

GameDevelopers
Conference

MARCH 20-24
SAN JOSE, CALIFORNIA

WHAT'S NEXT
GDC:06

www.gdconf.com

GAME DEVELOPERS CHOICE AWARDS

INDEPENDENT GAMES FESTIVAL

GDC MOBILE

SERIOUS GAMES SUMMIT

GAME CONNECTION



CMP

www.cmp.com

Universally Accessible Games: The case of motor-impaired users

www.ics.forth.gr/hci/ua-games

Dimitris Grammenos

gramenos@ics.forth.gr

Giannis Georgalis

jgeorgal@ics.forth.gr



Human-Computer Interaction Laboratory
Institute of Computer Science (ICS)
Foundation for Research and Technology - Hellas (FORTH)

Universally
Accessible
Games
Dimitris
Grammenos
&
Giannis
Georgalis



© HCI Lab
ICS-FORTH

GameDevelopers
Conference

Slide 2/27

UA-Games at ICS-FORTH (1/2)

- Universally Accessible Games (UA-Games) are games that
 - Follow the principles of *Universal Access and Design for All*
 - ▶ <http://www.ics.forth.gr/hci/ua-games/design4all.html>
 - ▶ http://ui4all.ics.forth.gr/isf_is4all/publications.html#White%20Paper
 - Are proactively designed to optimally fit and adapt to different individual gamer characteristics without the need for further adjustments or developments
 - Can be concurrently played among people with different abilities & disabilities
 - ▶ Ideally, also when sharing the same computer
 - Can be played on alternative technological platforms using a large variety of devices
 - ▶ Including assistive technologies

UA-Games at ICS-FORTH (2/2)

- Developed by the HCI Lab of ICS-FORTH in the context of Universally Accessible games initiative
 - UA Chess
 - ▶ Fully functional chess game
 - ▶ Can be played through a standard Web browser
 - ▶ www.ics.forth.gr/hci/ua-games/ua-chess
 - Access Invaders
 - ▶ A highly customizable, cross-platform, accessible remake of the classic Space Invaders game
 - ▶ www.ics.forth.gr/hci/ua-games/access-invaders
- Both games can be concurrently played by people with different abilities and preferences, including people with disabilities

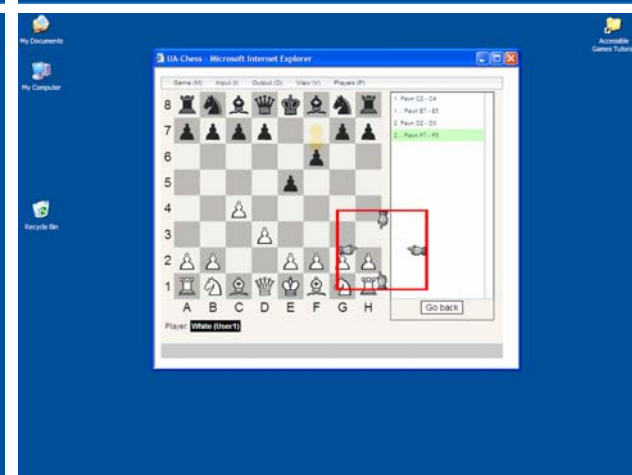
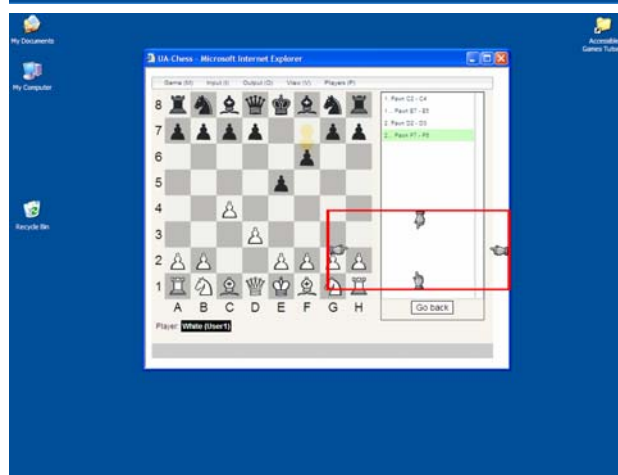
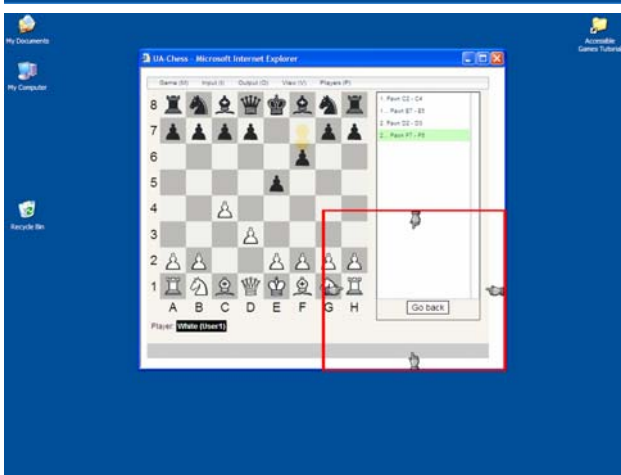
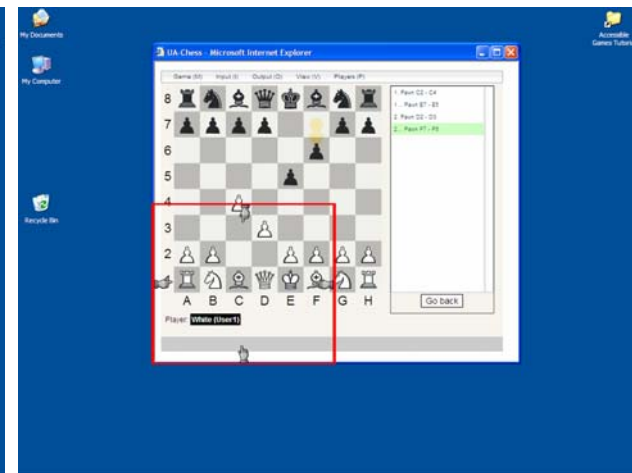
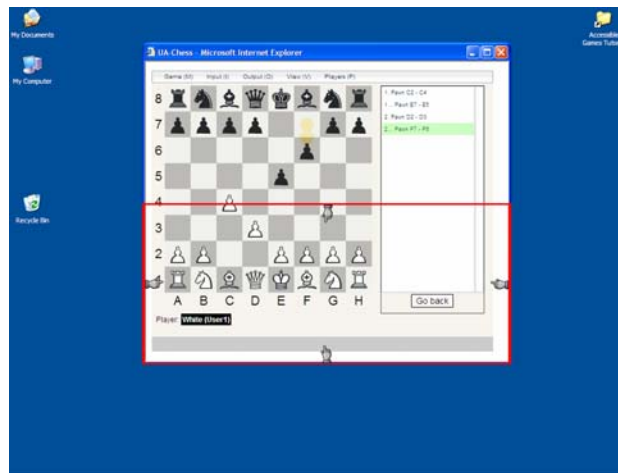
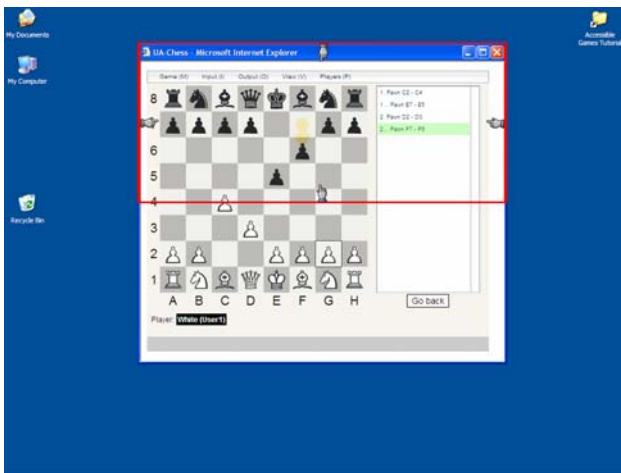
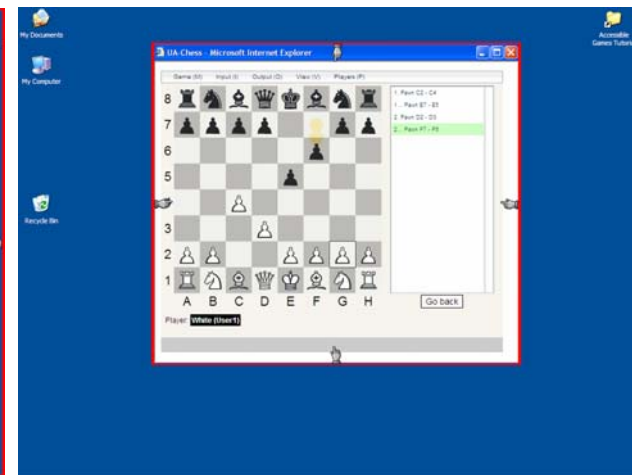
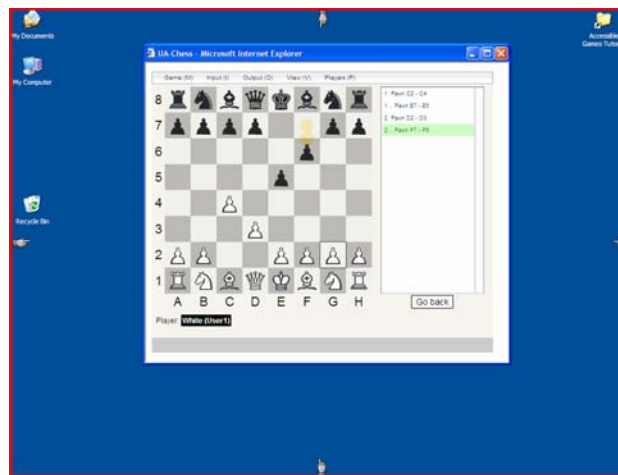
Overview

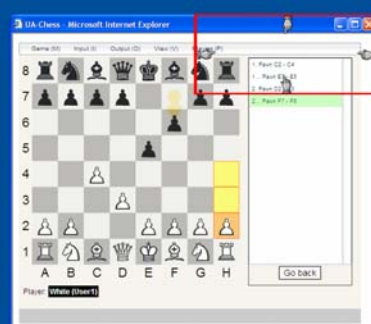
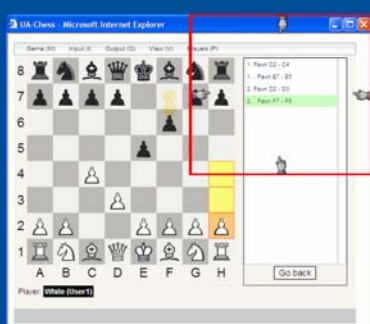
- Software techniques for supporting motor impaired users
 - External Scanning
 - UA-Chess
 - ▶ Embedded scanning
 - ▶ Focus management
 - Access Invaders
 - ▶ Embedded scanning
 - ▶ Reducing the switches
 - ▶ Affecting difficulty

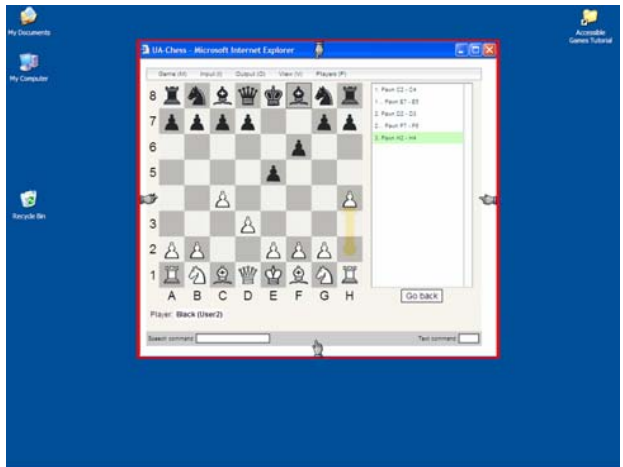
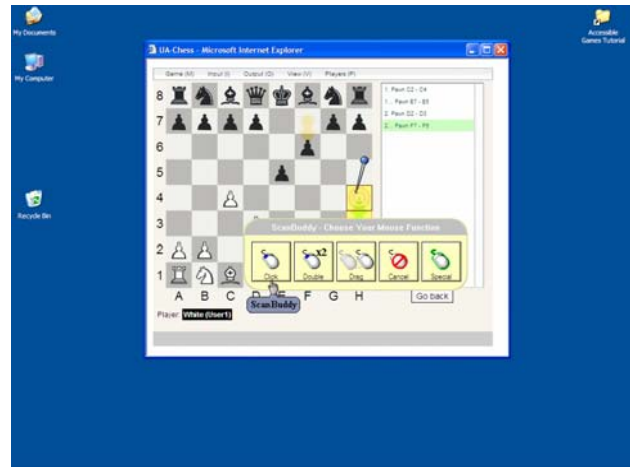
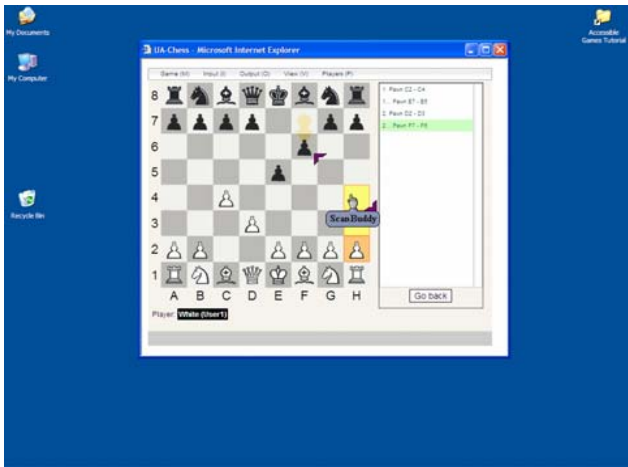
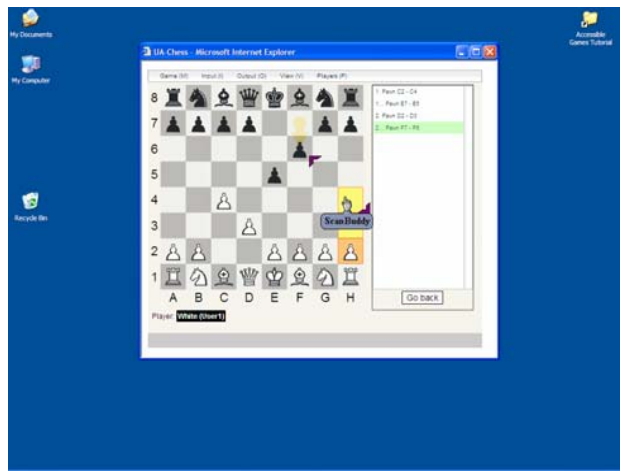
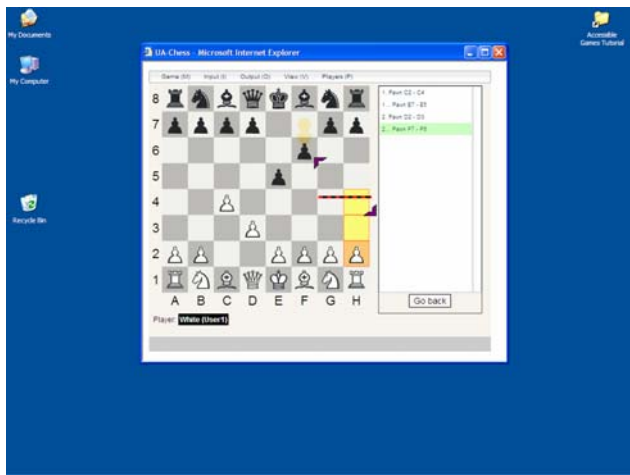
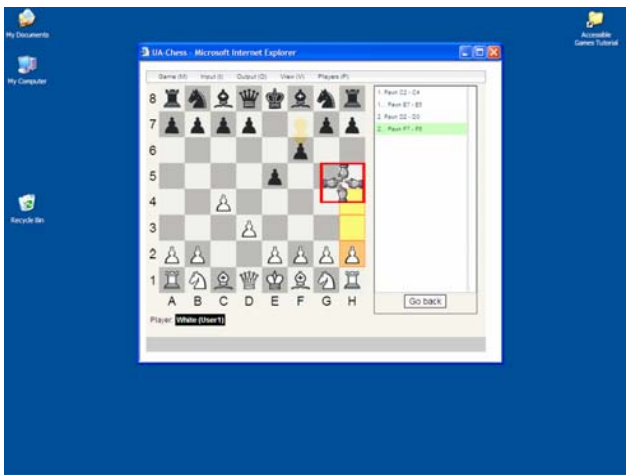
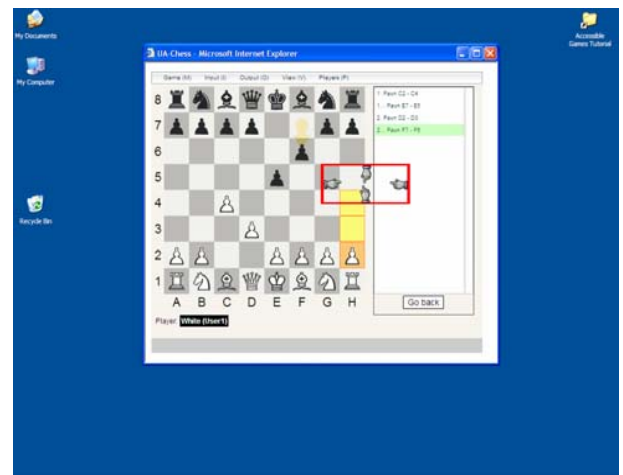
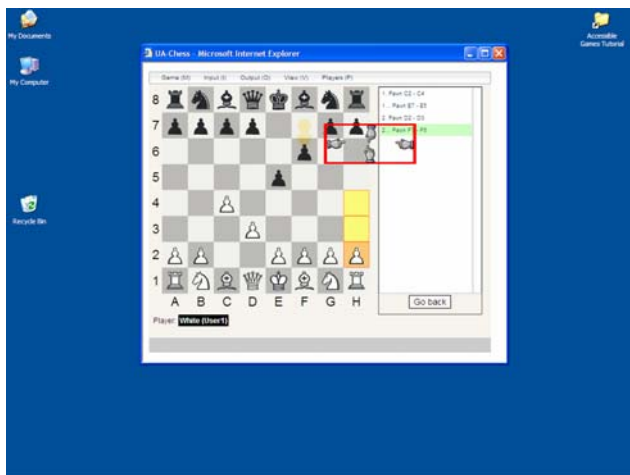
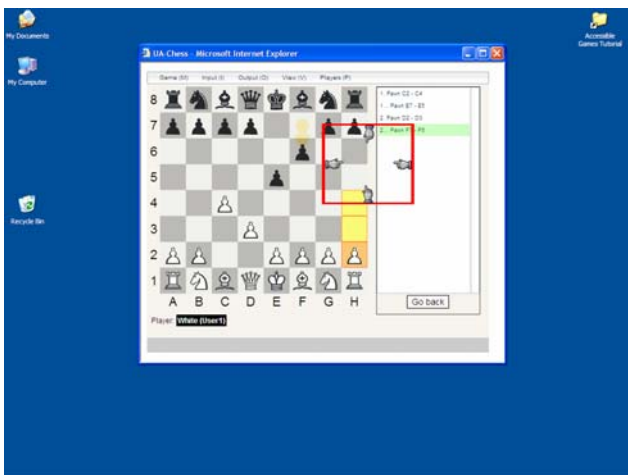
Scanning

- Scanning is a technique that is mainly used for providing computer access to people with hand-motor impairments
- The basic idea of scanning is that a special “marker” (e.g., a colored frame) indicates the current focus
- The area included in the focus frame is recursively sub-divided until it reaches a minimum
- The user can either move the focus marker or select whatever is in focus by using any kind of switches
 - E.g., keyboard keys, special switch hardware, voice
 - The focus marker can also be moved automatically by the system at constant time intervals

External scanning





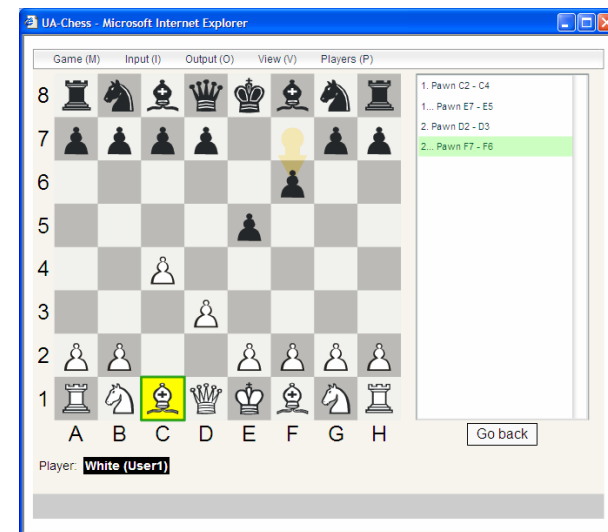
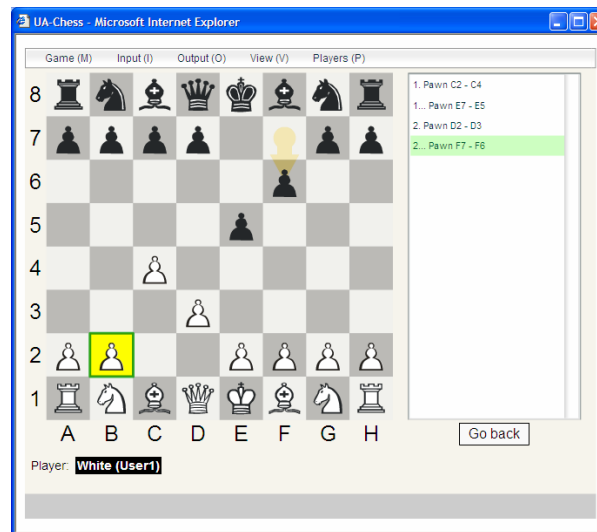
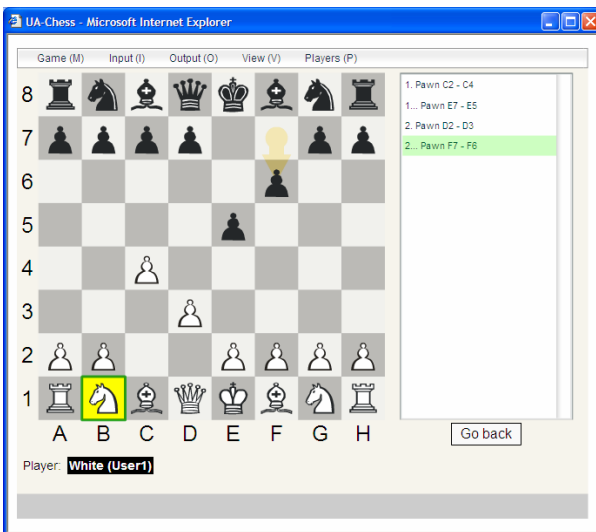


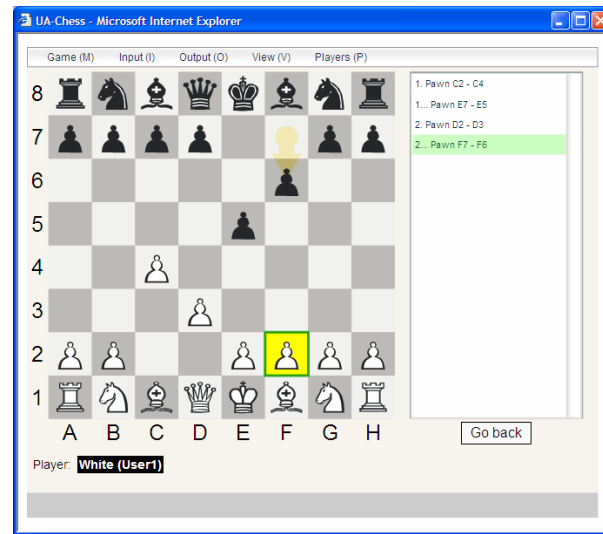
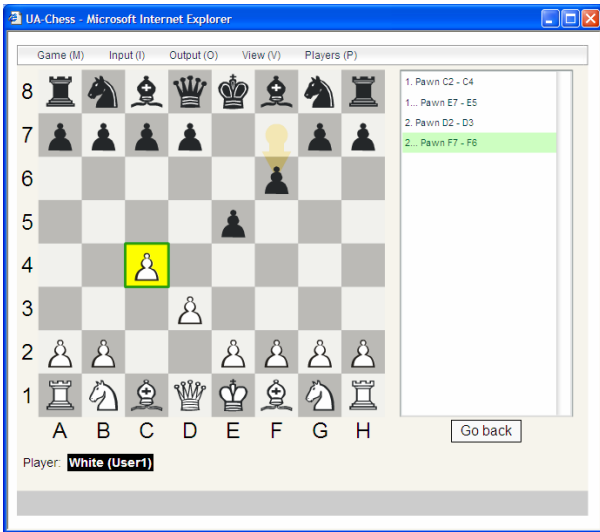
External vs. Embedded scanning (1/2)

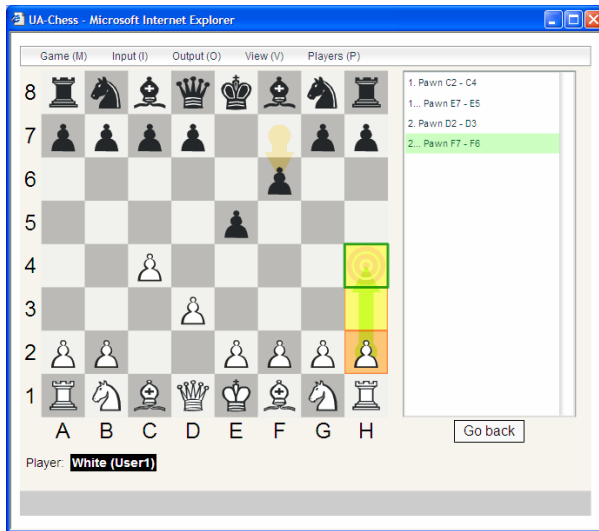
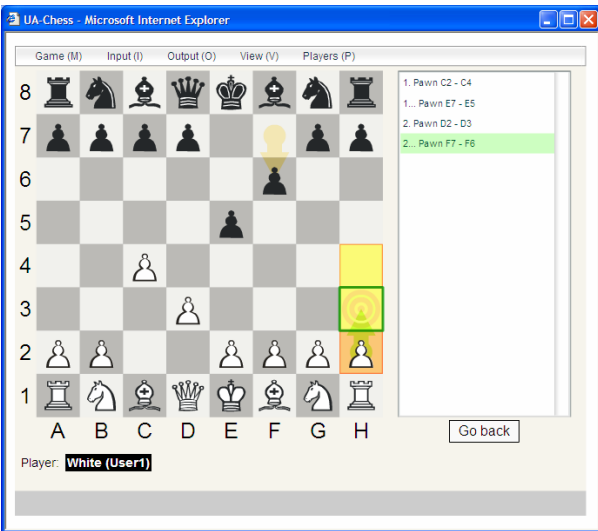
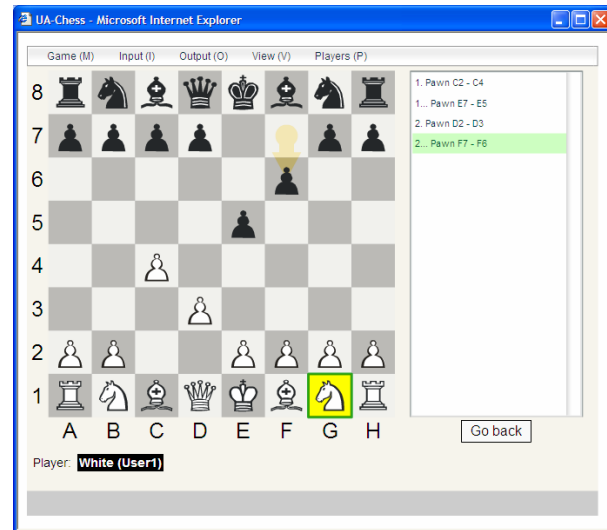
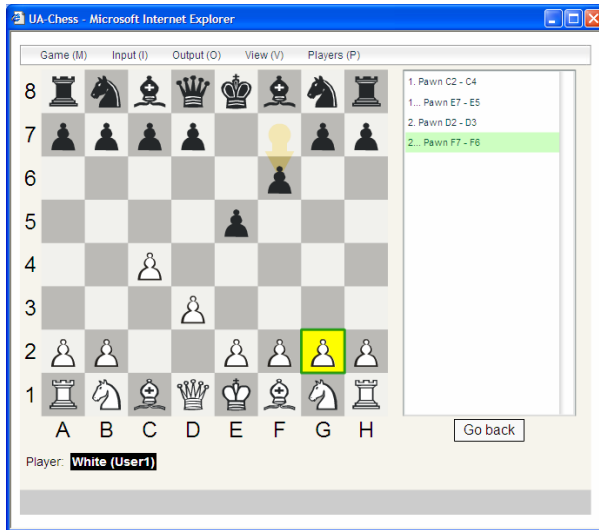
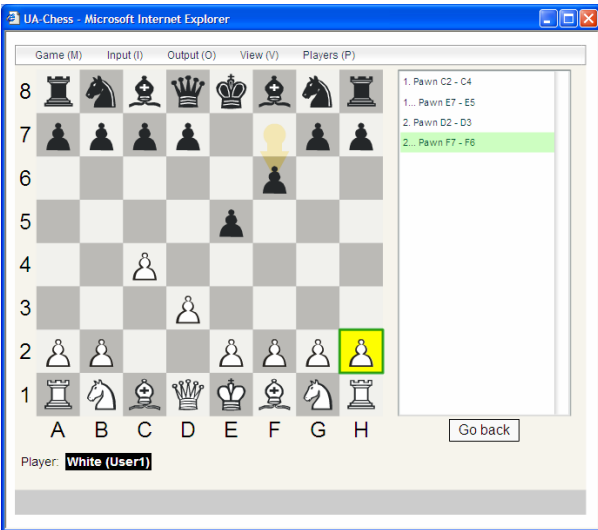
- External scanning using Scan Buddy
 - Emulates the mouse using 1 or 2 switches
 - Supports section & line scanning
- If no error is made in any click it would take
 - 16 clicks
 - ~35 seconds
- Furthermore, accessing the menus can be a real challenge as they are very small and hard to target
 - When a menu is selected, the scanning frame resets to the whole window
 - ▶ There is no way to directly scan the menu's contents



Embedded scanning







External vs. Embedded scanning (2/2)

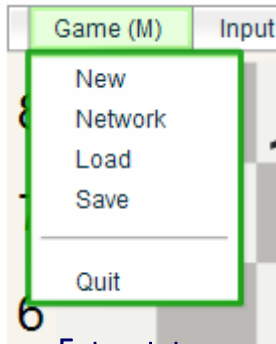
- Instead of using scanning for mouse emulation, it is embedded in the application
 - Only the pieces that can move are scanned
 - ▶ Interaction becomes much more efficient
- If no error is made in any click it takes
 - 3 clicks
 - ~15 seconds
 - ▶ Using the same scanning speed as in the previous example

UA Chess & Scanning (1/3)

- Only valid objects are considered
- Scanning objects
 - Container objects, used to group related objects and increase scanning efficiency
 - ▶ Menus, moves list, chessboard, pieces
 - ◆ Since each piece is considered as a collection of possible moves
 - Simple objects, which cannot contain any other object. When such an object is selected, a corresponding action is performed
 - ▶ Buttons, destination moves, menu and list items
- Scanning selection states
 - Select / Enter state
 - Exit state

UA Chess & Scanning (2/3)

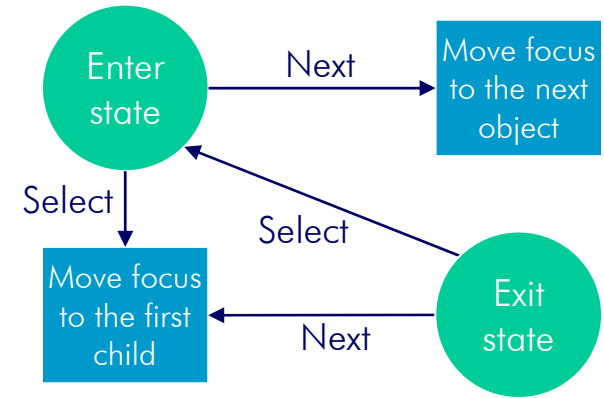
Container Objects



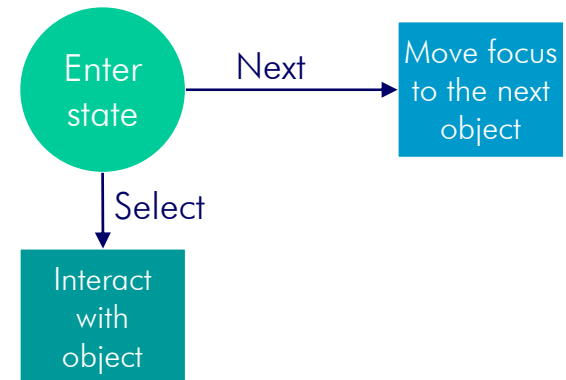
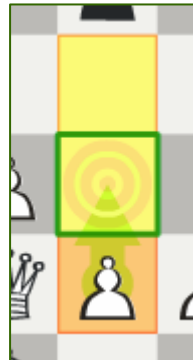
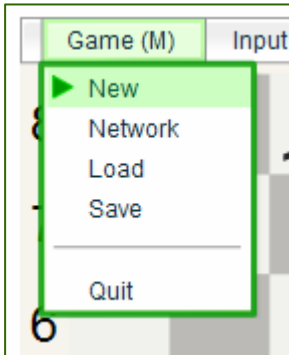
Enter state



Exit state



Simple Objects



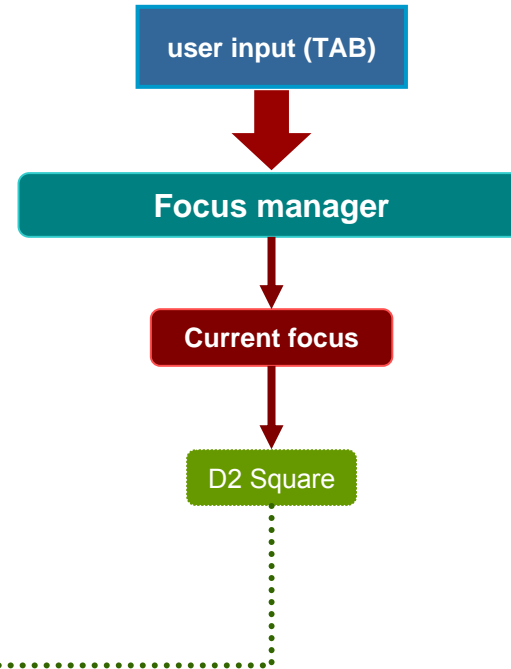
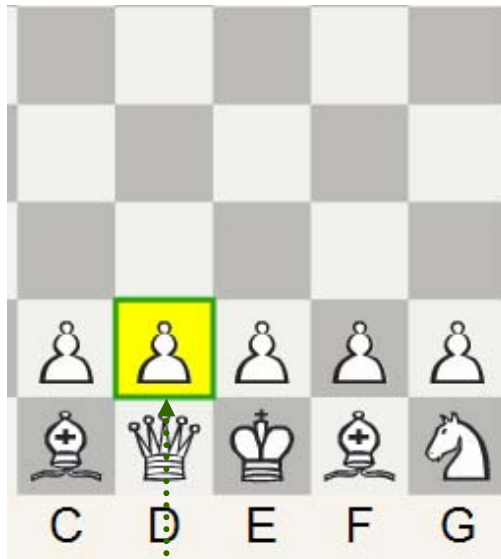
UA Chess & Scanning (3/3)

- Scanning requires 1-3 switches
 - Select, next, previous
 - Usually the following keys are associated with each action:
 - ▶ Select: SPACE / ENTER
 - ▶ Next: TAB (Page Up)
 - ▶ Previous: SHIFT + TAB (Page Down)
- If the user can only use 1 switch, the focus automatically shifts at fixed time intervals
 - Automatic scanning
- In an application using scanning, users should be able to control the following parameters:
 - Keyboard keys associated to each action
 - Frame size and color
 - Frame speed (in automatic scanning)

The focus manager (FM)

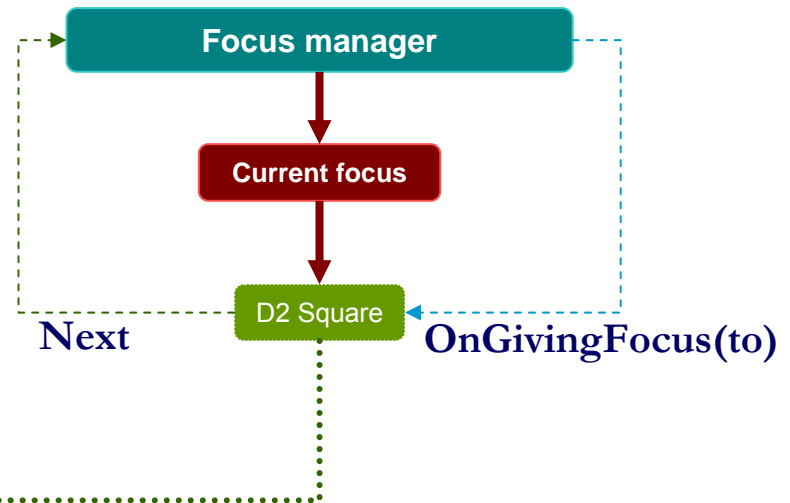
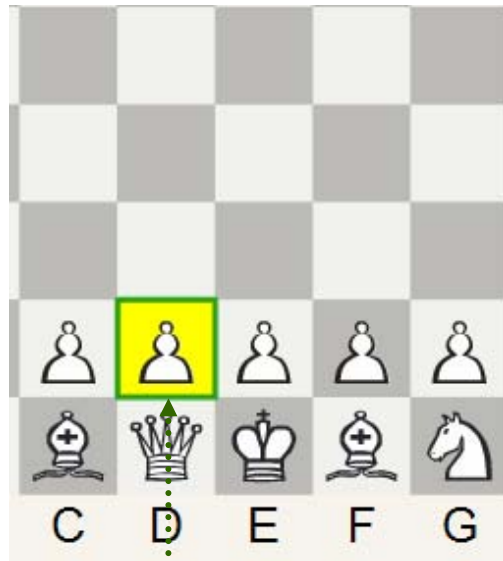
- Scanning in UA chess is implemented using a “Focus Manager” component which arbitrates and manages the current focus among the focusable objects of the game
- Whenever user input is detected (via any available input device and related interaction technique) the focus manager, based on the currently active interaction objects and the one having the focus, decides to do one of the following:
 - Move the focus to another object
 - Select the currently focused item
 - Nothing
- A single user action could require multiple actions from the Focus Manager’s part

Focus management example (1/3)



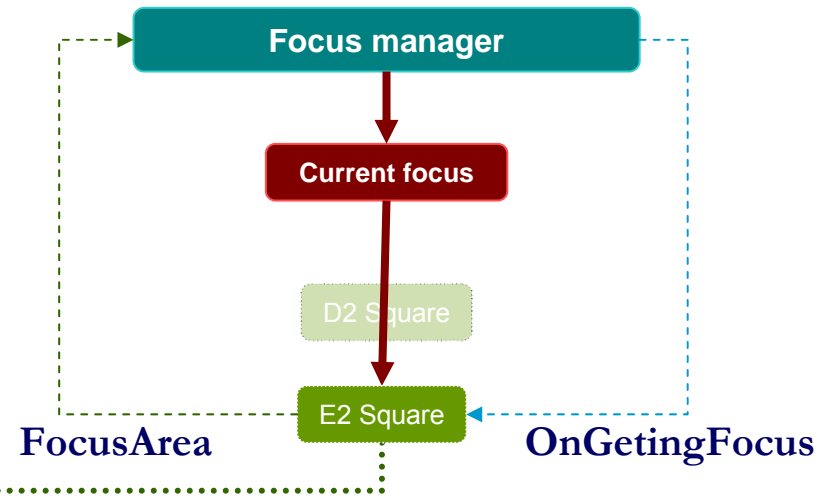
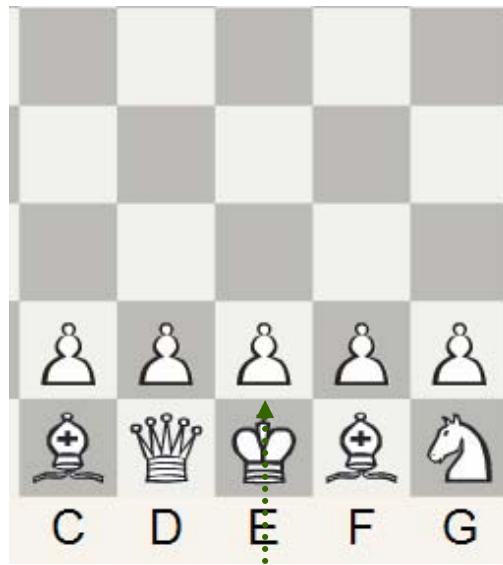
- Initially, the focus is on square D2
- The user presses Tab, so the FM has to move the focus to the next interaction object

Focus management example (2/3)



- The FM asks the currently focused object about its next object
 - Which is the next pawn because the container object is not activated
 - This is done for keeping the FM simple. All the focus logic is distributed among the game's objects
- The FM notifies the currently focused object that it is about to lose the focus
 - Indicates which object will get it
 - The square removes the yellow highlight from itself
 - The FM removes the green frame from the square

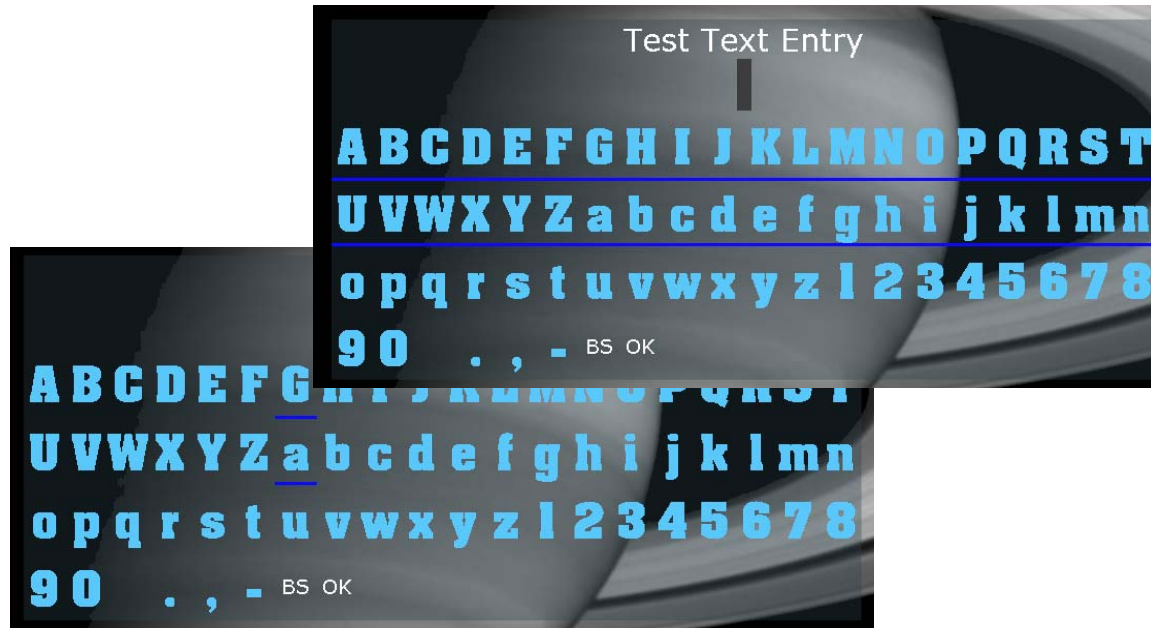
Focus management example (3/3)



- The FM notifies the object that will receive the focus and asks about the area that it should use to paint the focus frame
 - The square highlights itself
 - ▶ If the user is blind, then the square “reads” itself and its content
 - The FM draws a green frame around the square

Access Invaders & Scanning

- Automatic or manual scanning is used for:
 - Activating (selecting) menu options
 - Activating the text entry symbols to input text to the game
- Scanning makes the game's widgets accessible, not the game itself



Using 3 switches?

- Switches needed to play the game
 - Classic space invaders input is already very simple
- Can we reduce the number of switches ?



Using 2 switches?

- Eliminate one switch for movement
 - Make the spaceship move constantly and use one switch to change its direction
 - Use one switch for fire
- Eliminate the fire switch
 - Make the spaceship automatically fire against its opponents
 - Use the two switches for left/right movement
- Can we reduce the number of switches ?



Using 1 switch?

- Eliminate the fire and one directional switch
 - Use auto-fire
 - Make the spaceship move constantly
- Make the button dynamically change its function during the game
- The whole game can be used with one switch
 - Automatic scanning in the widgets
 - In game menu / pause can be activated when the switch is kept pressed for e.g. 5 seconds



Switch
direction

Constantly
moving

Auto Fire

Affecting the game-play

- If the game is still too difficult for a motor impaired user, the following attributes can be customized
 - Aliens
 - ▶ Their number
 - ▶ If they move & their speed
 - ▶ If / how often they fire
 - ◆ The bullets' speed
 - Player's ship
 - ▶ Its speed
 - ▶ Its bullets
 - ◆ Their maximum instantiations
 - ◆ Their speed
 - Shields
 - ▶ Enlarge or change shape
 - ▶ Allow the ship's bullets to pass through

Making a game accessible to motor impaired users

- Make the game work through the keyboard
 - All devices simulate the keyboard's scan-codes
- Employ scanning for navigating through the game's objects
 - ▶ Embedded in the game (i.e. don't rely on external scanning programs)
- Support reduction of distinct controls to different levels
- Make all the functions of the game that affect its difficulty configurable
- Speech recognition is also an option
 - But...