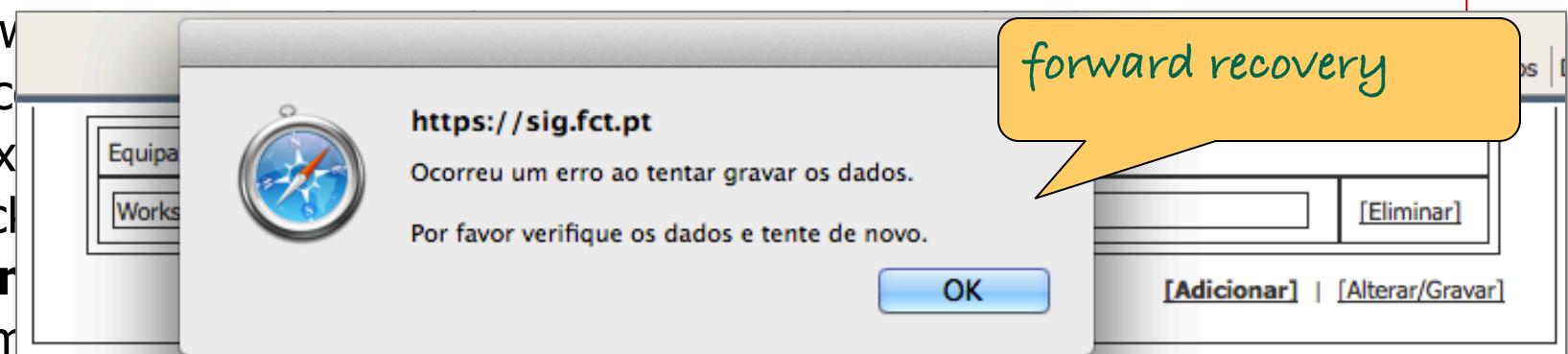
Recoverability

- The ability of users to take corrective action
- Forward recovery (e.g. when error cannot be undone)
 - accepting error state and working from there
 - Ex.: input validation
- Backward recovery
 - **undo** to return to previous state
 - Commensurate effort
 - Hard to undo effects should be hard to do
 - Easy to undo effect should be easy to do
 - Ex.: Trash can
 - easier to undo delete means no delete confirmation needed
 - emptying the trash can cannot be undone so confirmation should be requested

Principles of robustness 2/4

Recoverability

- The ability of users to take corrective action
- Forward recovery
- actions
- Examples
- Backward recovery
- URLs
- Comments
- History
- Error handling
- Ease of use
- Examples



A screenshot of a web application interface. A modal dialog box is centered, displaying the title "8. Descrição detalhada das actividades desenvolvidas". Below it is a table with columns "Nome" and "Descrição". A yellow speech bubble points to the table area with the text "backward recovery". At the bottom of the screen, there is a navigation bar with buttons: "Date updated", "UNDO", "HIDE", and "[Alterar/Gravar]" next to a circular progress icon.

Principles of robustness 3/4

Responsiveness

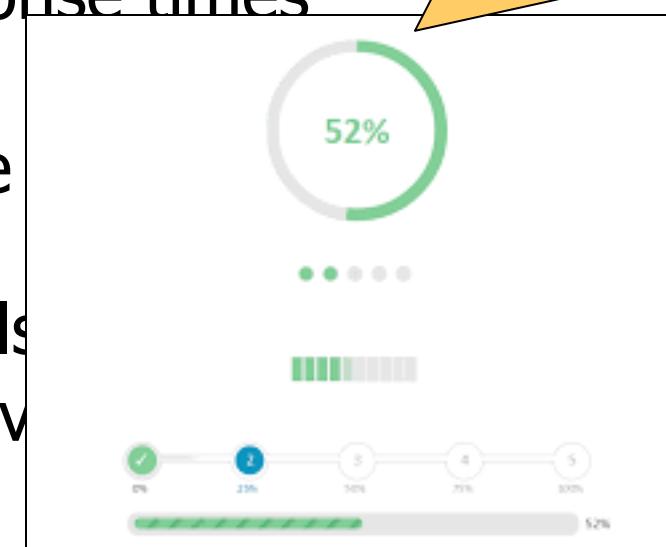
- How users perceive rate of communication with the system
- Short or instantaneous response times
 - From the user perspective
 - When not possible, provide indication of activity
- Stability of response times also relevant
 - Ex. Menus response times vs motor skills

Principles of robustness 3/4

Responsiveness

- How users perceive rate of communication with the system
- Short or instantaneous response times
 - From the user perspective
 - When not possible, provide activity
- Stability of response times also
 - Ex. Menus response times vs

compensating for poor responsiveness



Principles of robustness 4/4

Task conformance

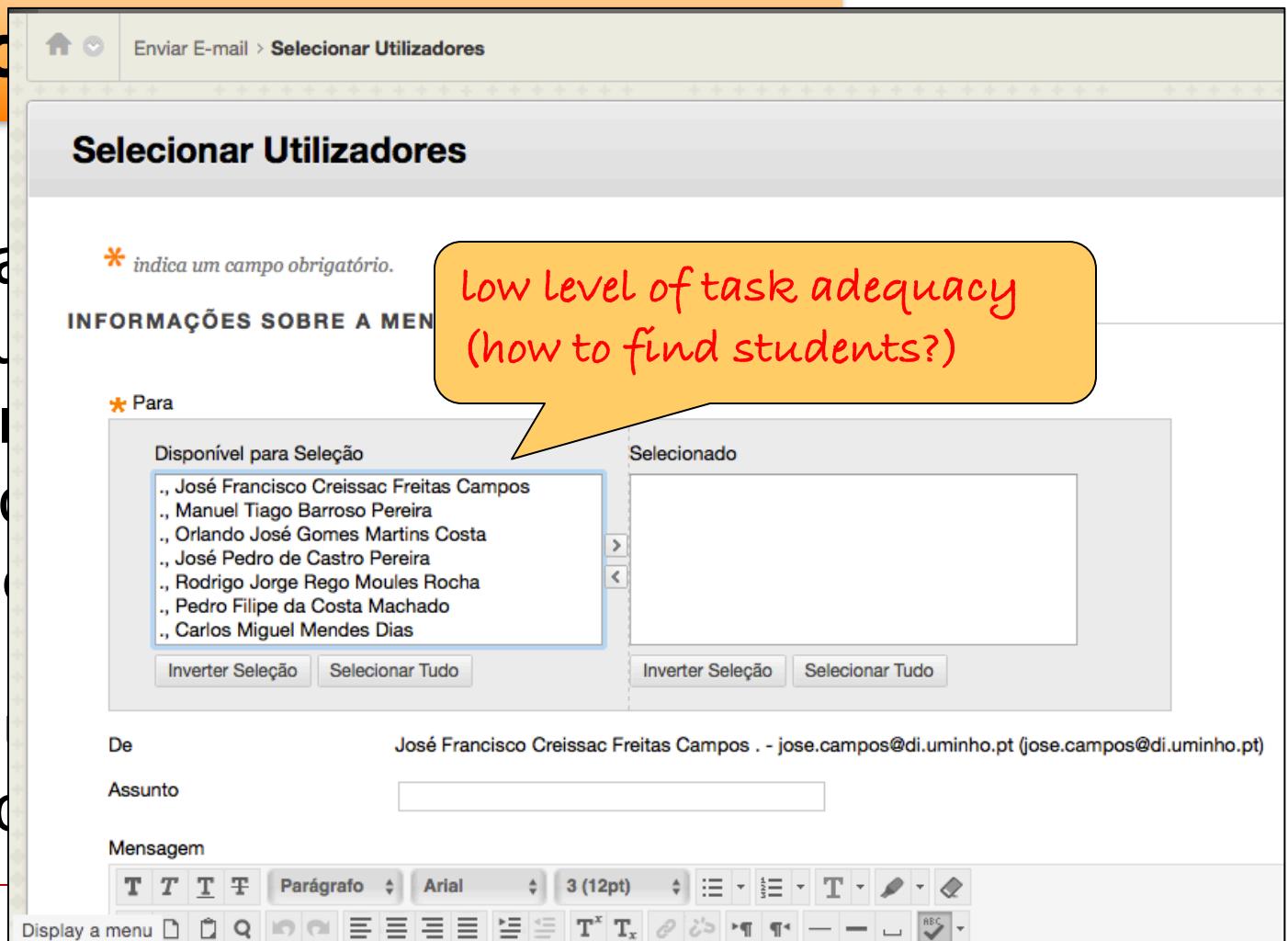
- Degree to which system services support the users' tasks
 - C.f. Gulf of Execution
- Task completeness
 - Level of support for users tasks
- Task adequacy
 - Match between system support for task and users understanding of task
- Exemplo: Adicionar autores a uma publicação?

Principles of robustness 4/4

Also, lackin in flexibility/
costumizability (sort order?)

Task co...

- Degree of users' task control
- C.f. Guidance
- Task configuration
- Level of control
- Task adaptation
- Matching users
- Examples



Principles of usability

