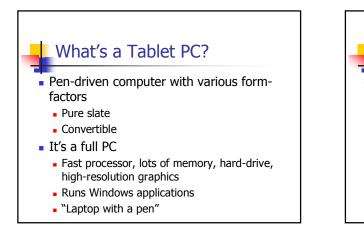
#### The Tablet PC: Designing Penbased Applications

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Slides derived from Rob Jarrett Microsoft Corporation robjarr@microsoft.com

#### Topics

- Tablet PC introduction
  - What and why
- Usability issues
  - Hardware requirements
  - Display
  - Pen as mouse
  - Digital ink entry, editing, gestures, and recognition



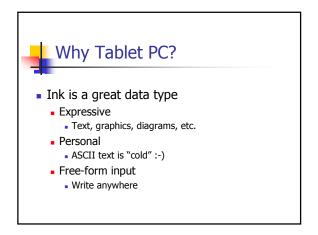
# Why Tablet PC?

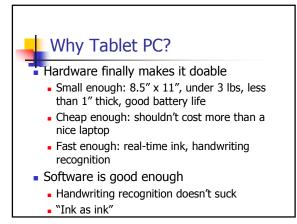
- Desktop and laptop computing doesn't fit well with certain common situations
  - Meetings: laptops can be annoying and/or remove user from discussion
  - Relaxing (e.g. leaning back in chair, lying on couch): laptops must be on a flat surface
  - On-the-go (walking, standing waiting): laptops must remain statically positioned for use

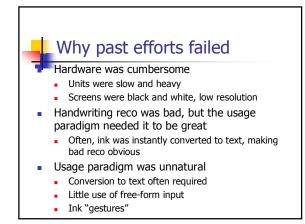
# Why Tablet PC? Desktop and laptop computing can feel unnatural Entering information can be awkward (e.g. ASCII text into a word-processor) Using the mouse – hard to master, and disconnected from the task at hand Must be sitting upright when operating a computer

# Why Tablet PC? Using a pen is natural Task adapted to human physiology rather than the other way around Evolved over thousands of years

- Easy
  - Most people can do it
  - Direct interaction/input
  - "Always on"







## Why past efforts failed

- No standard software development platform
  - Low market penetration, tough business justification for 3<sup>rd</sup> parties
  - Therefore no "killer apps"
- Portable computers were niche
  - Networking wasn't common for PCs
  - Tradeoffs were significant in comparison to today (e.g. screens, upgradability, speed)

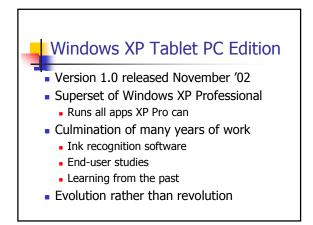
#### What about palm-sized devices?

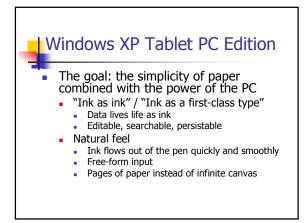
Great at what they do

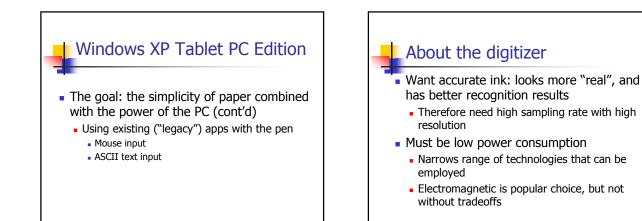
- Contacts, scheduling, jotting down short notes, etc.
- Saving grace (IMO): synchronization with desktop PCs
- Form factor is awesome
  - Fits in your pocket or hand!

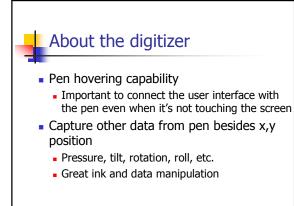
#### What about palm-sized devices?

- We still have to adapt to them
  - Small screens
  - "Graffiti" input
- Not good at desktop tasks
  - Unsatisfying for web surfing, email composition, document viewing, etc.
  - Syncing is a pain for some
  - Peripheral device for many users









# About the digitizer

- Tradeoffs: sensitive to interference
  - Hard drive, CPU, battery, and other components can alter where the digitizer thinks the pen actually is
  - Calibration system (i.e. software correction) helps tremendously, but still not perfect

#### Display hardware

- User can't write directly on the LCD surface
  - Psychedelic color blooming occurs because of squishing liquid crystals; very distracting
    Bad for the display
- Solution: glass overlay

High DPI displays

Ink and eBooks look great

Tradeoff: Legacy apps suffer

Targeting areas get smaller

icons hard to see

increased DPI

easier

Displays are small but high resolution –

Many hard-coded pixel sizes, meaning text,

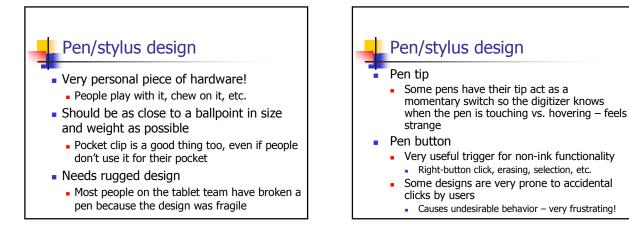
 Can only expect evolution here; platform makes this a pain today, tomorrow will be

- Doesn't allow any "give" across the display
- Protects the LCD

#### **Display hardware**

#### Tradeoffs:

- No "give" means it feels unnatural
- Glass is slippery to a hard plastic pen
   Pen skids a little, making writing and targeting a bit more difficult
- Parallax
  - Thickness of glass causes visual disconnect from ink/cursor/etc. when pen tip touches the display
- These will get better



#### Portrait-mode display

Support portrait mode; just like paper

- Great for web surfing, reading eBooks and most other document types
- Hot-switch to landscape and back is great for convertibles
- Tradeoff: Legacy apps suffer
  - All written assuming horizontal > vertical resolution
  - Toolbars, menus, etc. can be cut off

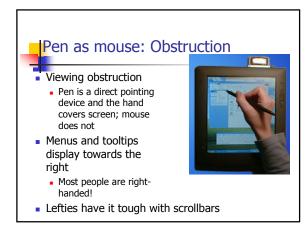
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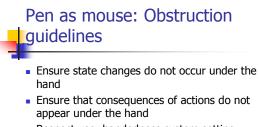
#### Pen as mouse: Hovering

- Hovering still with a pen is tough
  - While in-air, our control of a pen is considerably worse than when the pen is touching a surface
  - Mouse is intrinsically static, pen is not
  - Legacy applications typically assume cursor must be perfectly still for e.g. tooltips to appear
  - Software help needed to "smooth" hover location of cursor

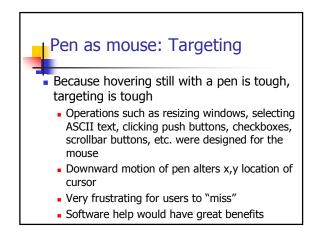
#### Pen as mouse: Hovering guidelines

- Features requiring hover should have generous tolerances
  - For instance, tooltips
  - Use COMCTL32 provided ToolBars
- Test hover-triggered features for ease of use





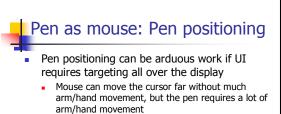
- Respect user handedness system setting
   Check SPI\_GETMENUDROPALIGNMENT via SystemParametersInfo()
  - Apply it to Tooltips, menus, popup menus



#### Pen as mouse: Clicking

#### Clicking with a pen is tough

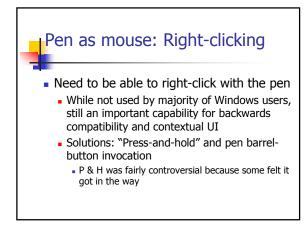
- Legacy applications typically assume during a click the mouse doesn't move
- Pen taps are more like little strokes or stabs because of pen skidding and high-precision digitizers
- Detecting the difference between tap and a drag is an interesting problem!
- Double-clicking is even tougher
  - Quick motion means sloppier result



- Menus and toolbars are typically at the top of a window; editing often occurs mid-way or toward the bottom
  - Lots of physical arm/hand movement results a real pain for users
  - More local UI is desirable (e.g. context menus)

#### Pen as mouse: Targeting guidelines

- Cursor feedback
- Bigger, easily-targeted controls
- Generous tap, double-click, and hover tolerances
- Keep related objects in proximity





#### Digital ink performance

Writing requires uninterrupted inking

- Users have difficulty with delays in ink appearance
- Users are frustrated with delays in inking
- Guideline
  - Ensure fast efficacy
  - Is it as fast as writing on paper?

#### Pen modes & cursors

- Explicit vs. implicit input modes
   A.k.a. *Modal* vs. *modeless*
- How to allow things to be efficient but not confuse users
  - Select mode uses "right-mouse button" for implicit mode as well as utilizing an explicit mode
  - Erase mode uses pen's eraser tip (if available) for implicit mode as well as utilizing an explicit mode

#### Pen modes & cursors

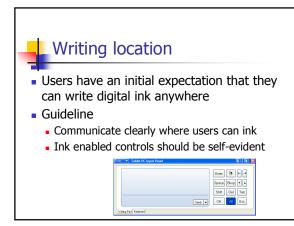
- Need feedback as to the mode of the pen
  - Indicates actions available to the user

#### Guideline

- Develop a set of cursor feedback to indicate the different modes of the pen
- Careful attention to cursor design
  - Either symmetric or use handedness setting

## Pen gestures Gestures need precise tuning

- Trade-off between accidental activation vs. not getting when wanted
- False activations are annoying and distracting to the task!
- Guideline
  - Use gestures guardedly
  - Error on the side of having "zero" incidence of false activation
  - Non-destructive consequences are better



# Ink selection

- Traditional rectangular selection tools are inadequate
- "Lasso" selection is much more natural
  - Percentage-based stroke tolerances
  - Employ word-based selection
  - Visual feedback is essential, real-time is much better than static

#### Recognition expectations

- Handwriting recognition is highly variable by person
  - Errors are expected
  - Perceived good or bad handwriting effects expectation of accuracy
- Guideline
  - Be realistic about recognition accuracy rate, don't rely heavily on it for authoring