

# Chapter 3

Principles and practice of  
interactive systems *design*

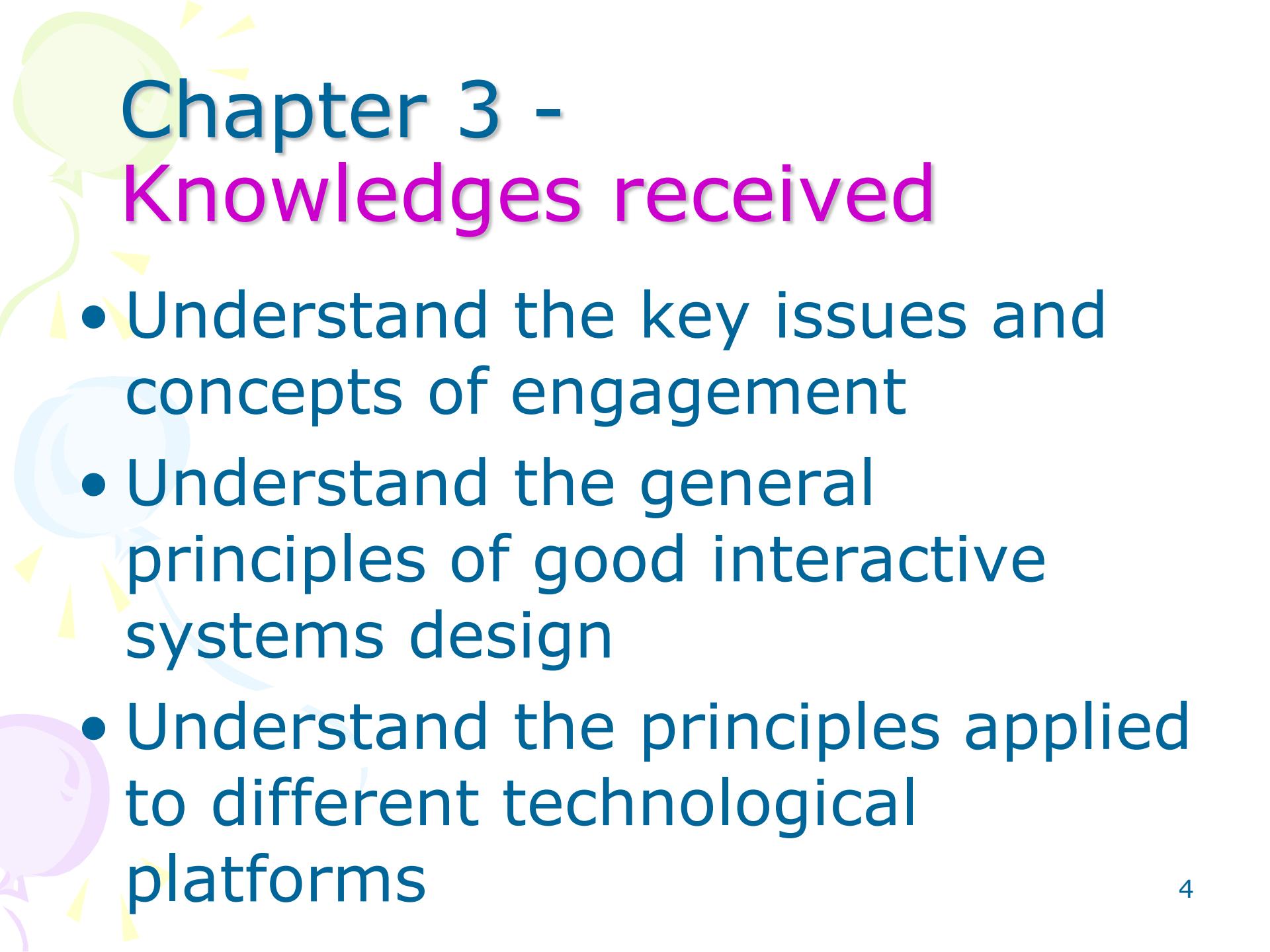


# Chapter 3

- 3.1 Introduction
- 3.6 Design principles
- 3.2 Accessibility
- 3.5 Engagement
- 3.7 Designing for windows application
- 3.8 Designing websites
- 3.9 Designing for other technologies

# Chapter 3 (2)

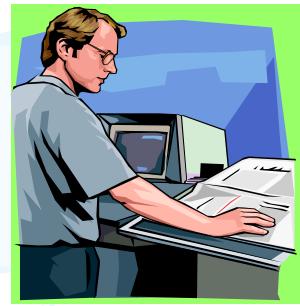
- To provide advice and guidance that will result in high-quality design
- Designers have to consider not just the functionality of a system but also the whole experience of using it and owning it.
- ⇒ This chapter explores how designers can create appropriate experiences for the user in different contexts.



# Chapter 3 - Knowledges received

- Understand the key issues and concepts of engagement
- Understand the general principles of good interactive systems design
- Understand the principles applied to different technological platforms

## 3.1 Introduction



Interactive  
systems  
designer

PACT elements  
harmonized in a domain

## Systems and products

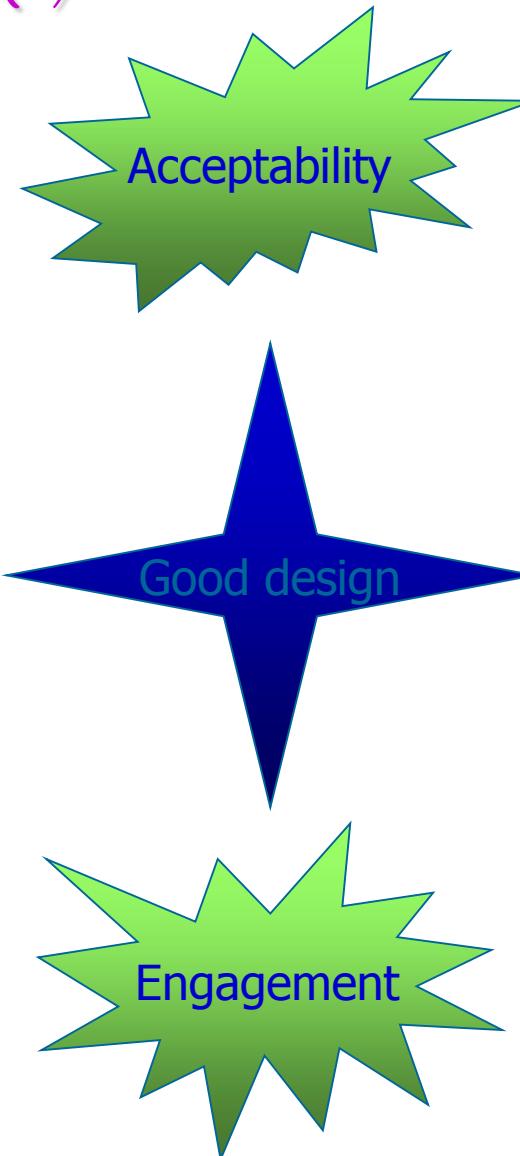


Accessible, usable, socially,  
economically acceptable  
and engaging



Learnable, effective  
and accomodating

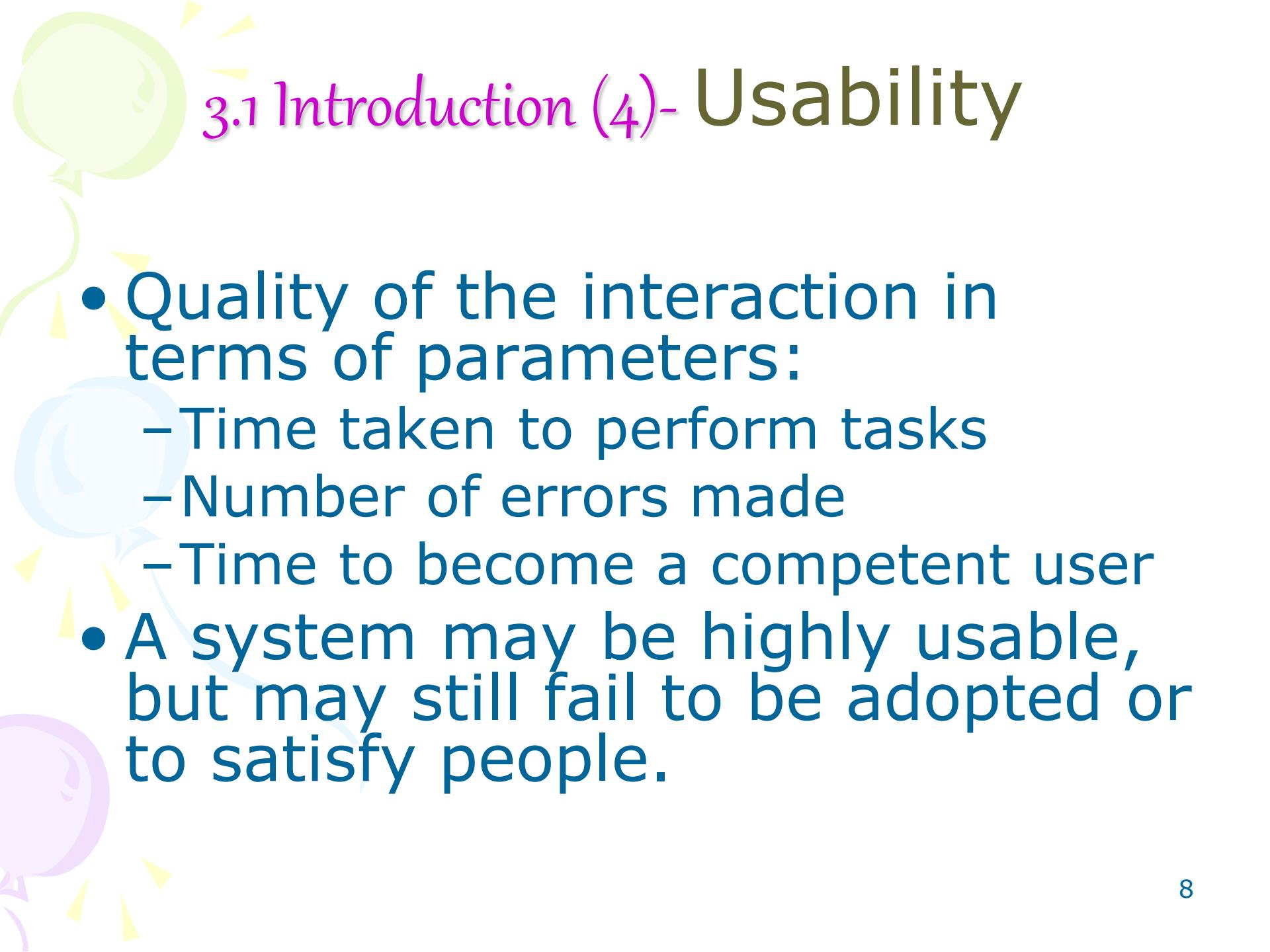
## 3.1 Introduction (2)





## 3.1 Introduction (3)

- **Accessibility** : Remove/ install the barriers for people from using the system at all.
- **Acceptability**: Fitness for purpose in the context of use.
- **Engagement**: Designing for great, exciting and riveting experiences.



## 3.1 Introduction (4)- Usability

- Quality of the interaction in terms of parameters:
  - Time taken to perform tasks
  - Number of errors made
  - Time to become a competent user
- A system may be highly usable, but may still fail to be adopted or to satisfy people.



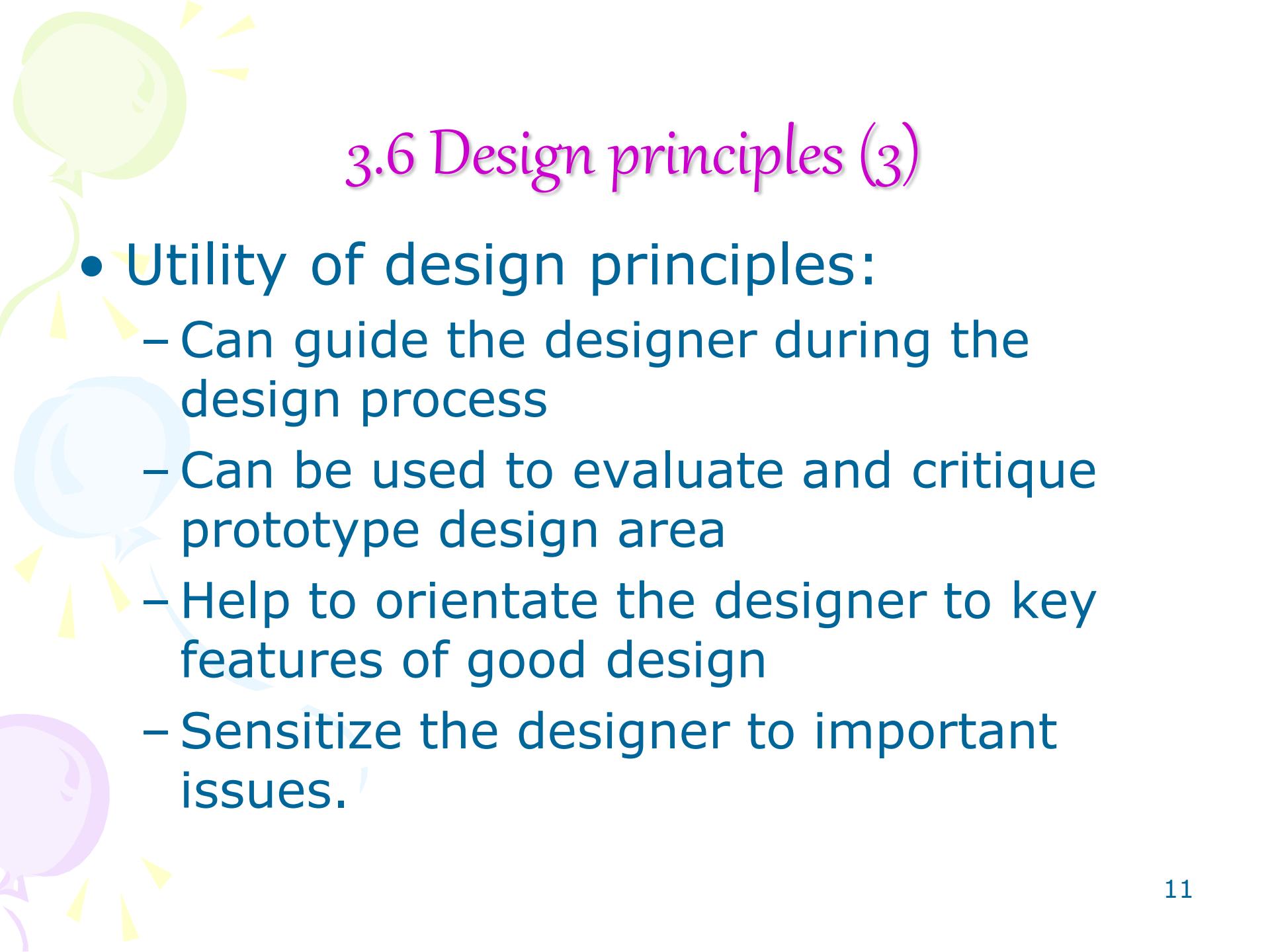
## 3.6 Design principles

- History:
  - Over the years, many principles of good interactive system design have been developed (Don Norman, 1998; Jacob Nielsen, 1993).
  - However, the level of abstraction by different people at different times:
    - Inconsistent
    - Confusing
  - There is also good design principles derived from psychology. Ex: minimize memory load.



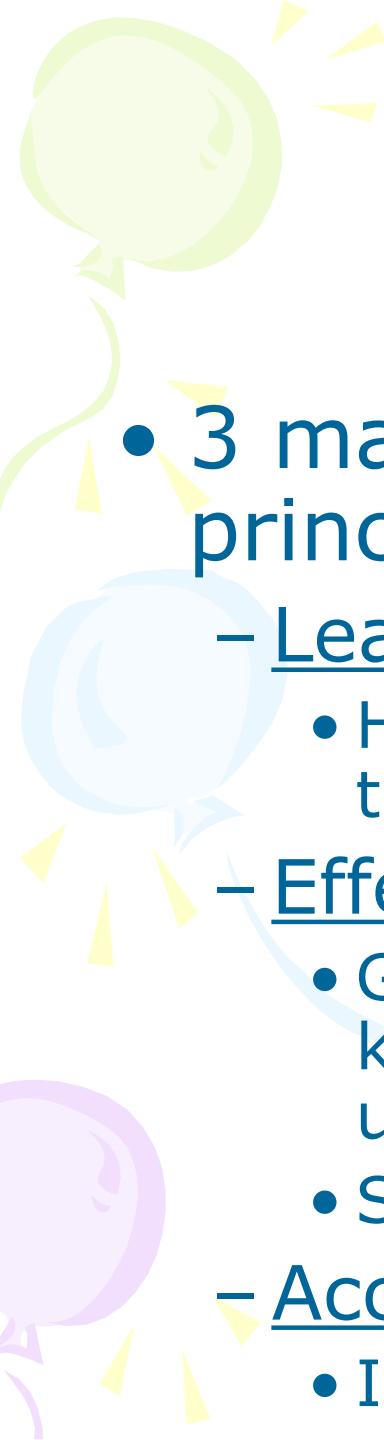
## 3.6 Design principles (2)

- The application of design principles ⇒ established guidelines and patterns of interaction in certain circumstances. Ex:
  - “Undo” command in Windows application
  - “back” button on a website
  - Greying- out of inappropriate options on menus



## 3.6 Design principles (3)

- Utility of design principles:
  - Can guide the designer during the design process
  - Can be used to evaluate and critique prototype design area
  - Help to orientate the designer to key features of good design
  - Sensitize the designer to important issues.



## 3.6 Design principles (4)

- 3 main categories of design principles:
  - Learnability:
    - Helping people access, learn and remember the system: principles 1-4
  - Effectiveness:
    - Giving them the sense of being in control, knowing what to do and how to do it (ease of use): principles 5-7
    - Safely and securely (safety): principles 8-9
  - Accommodation:
    - In a way that suits them: principles 10-12



## 3.6 Design principles (4b)

### Learnability:

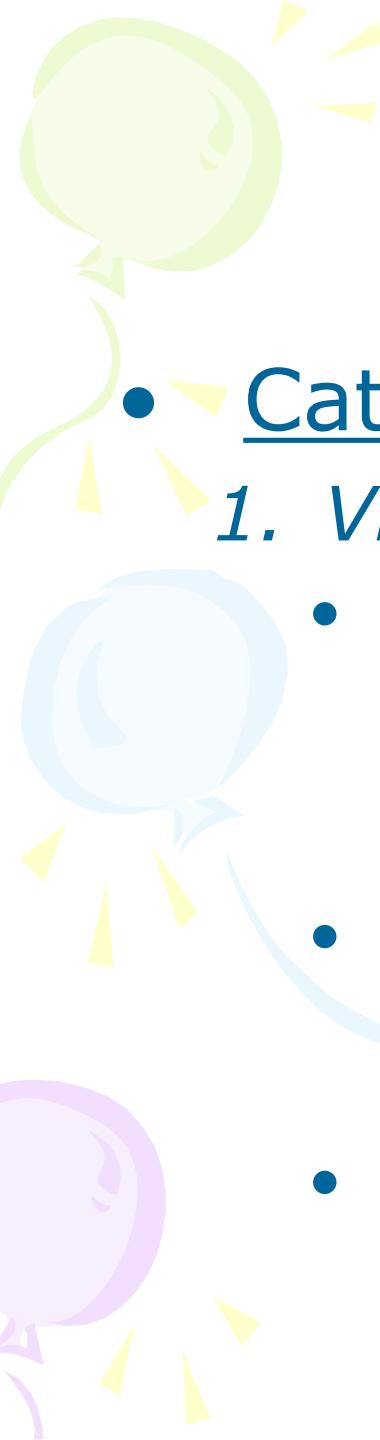
- 1. *Visibility*
- 2. *Consistency*
- 3. *Familiarity*
- 4. *Affordance*

### Accommodation

- 5. *Flexibility*
- 6. *Style*
- 7. *Conviviality*

### Effectiveness :

- 8. *Navigation*
- 9. *Control*
- 10. *Feedback*
- 11. *Recovery*
- 12. *Constraints*

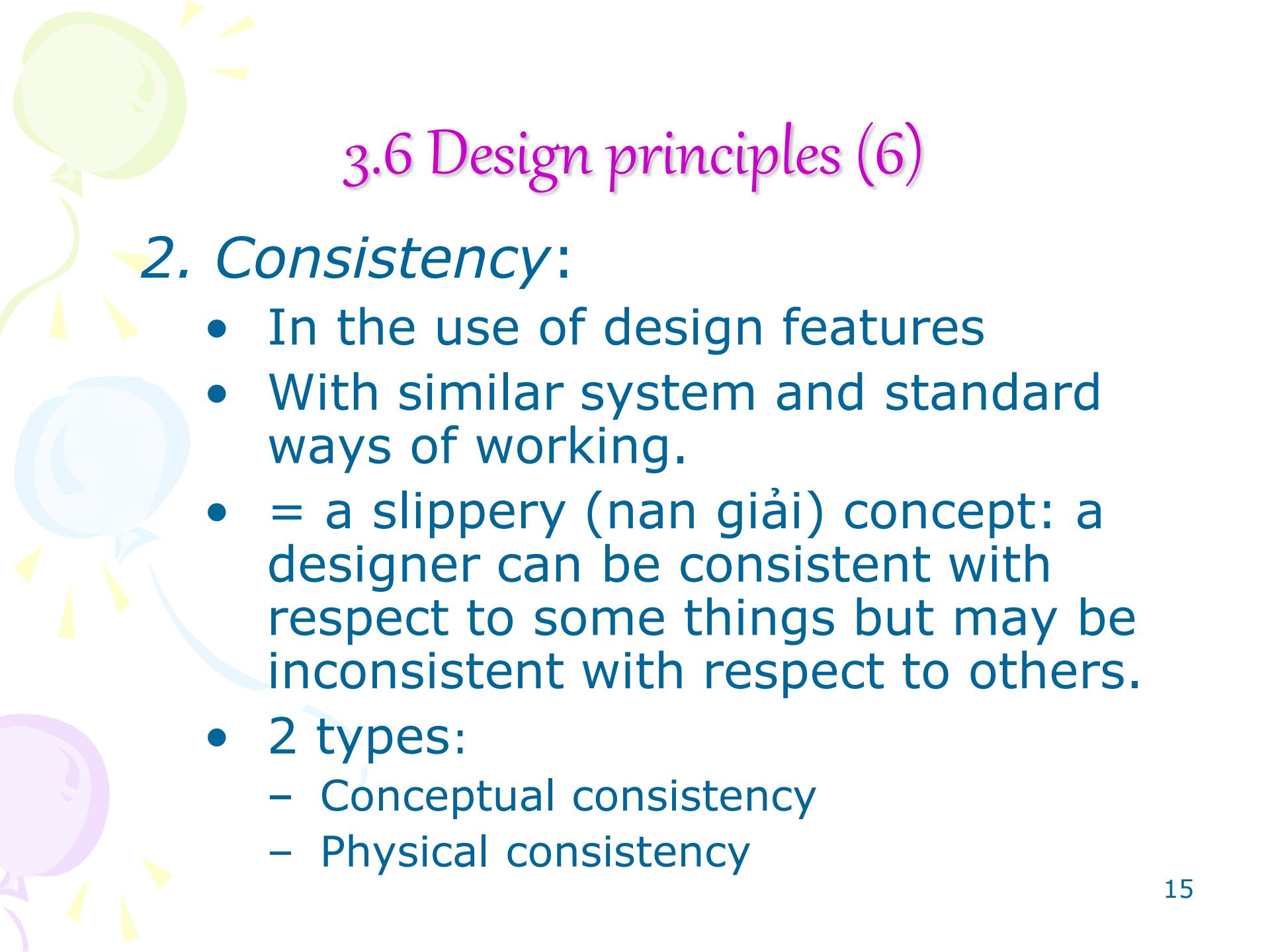


## 3.6 Design principles (5)

- Category 1: Learnability

### 1. *Visibility:*

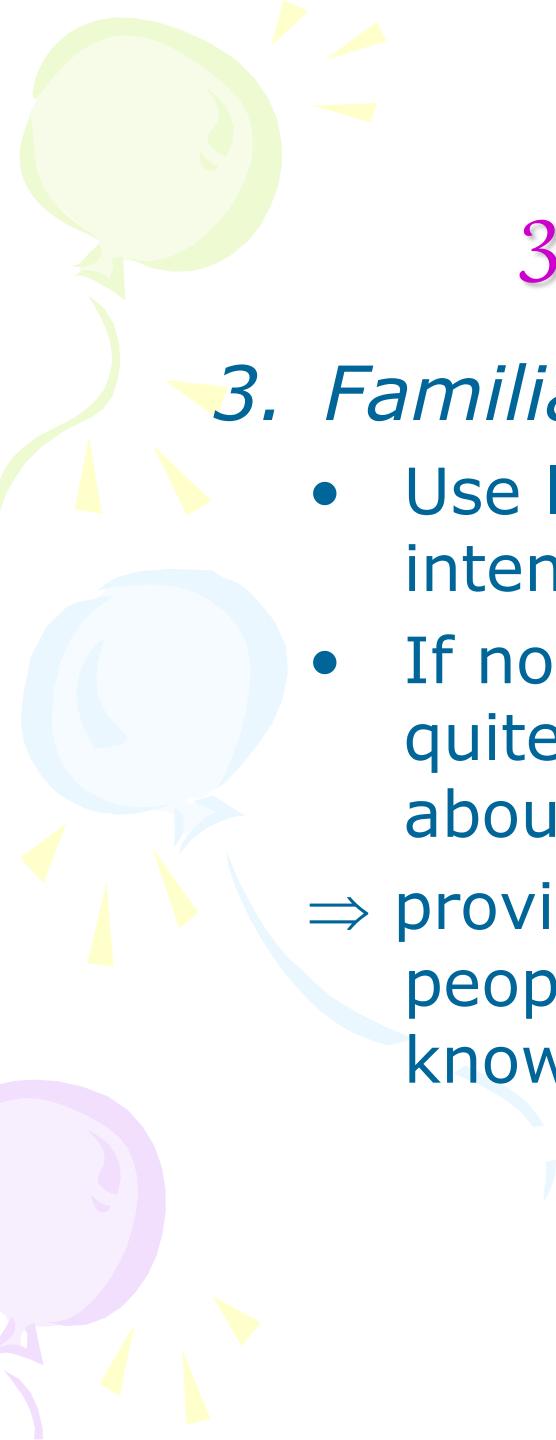
- Try to ensure that things are visible so that the people can see what functions are available and what the system is currently doing.
- Psychological principle: It is easier to recognize things than to have to recall them.
- If it is not possible to make it visible, make it observable.



## 3.6 Design principles (6)

### 2. Consistency:

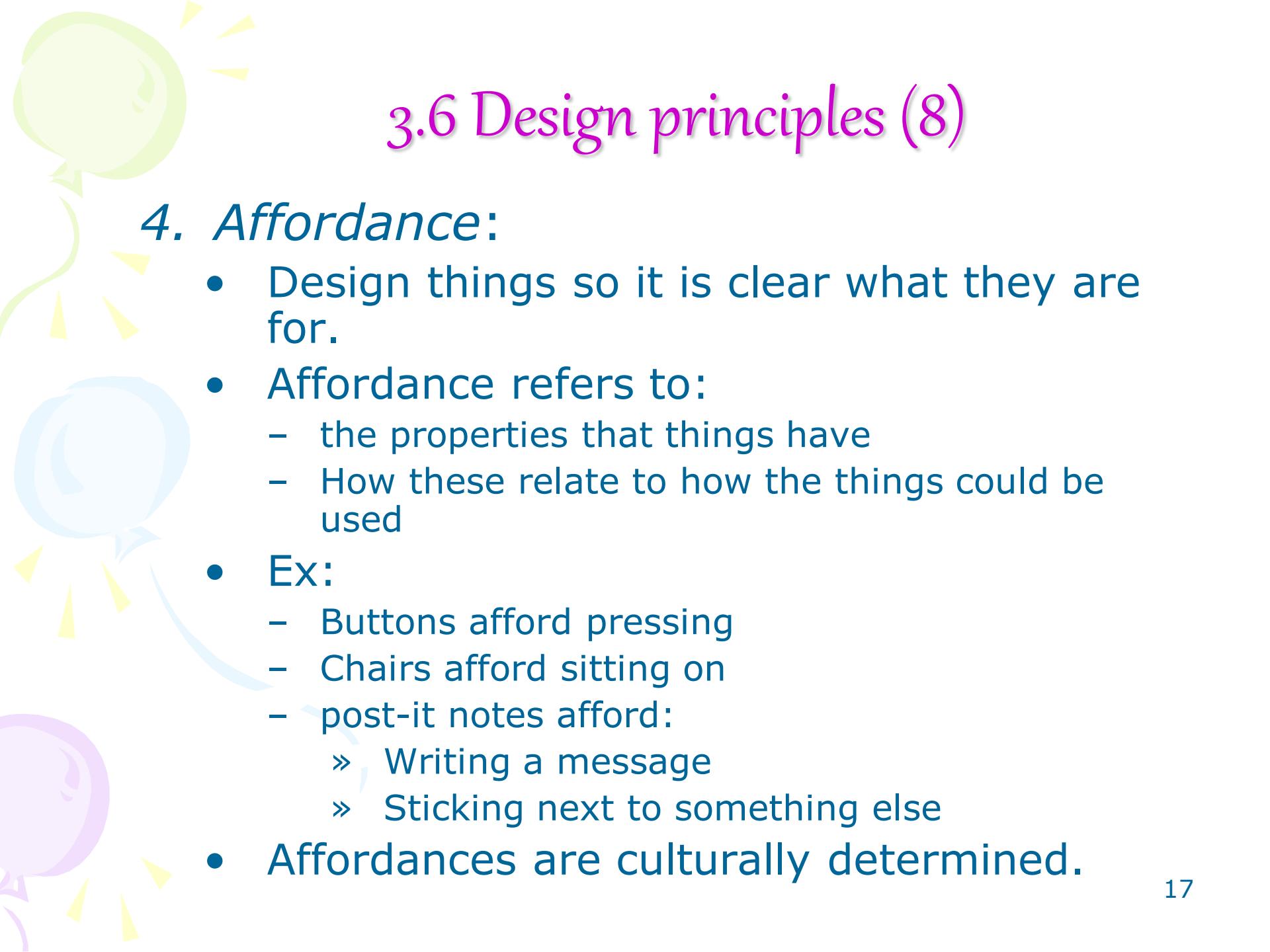
- In the use of design features
- With similar system and standard ways of working.
- = a slippery (nan giải) concept: a designer can be consistent with respect to some things but may be inconsistent with respect to others.
- 2 types:
  - Conceptual consistency
  - Physical consistency



## 3.6 Design principles (7)

### 3. Familiarity:

- Use language and symbols that the intended audience will be familiar with.
- If not possible because the concepts are quite different from those people know about
  - ⇒ provide a suitable metaphor to help the people transfer similar and related knowledge from 1 more familiar domain.



## 3.6 Design principles (8)

### 4. Affordance:

- Design things so it is clear what they are for.
- Affordance refers to:
  - the properties that things have
  - How these relate to how the things could be used
- Ex:
  - Buttons afford pressing
  - Chairs afford sitting on
  - post-it notes afford:
    - » Writing a message
    - » Sticking next to something else
- Affordances are culturally determined.

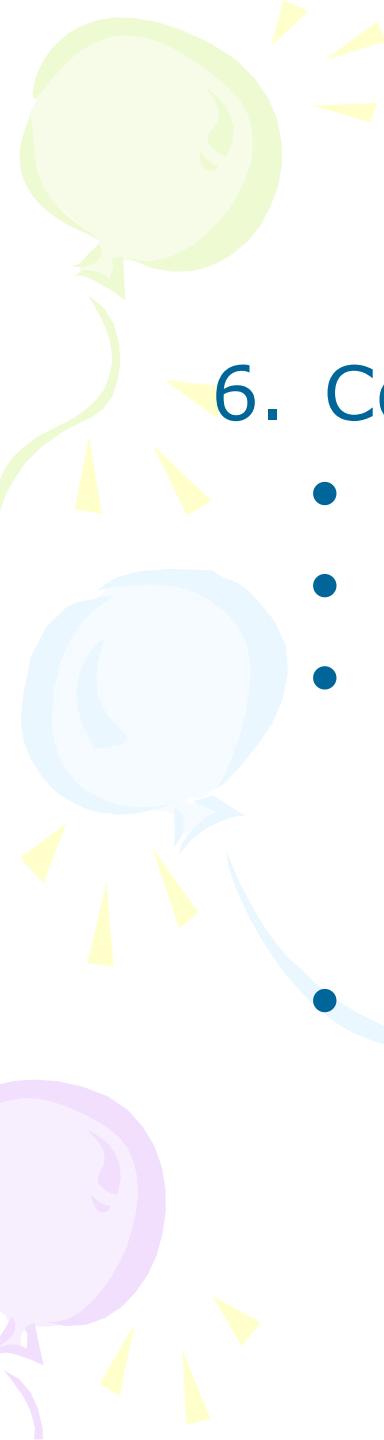


## 3.6 Design principles (9)

- Category 2: Effectiveness

### 5. Navigation:

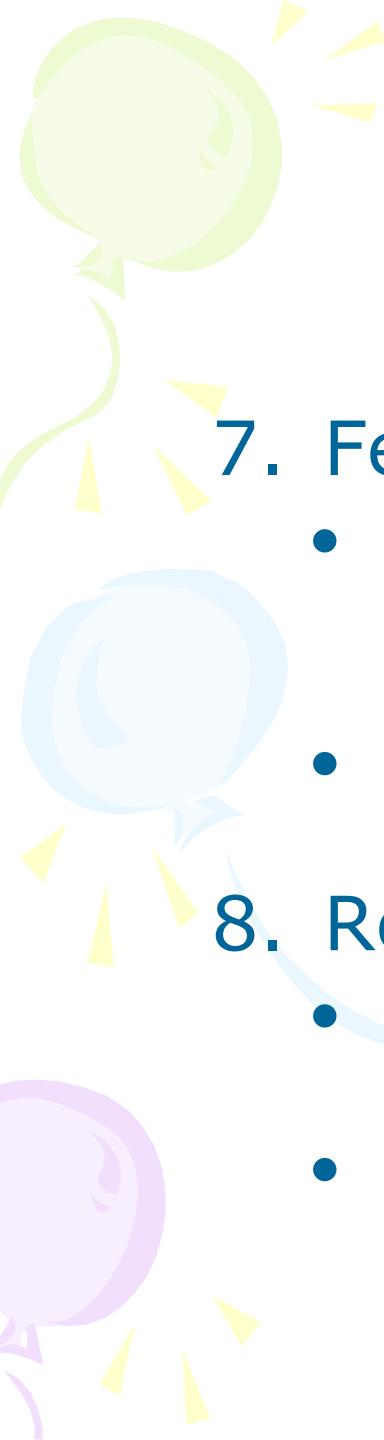
- Provide support to enable people to move around the parts of the system:
  - Maps
  - Directional signs
  - Information signs



## 3.6 Design principles (10)

### 6. Control:

- Make clear who or what is in control
- Allow people to take control
- Is enhanced if there is a clear, logical mapping between:
  - controls, and
  - the effects they have
- Make clear the relationship between:
  - What the system does, and
  - What will happen in the world outside the system



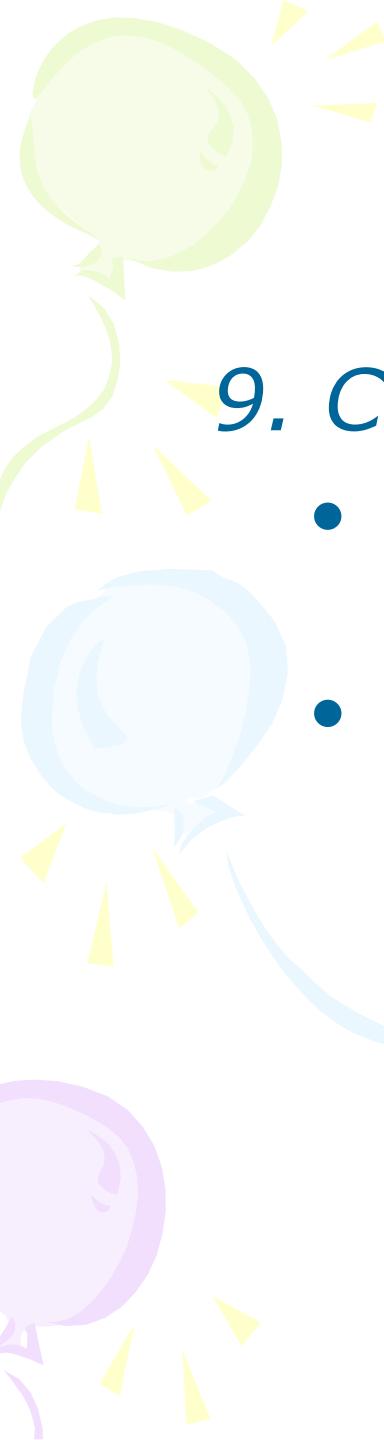
## 3.6 Design principles (11)

### 7. Feedback:

- Rapidly feed back information from the system to people so that they know what effect their actions have had.
- Constant and consistent feedback will enhance the feeling of control.

### 8. Recovery:

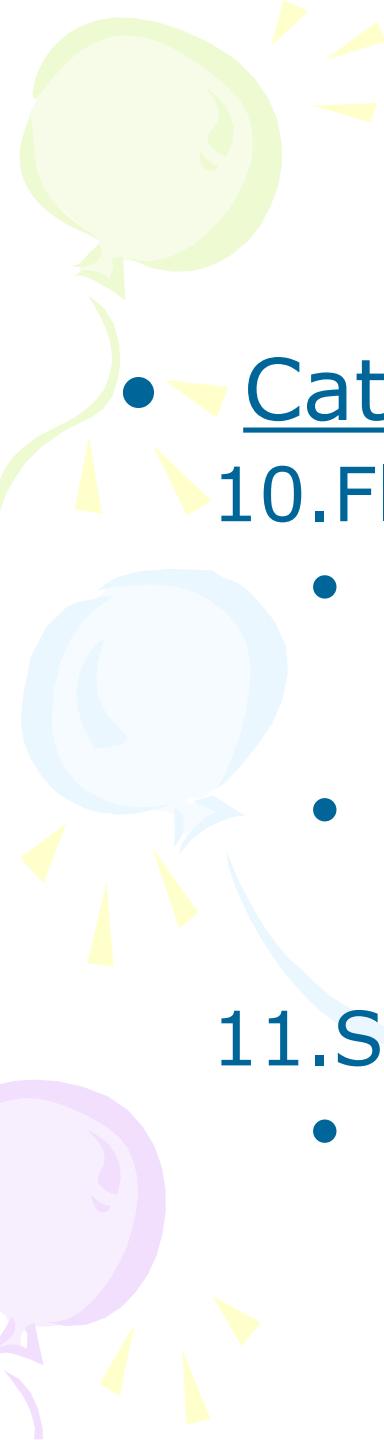
- Enable recovery from actions, particularly mistakes and errors,
- Quick and effective



## 3.6 Design principles (12)

### 9. *Constraints*:

- Provide constraints so that people do not try to do inappropriate things
- In particular, people should be prevented from making serious errors through properly:
  - Constraining allowable actions
  - Seeking confirmation of dangerous operations



## 3.6 Design principles (13)

- Category 3: Accommodation

### 10. Flexibility:

- Allow multiply ways of doing things so as to accommodate users with different levels of experience and interest in the system.
- Provide people with the opportunity to change the way things look or behave so that they can personalize the system.

### 11. Style:

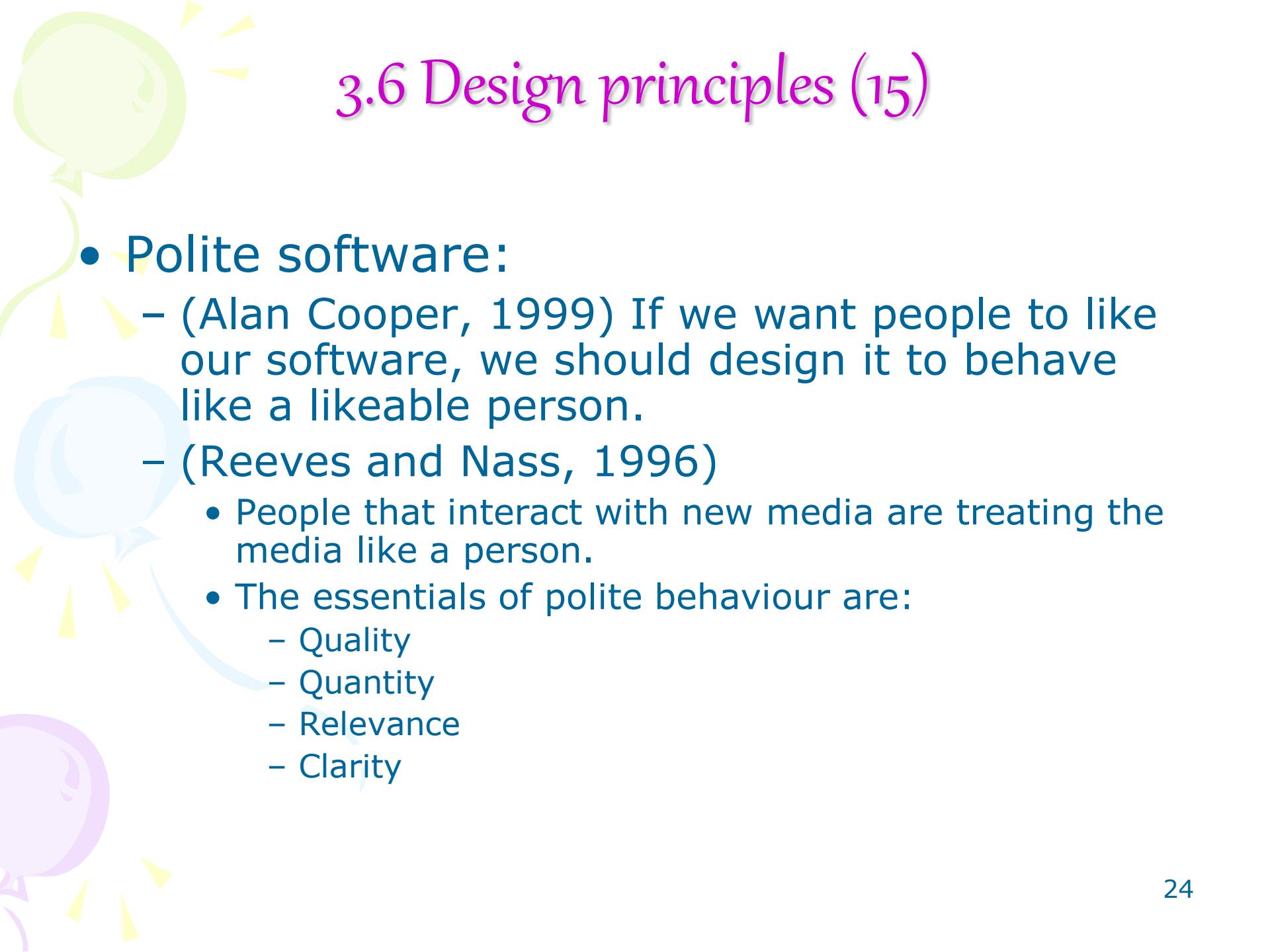
- Design should be stylish and attractive.



## 3.6 Design principles (14)

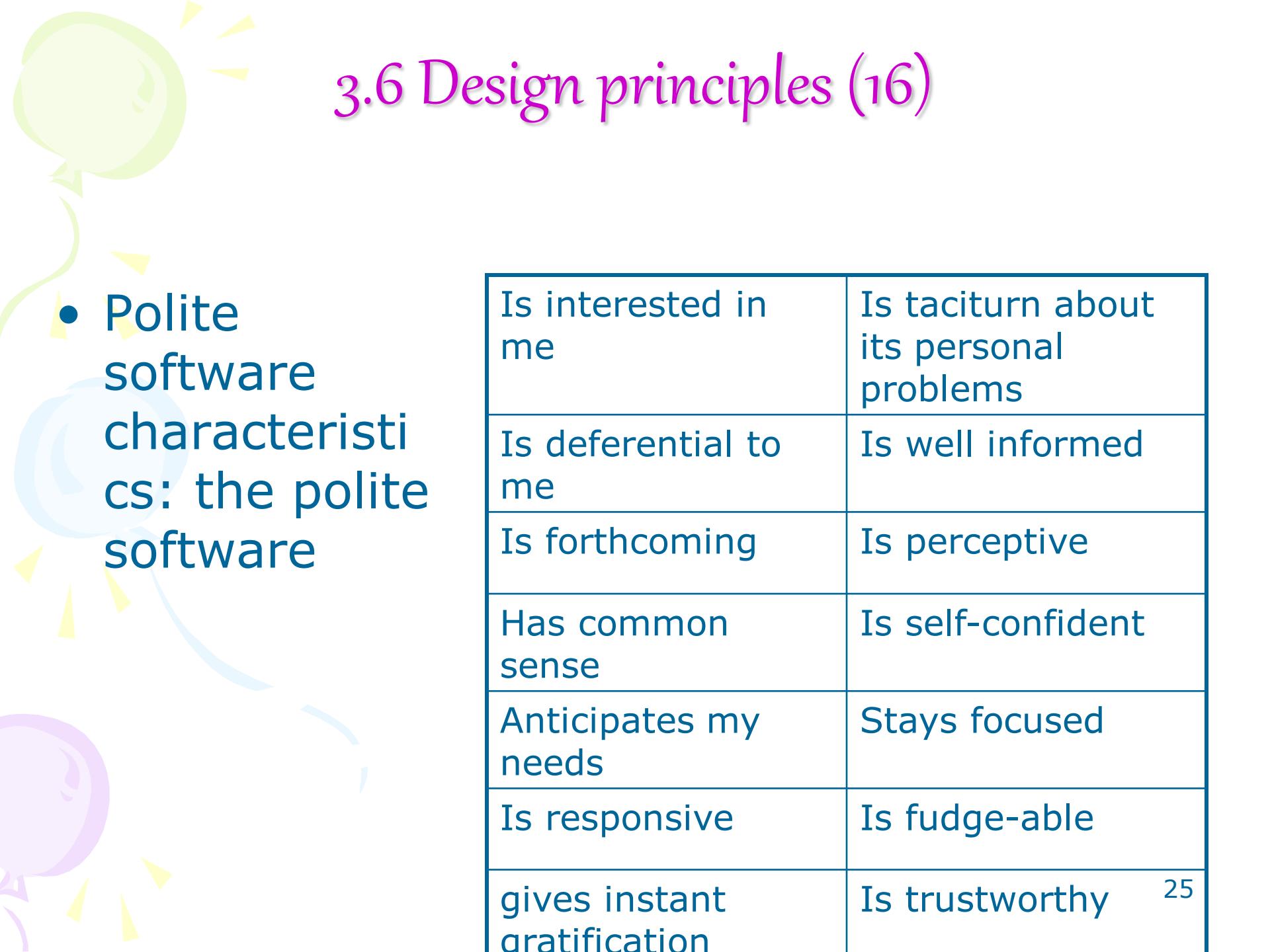
### 12. Conviviality:

- Interactive systems should be polite, friendly, and generally pleasant.
- They should not contain:
  - aggressive message ,
  - an abrupt interruption
- Conviviality also suggest joining in and using interactive technologies to connect and support people.



## 3.6 Design principles (15)

- Polite software:
  - (Alan Cooper, 1999) If we want people to like our software, we should design it to behave like a likeable person.
  - (Reeves and Nass, 1996)
    - People that interact with new media are treating the media like a person.
    - The essentials of polite behaviour are:
      - Quality
      - Quantity
      - Relevance
      - Clarity



## 3.6 Design principles (16)

- Polite software characteristics: the polite software

Is interested in me	Is taciturn about its personal problems
Is deferential to me	Is well informed
Is forthcoming	Is perceptive
Has common sense	Is self-confident
Anticipates my needs	Stays focused
Is responsive	Is fudge-able
gives instant gratification	Is trustworthy



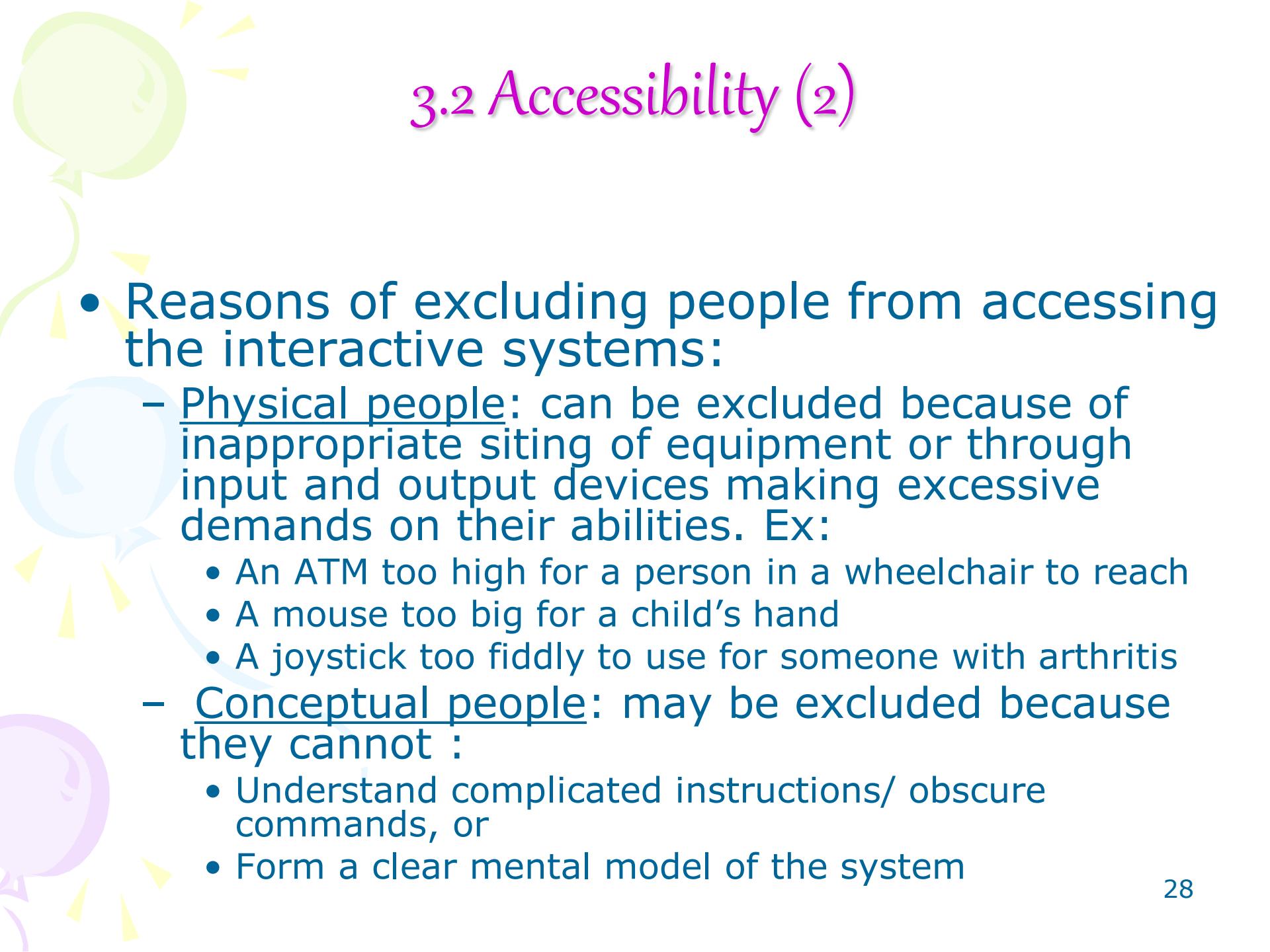
## 3.2 Accessibility

- Access to information spaces, as to physical spaces, for people with disabilities
  - = an important legal and ethical requirement
- There are declarations and guidelines on ensuring that everyone can access to information delivered through software technologies.



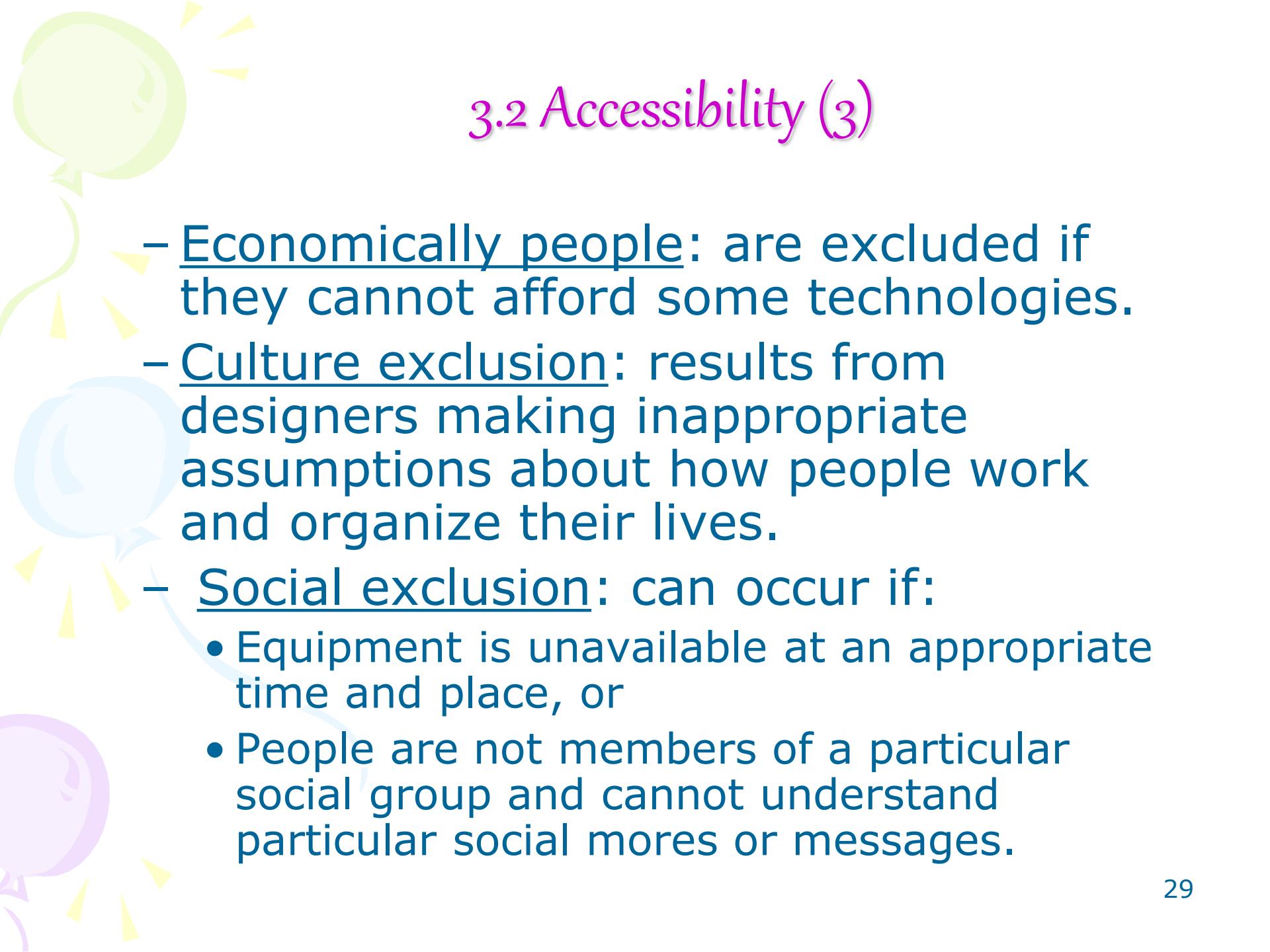
## 3.2 Accessibility (2)

- Designers need to focus on demands that theirs designs make on people's abilities.
- Designers have to design for the elderly and for children.
- (Newell, 1995) The sort of issues :
  - That face an ordinary user in an extra-ordinary environment (ex: under stress, time pressure)
  - Are often similar to the issues that face an extra-ordinary user in an ordinary environment.



## 3.2 Accessibility (2)

- Reasons of excluding people from accessing the interactive systems:
  - Physical people: can be excluded because of inappropriate siting of equipment or through input and output devices making excessive demands on their abilities. Ex:
    - An ATM too high for a person in a wheelchair to reach
    - A mouse too big for a child's hand
    - A joystick too fiddly to use for someone with arthritis
  - Conceptual people: may be excluded because they cannot :
    - Understand complicated instructions/ obscure commands, or
    - Form a clear mental model of the system



## 3.2 Accessibility (3)

- Economically people: are excluded if they cannot afford some technologies.
- Culture exclusion: results from designers making inappropriate assumptions about how people work and organize their lives.
- Social exclusion: can occur if:
  - Equipment is unavailable at an appropriate time and place, or
  - People are not members of a particular social group and cannot understand particular social mores or messages.



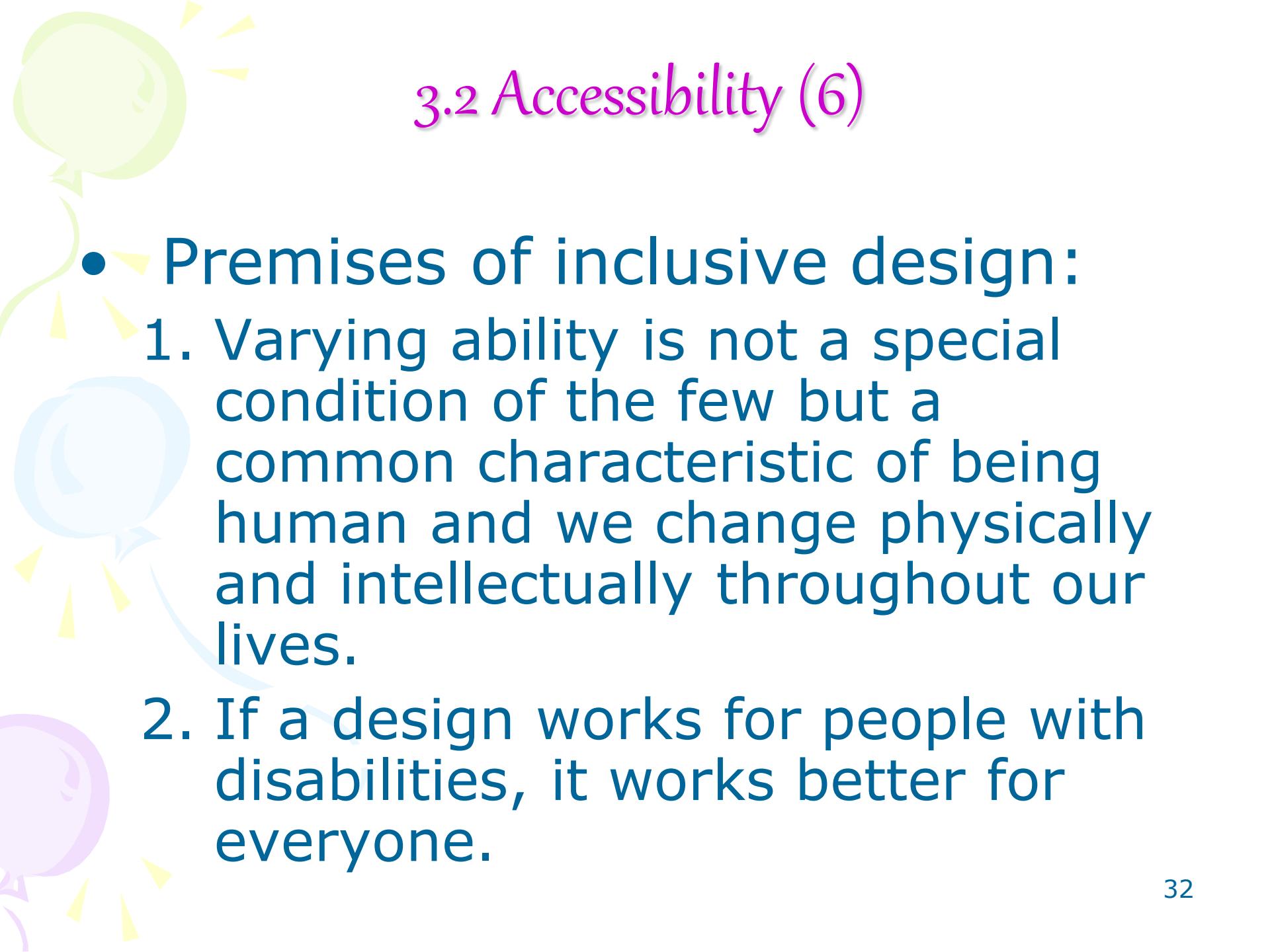
## 3.2 Accessibility (4)

- 2 main approaches to design for accessibility:
  - “Design for all”
  - Inclusive design
- “Design for all” = universal design
  - Goes beyond the design of interactive systems
  - Applied to all design endeavours



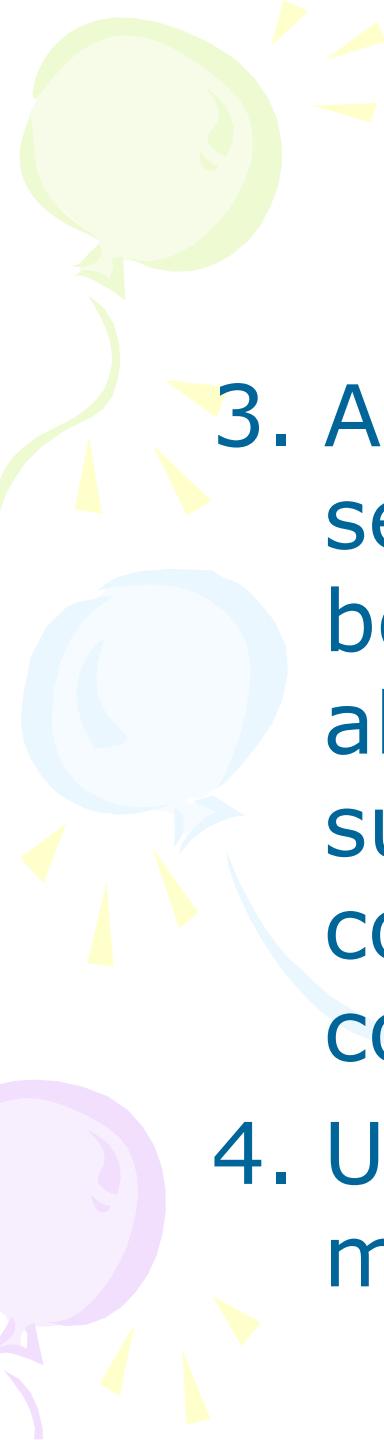
## 3.2 Accessibility (5)

- Principles of universal design:
  1. Equitable use
  2. Flexibility in use
  3. Simple, intuitive use
  4. Perceptible information
  5. Tolerance for error
  6. Low physical effort
  7. Size and space for approach and use



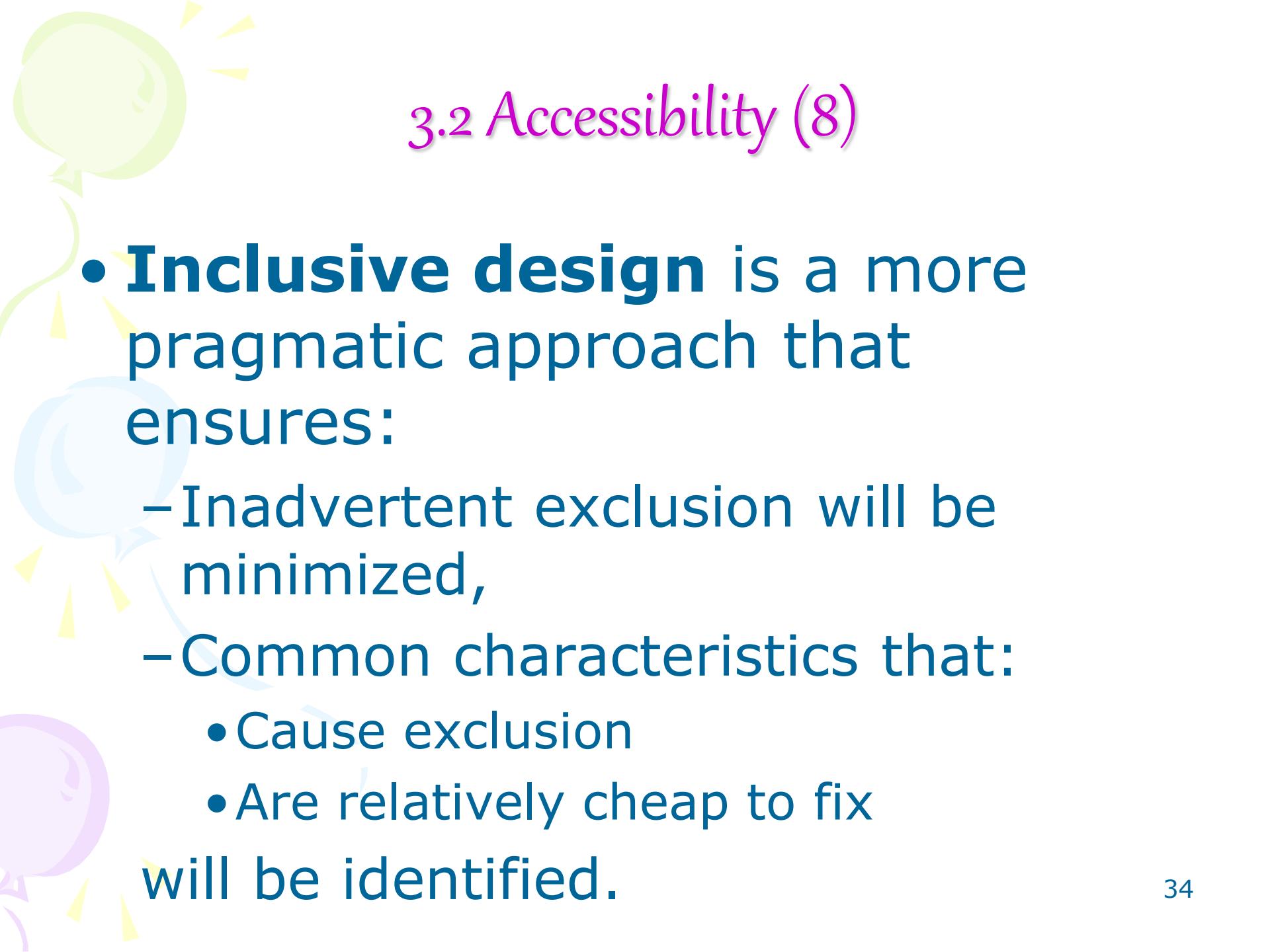
## 3.2 Accessibility (6)

- Premises of inclusive design:
  1. Varying ability is not a special condition of the few but a common characteristic of being human and we change physically and intellectually throughout our lives.
  2. If a design works for people with disabilities, it works better for everyone.



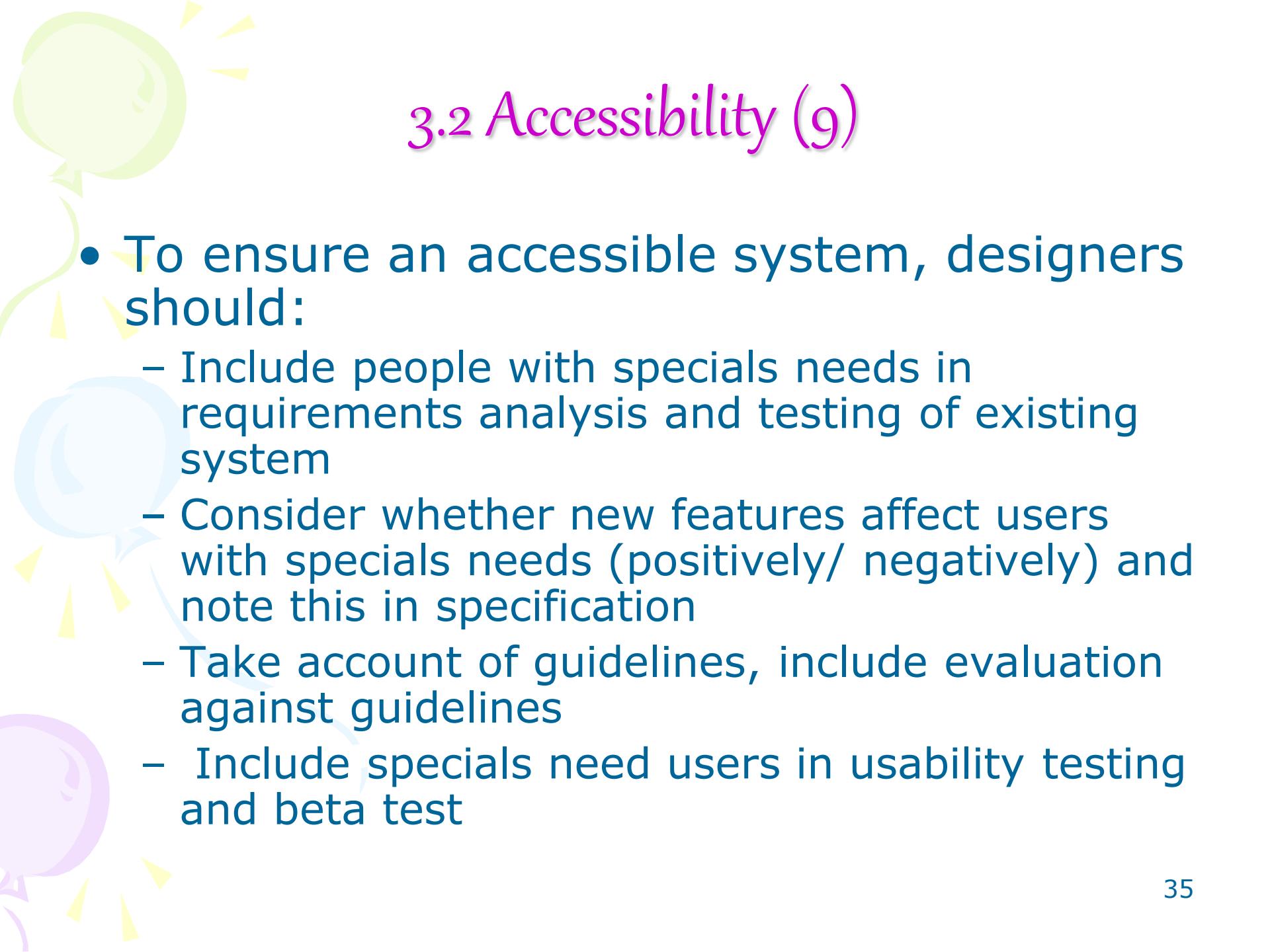
## 3.2 Accessibility (7)

3. At any point of our lives, personal self-esteem, identity and well-being are deeply affected by our ability to function in our physical surroundings with a sense of comfort, independence and control.
4. Usability and aesthetics are mutually compatible.



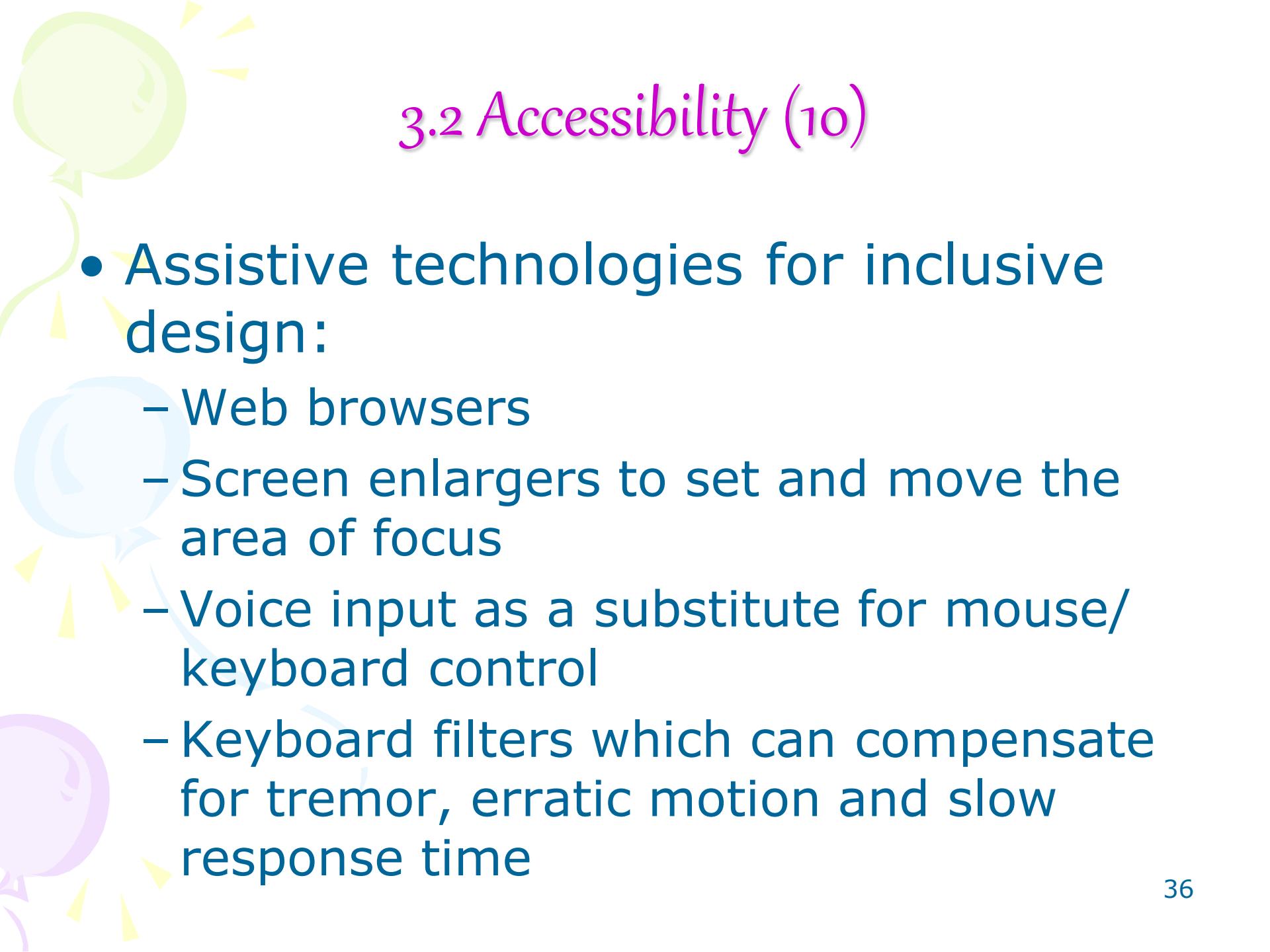
## 3.2 Accessibility (8)

- **Inclusive design** is a more pragmatic approach that ensures:
  - Inadvertent exclusion will be minimized,
  - Common characteristics that:
    - Cause exclusion
    - Are relatively cheap to fix
- will be identified.



## 3.2 Accessibility (9)

- To ensure an accessible system, designers should:
  - Include people with special needs in requirements analysis and testing of existing system
  - Consider whether new features affect users with special needs (positively/ negatively) and note this in specification
  - Take account of guidelines, include evaluation against guidelines
  - Include special need users in usability testing and beta test



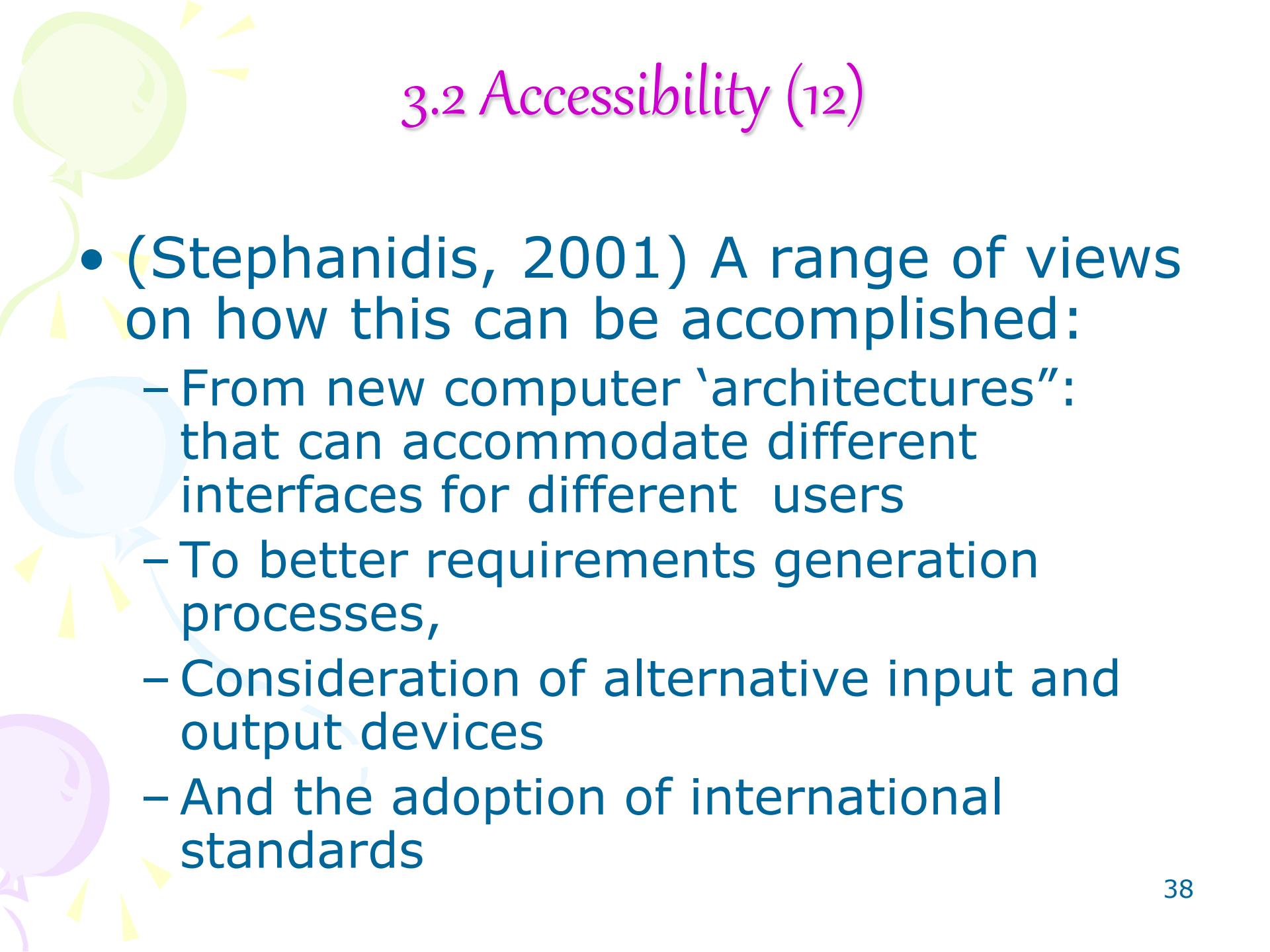
## 3.2 Accessibility (10)

- Assistive technologies for inclusive design:
  - Web browsers
  - Screen enlargers to set and move the area of focus
  - Voice input as a substitute for mouse/keyboard control
  - Keyboard filters which can compensate for tremor, erratic motion and slow response time



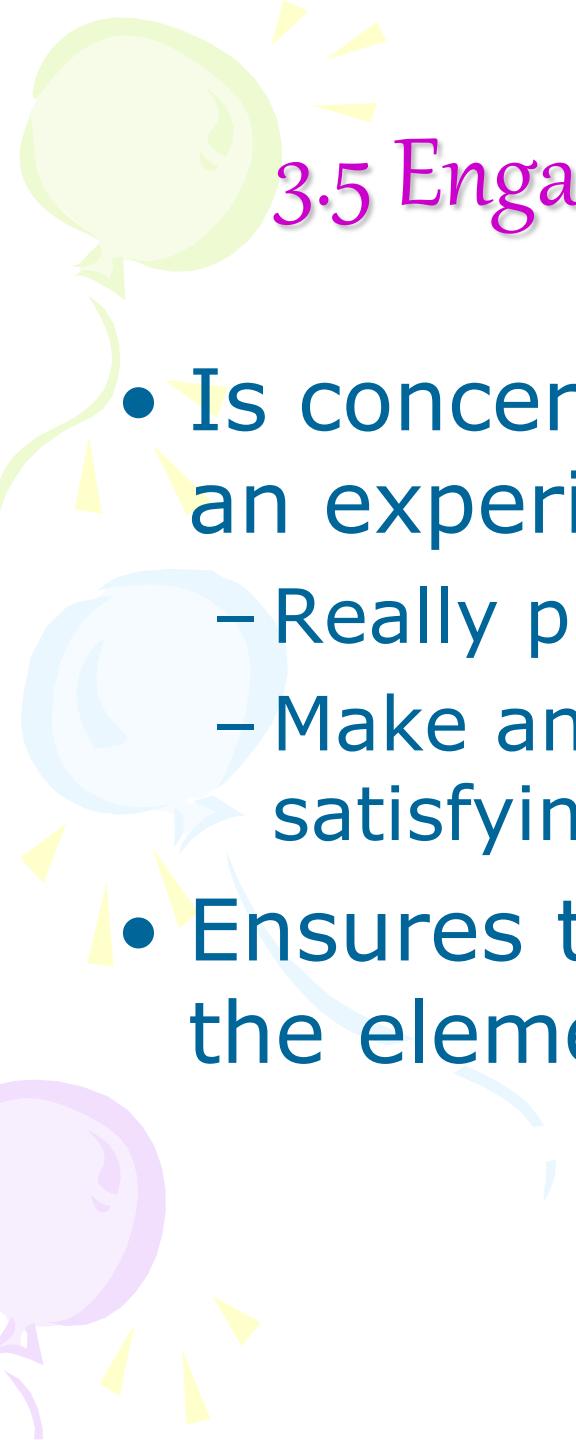
## 3.2 Accessibility (11)

- To a large extent, **universal design** is just good design:
  - To design to cater for the widest range of human abilities.
  - Will be better for everyone by considering access issues early in the design process.



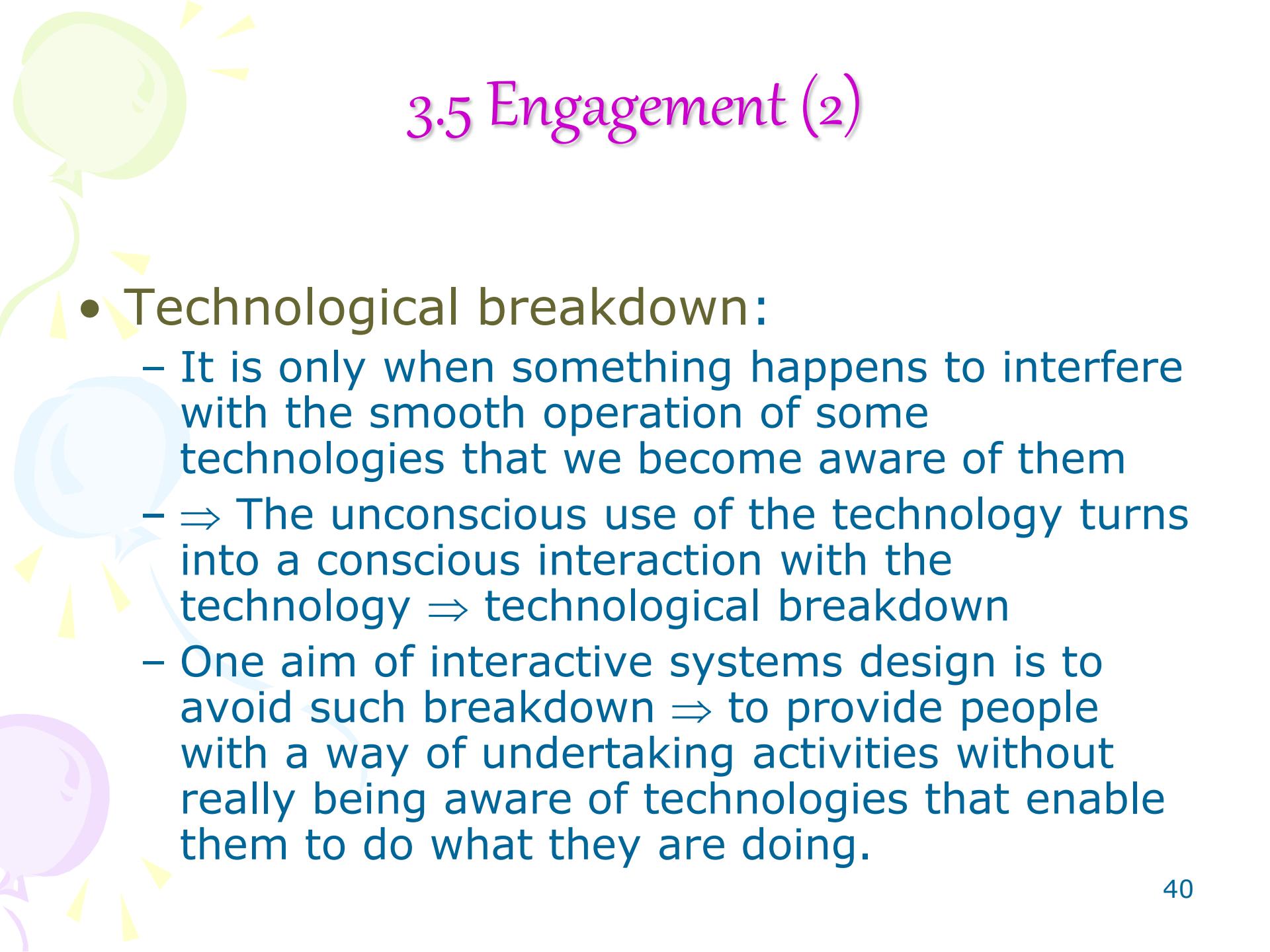
## 3.2 Accessibility (12)

- (Stephanidis, 2001) A range of views on how this can be accomplished:
  - From new computer ‘architectures’: that can accommodate different interfaces for different users
  - To better requirements generation processes,
  - Consideration of alternative input and output devices
  - And the adoption of international standards



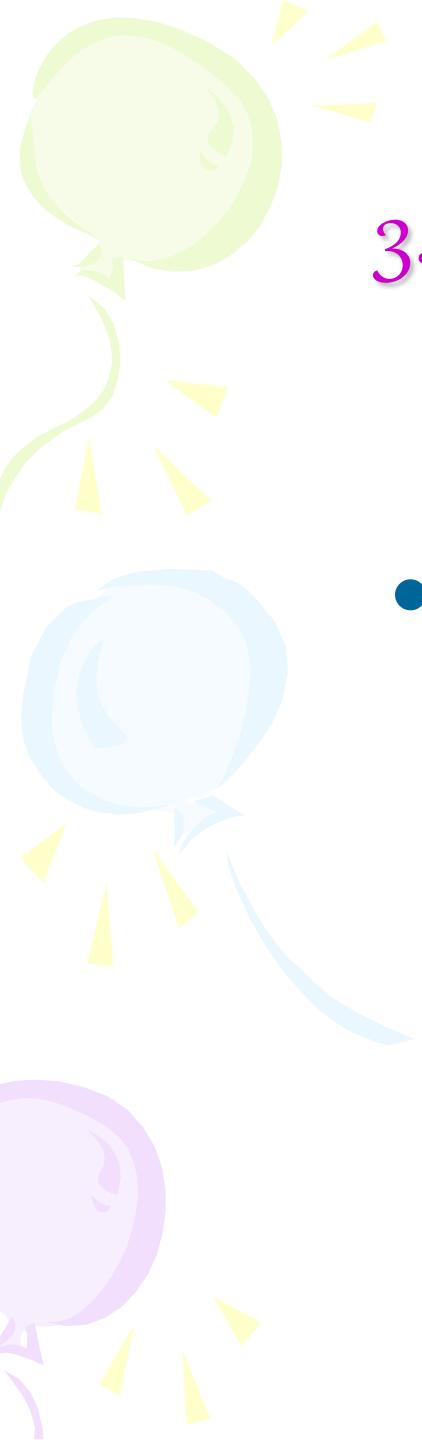
## 3.5 Engagement

- Is concerned with all the qualities of an experience that:
  - Really pull people in,
  - Make an interactive system memorable, satisfying, enjoyable and rewarding.
- Ensures that the interaction flows, the elements are truly harmonized.



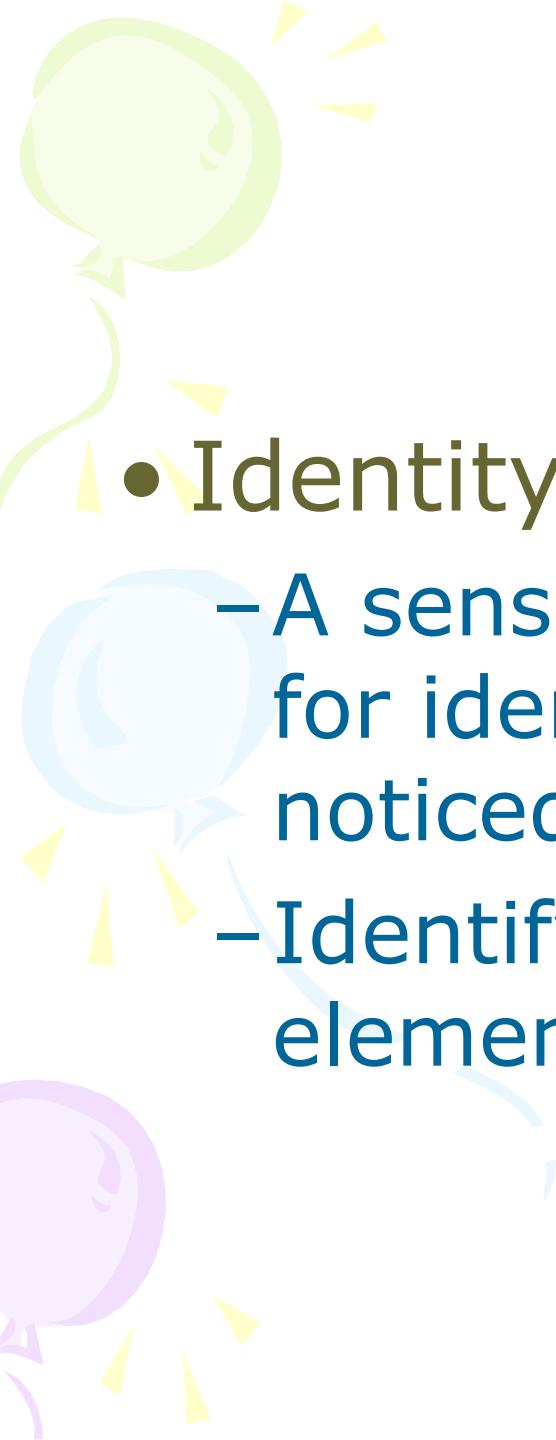
## 3.5 Engagement (2)

- Technological breakdown:
  - It is only when something happens to interfere with the smooth operation of some technologies that we become aware of them
  - ⇒ The unconscious use of the technology turns into a conscious interaction with the technology ⇒ technological breakdown
  - One aim of interactive systems design is to avoid such breakdown ⇒ to provide people with a way of undertaking activities without really being aware of technologies that enable them to do what they are doing.



## 3.5 Engagement (3)

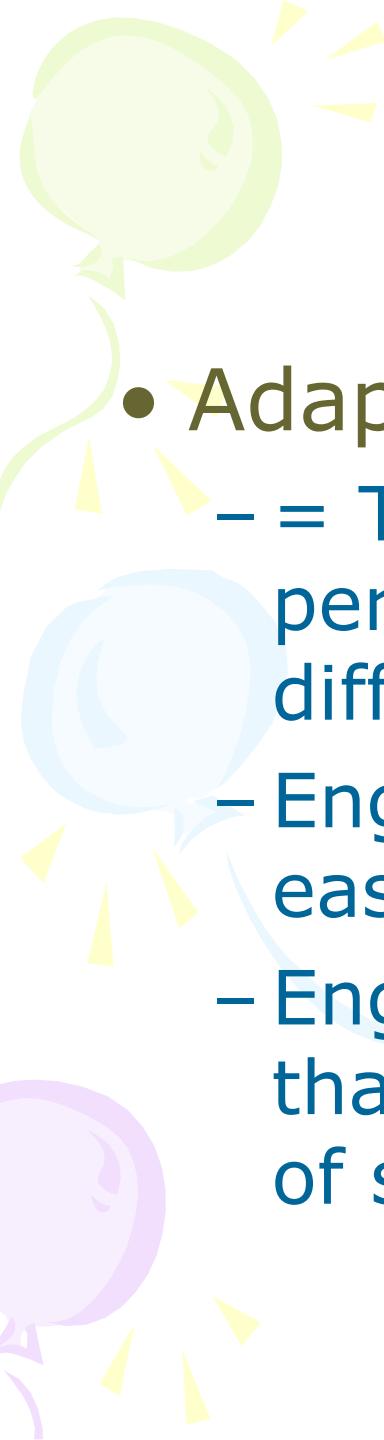
- Keys features of engagement:
  - Identity
  - Adaptivity
  - Narrative
  - Immersion
  - Flow



## 3.5 Engagement (4)

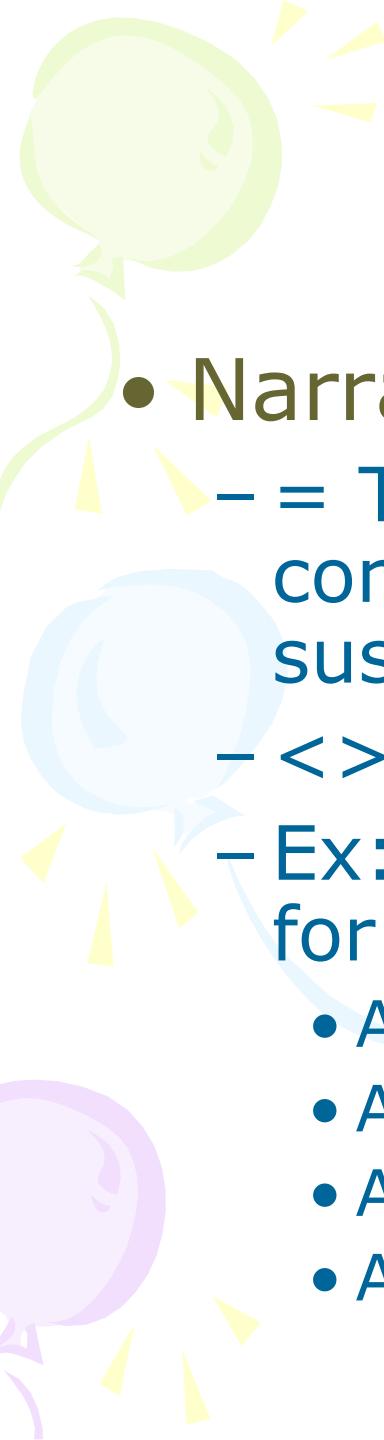
- Identity:

- A sense of authenticity is needed for identity and is often only noticed when it breaks down.
- Identifying with something= key element of engagement



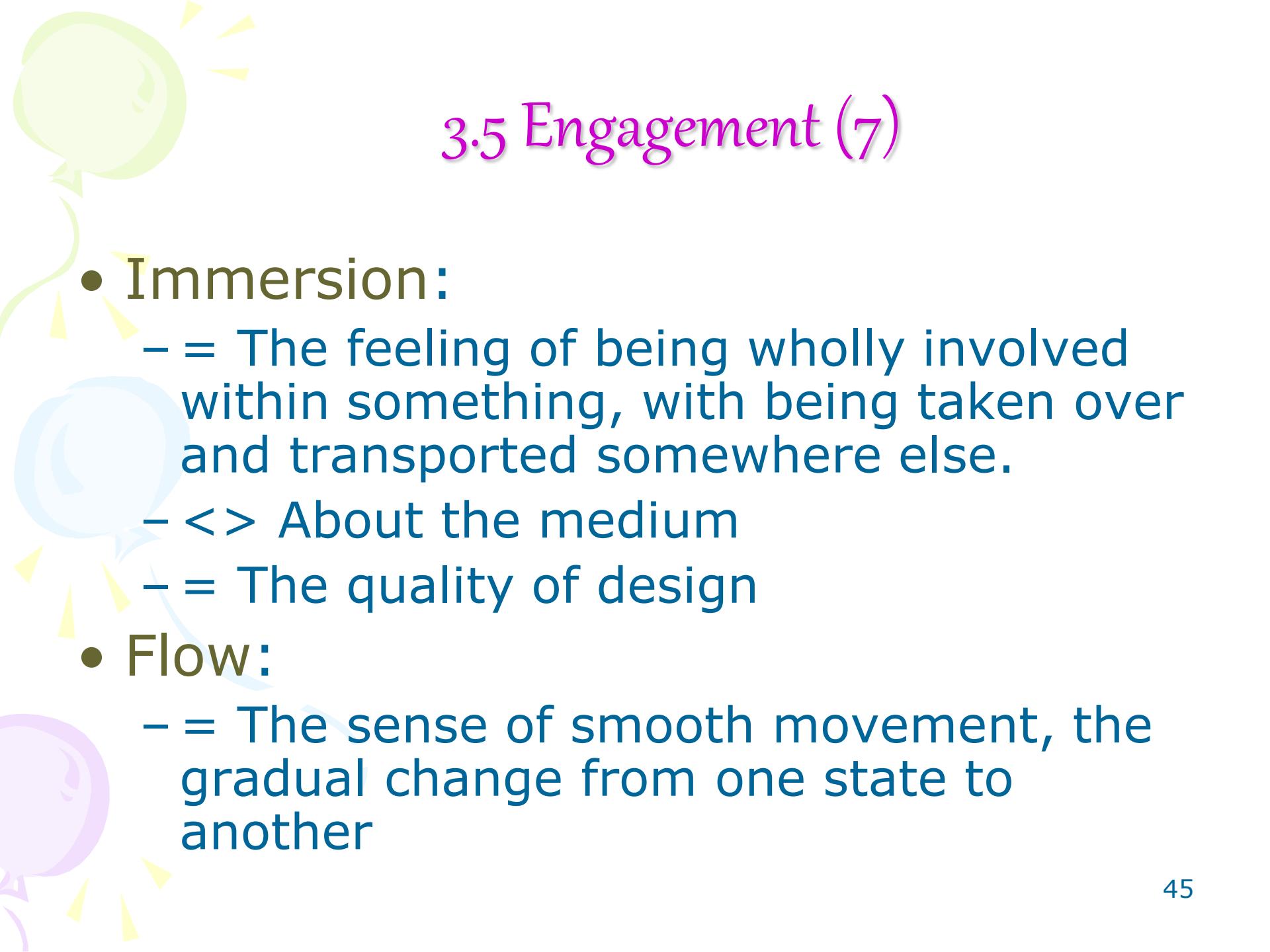
## 3.5 Engagement (5)

- **Adaptivity:**
  - = To do with the change and personalization with changing levels of difficulty, pace and movement.
  - Engagement <> about making things easy
  - Engagement = about making things that can be experienced at many levels of skill and enjoyment.



## 3.5 Engagement (6)

- **Narrative:**
  - = To do with telling a good story, with convincing characters, plot and suspense.
  - <> just about fiction
  - Ex: Good narrative is just as important for:
    - A company's promotional video
    - A lecture of interaction design
    - A menu structure on a mobile phone
    - Any other design problem



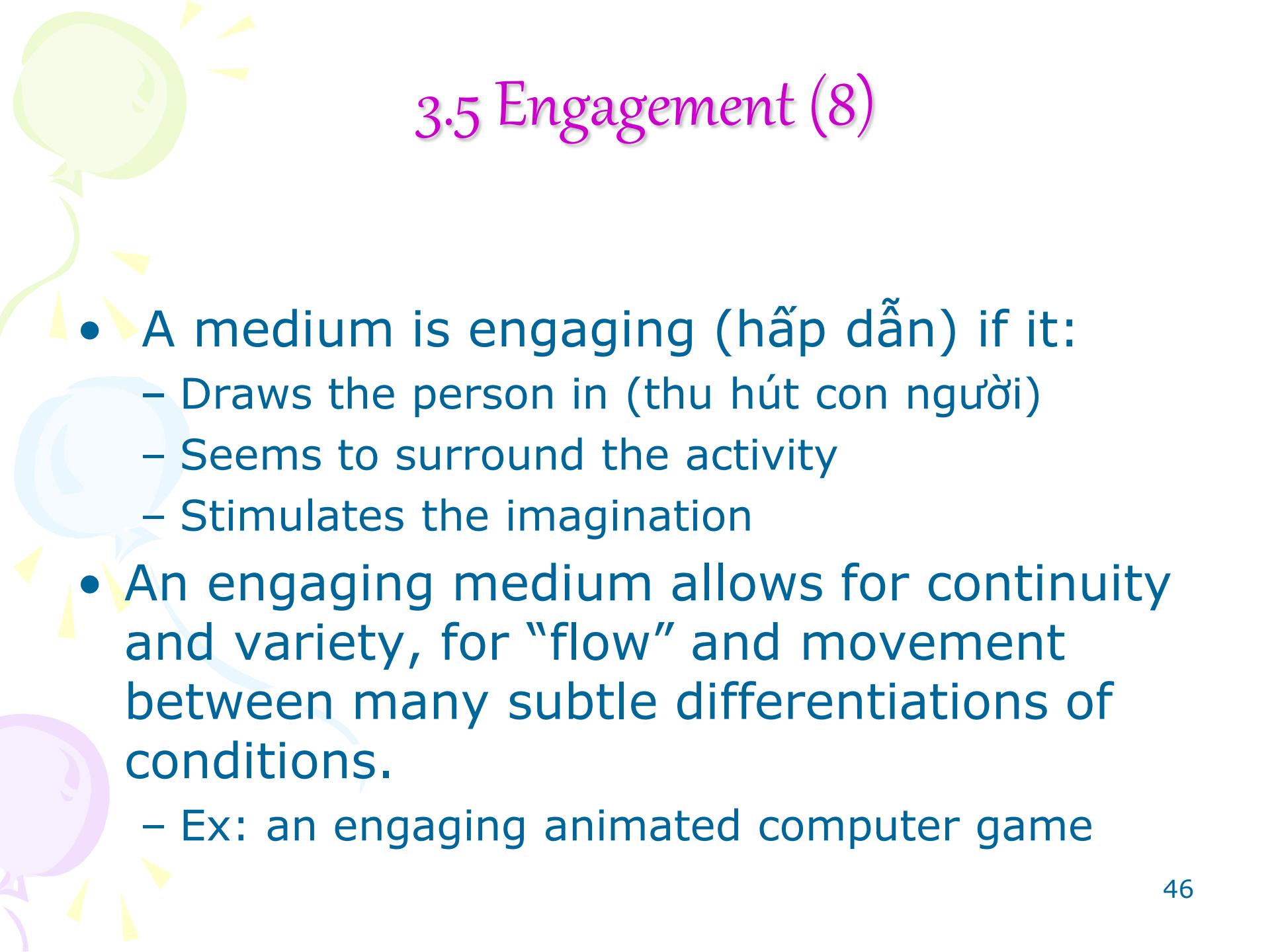
## 3.5 Engagement (7)

- **Immersion:**

- = The feeling of being wholly involved within something, with being taken over and transported somewhere else.
  - <> About the medium
  - = The quality of design

- **Flow:**

- = The sense of smooth movement, the gradual change from one state to another



## 3.5 Engagement (8)

- A medium is engaging (hấp dẫn) if it:
  - Draws the person in (thu hút con người)
  - Seems to surround the activity
  - Stimulates the imagination
- An engaging medium allows for continuity and variety, for “flow” and movement between many subtle differentiations of conditions.
  - Ex: an engaging animated computer game

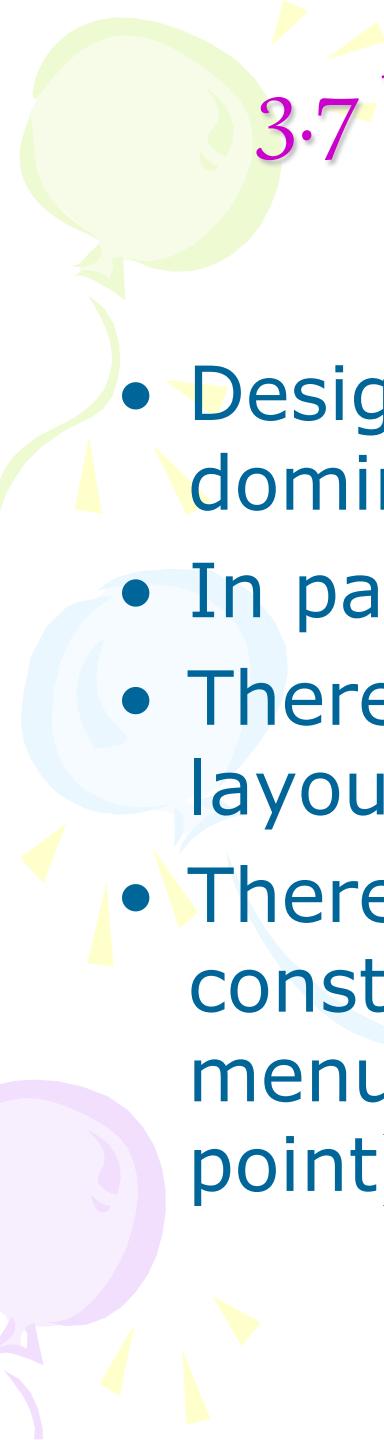
## 3.7 Designing for window applications

- Desktop: familiar combination of
    - Windows
    - Icons
    - Menus
    - Pointers
  - Information and communication technologies are becoming ⇒ This form of interaction is ubiquitous and appears on PDAs and other mobile devices as well as on desktop computers.
- 
- The diagram illustrates the WIMP interface. On the left, there is a list of four components: Windows, Icons, Menus, and Pointers. A blue curly brace groups these four items together. To the right of this group is a light green rectangular box with a thin blue border. Inside the box, the text "WIMP interface" is written in a dark blue font. The entire slide has a decorative background featuring stylized balloons in yellow, green, blue, and pink with yellow streamers at the bottom.



## 3.7 Designing for window applications (2)

- Consistency
- Visibility
- Familiarity
- Recovery
- Affordances
- Navigation
- Control
- Feedback
- Flexibility
- Style and conviviality



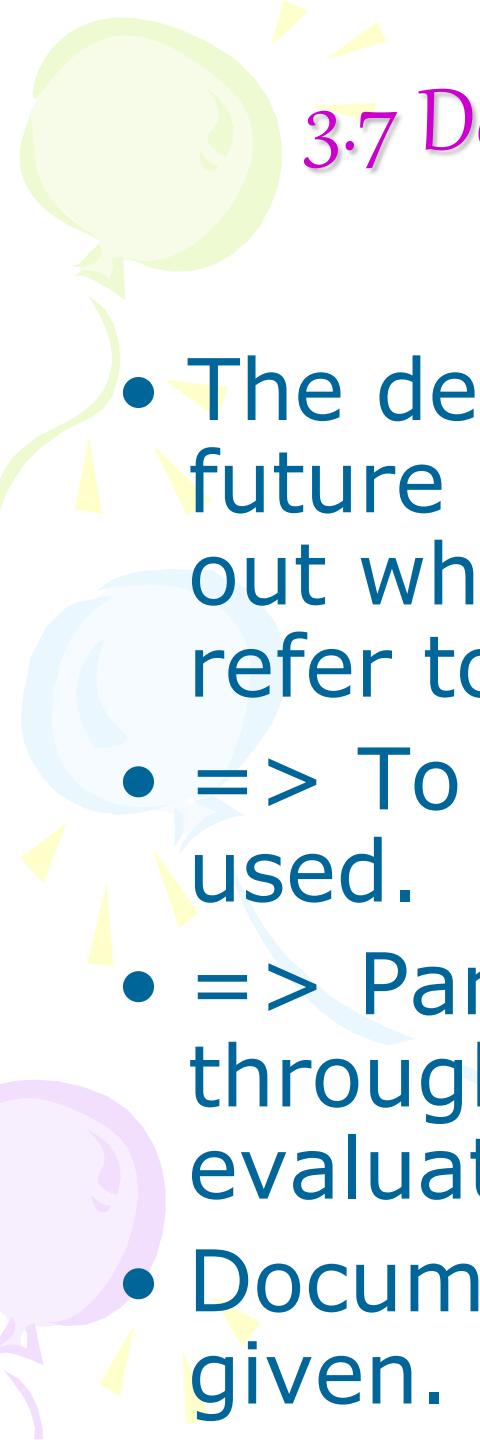
## 3.7 Designing for window applications- Consistency

- Designing for window applications is still dominated primarily by issues of usability.
- In particular, the key issue = consistency.
- There are clear guidelines for menu layout, ordering, dialogue boxes
- There are standards for providing constraints (ex: greying out items on a menu that are not relevant at a particular point).



## 3.7 Designing for windows applications- Visibility

- Screen design is important
- Attention needs to be paid to the layout of the objects on a screen = to the use of
  - appropriate, non-clashing colours
  - tables, graphs or text for the careful layout of information
- Avoiding clutter (hỗn độn, hỗn loạn)

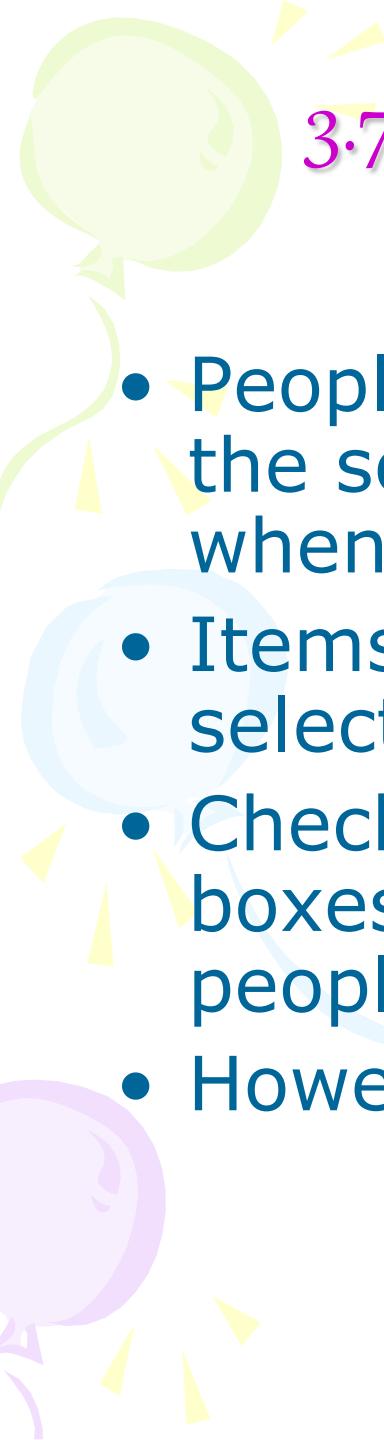


## 3.7 Designing for windows applications- Familiarity

- The designer can talk to the actual future users of the system and find out what they want and how they refer to things.
- => To ensure *familiar* language is used.
- => Participatory design techniques: through workshops, meetings, evaluation of design ideas.
- Documentation and training can be given.

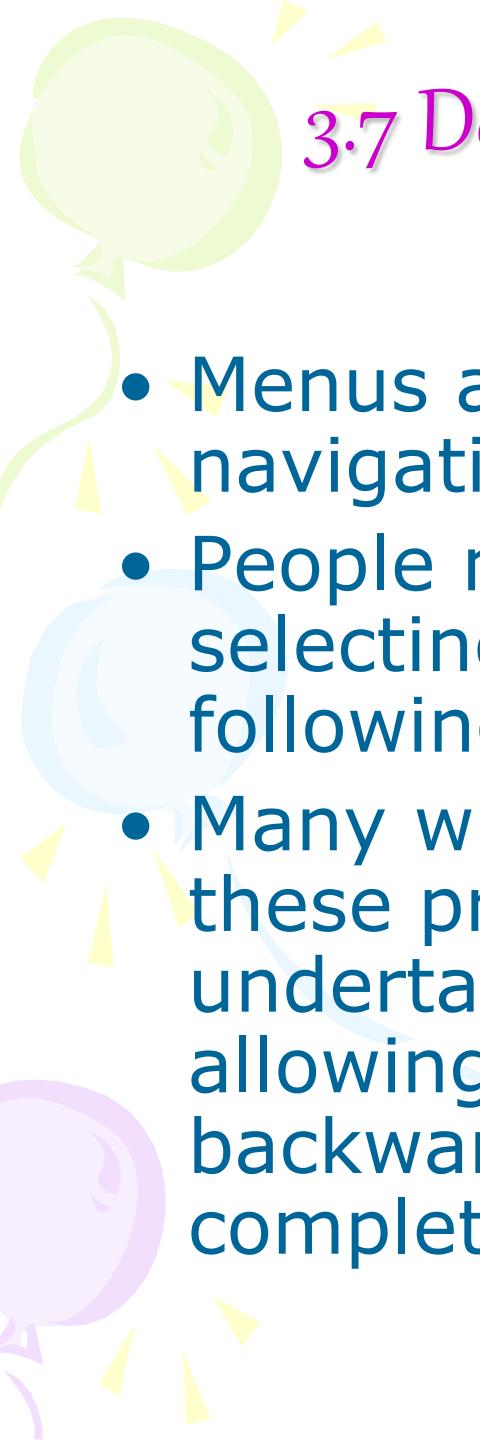
## 3.7 Designing for windows applications- Recovery

- A good design will ensure that there is easy error recovery
  - ⇒ by providing warning signs for drastic actions (ex: destroy)
  - ⇒ Undo command.



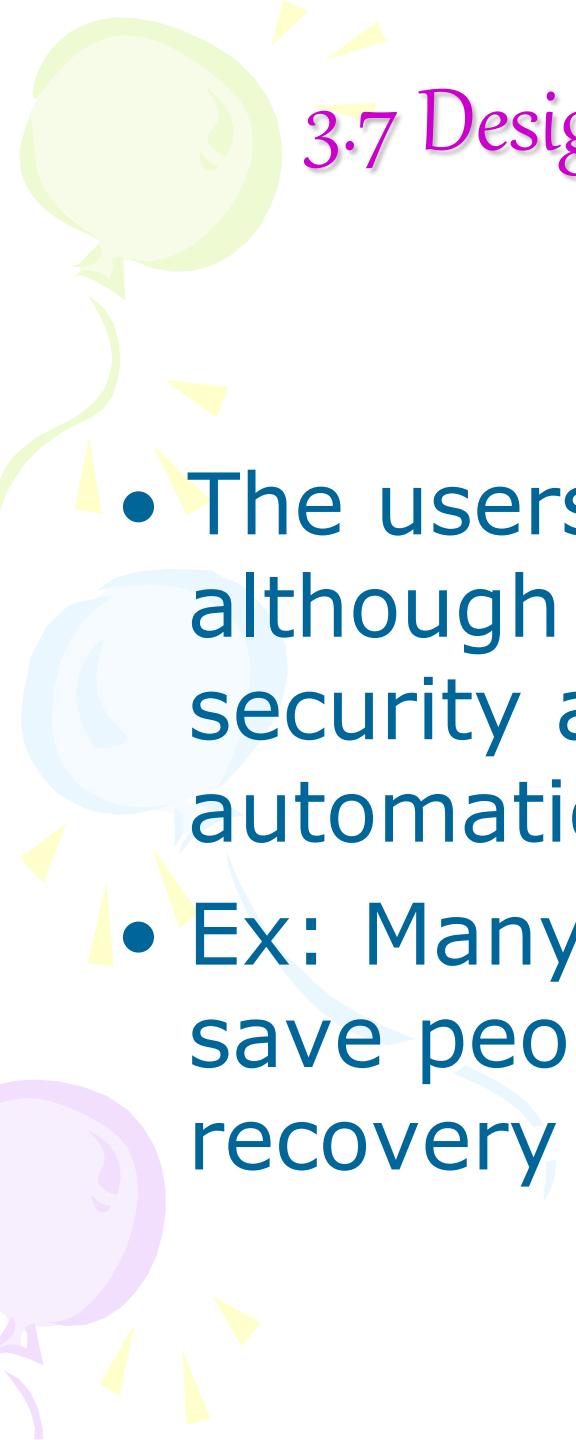
## 3.7 Designing for windows applications-Affordances

- People expect to see a menu at the top of the screen, the items should be displayed when the header is clicked on.
- Items that are not greyed out will afford selecting.
- Check boxes, radio button and text entry boxes should afford selecting because people is familiar with the standards.
- However, care needs to be taken.



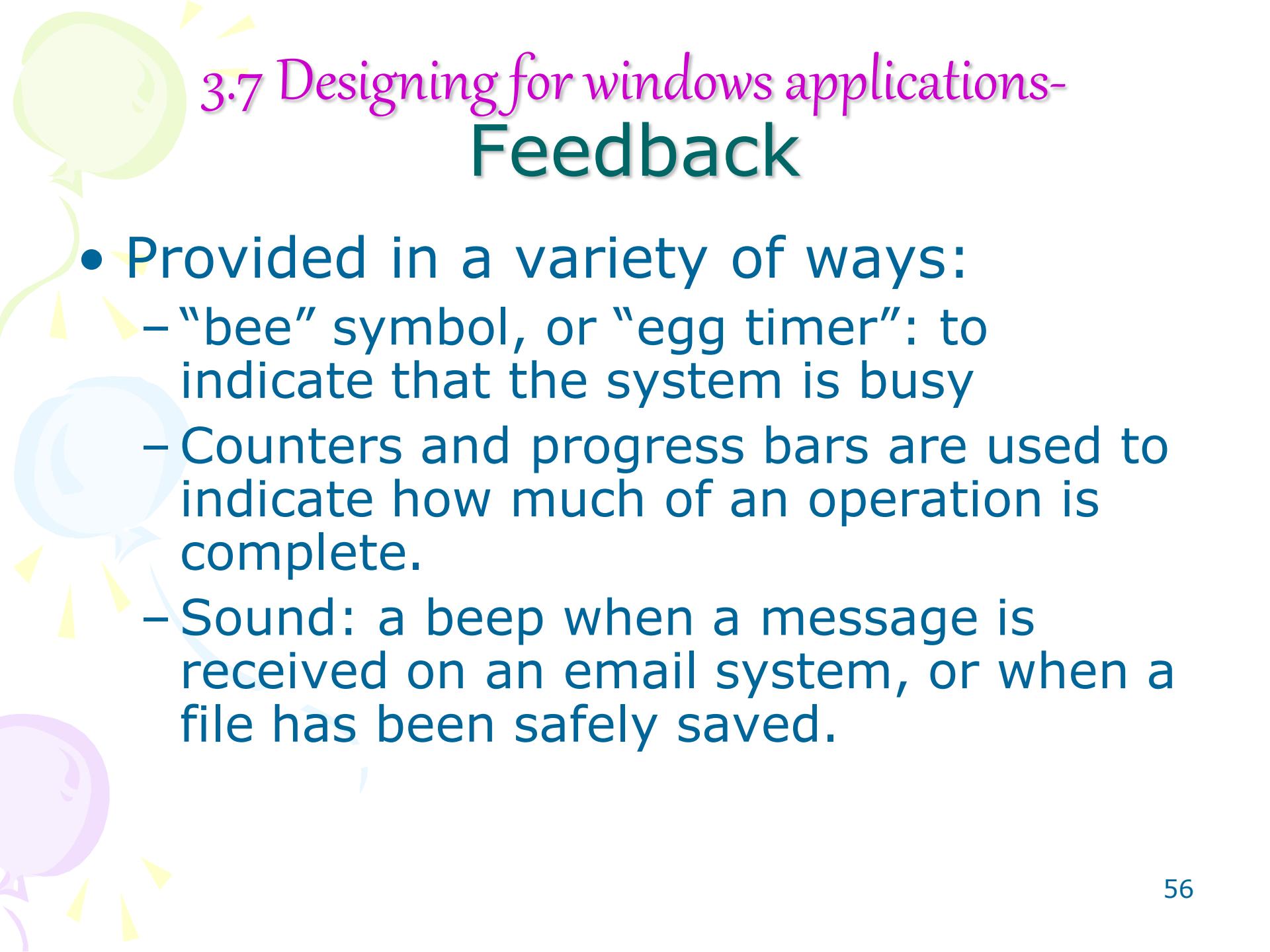
## 3.7 Designing for windows applications- Navigation

- Menus are also the main form of navigation in window applications.
- People move around the application by selecting items from menus and then following dialogues structures.
- Many window applications use “wizards”: these provide step-by-step instructions for undertaking a sequence of operations, allowing users to go forward and backward to ensure that all steps are completed.



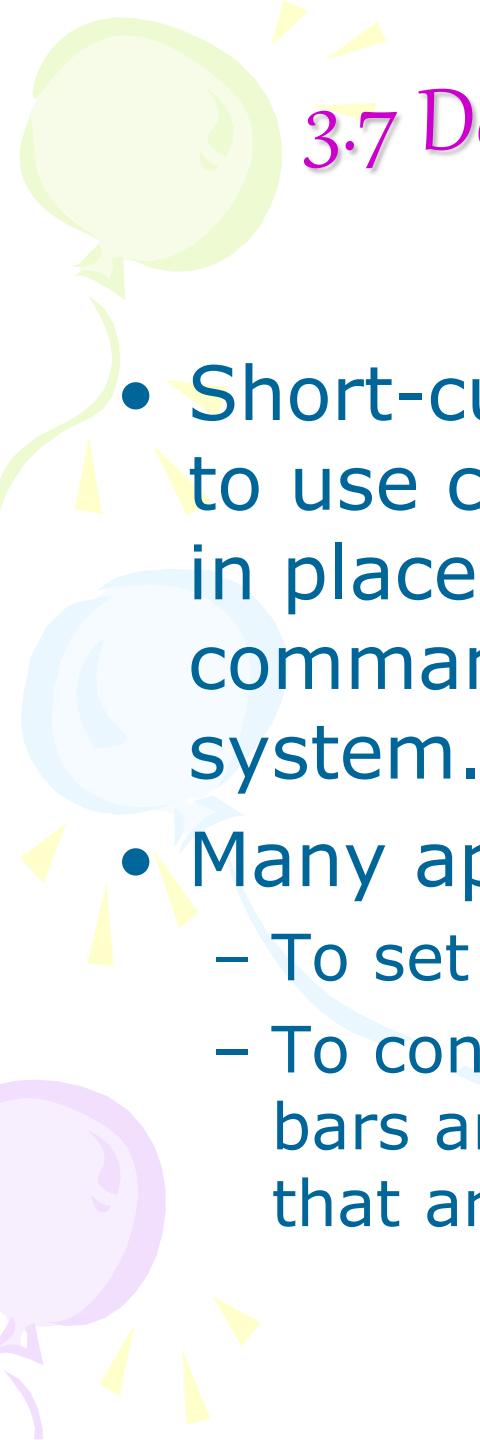
## 3.7 Designing for windows applications- Control

- The users have to initiate actions, although some features that provide security are undertaken automatically.
- Ex: Many applications automatically save people's work to help with recovery if mistakes are made.



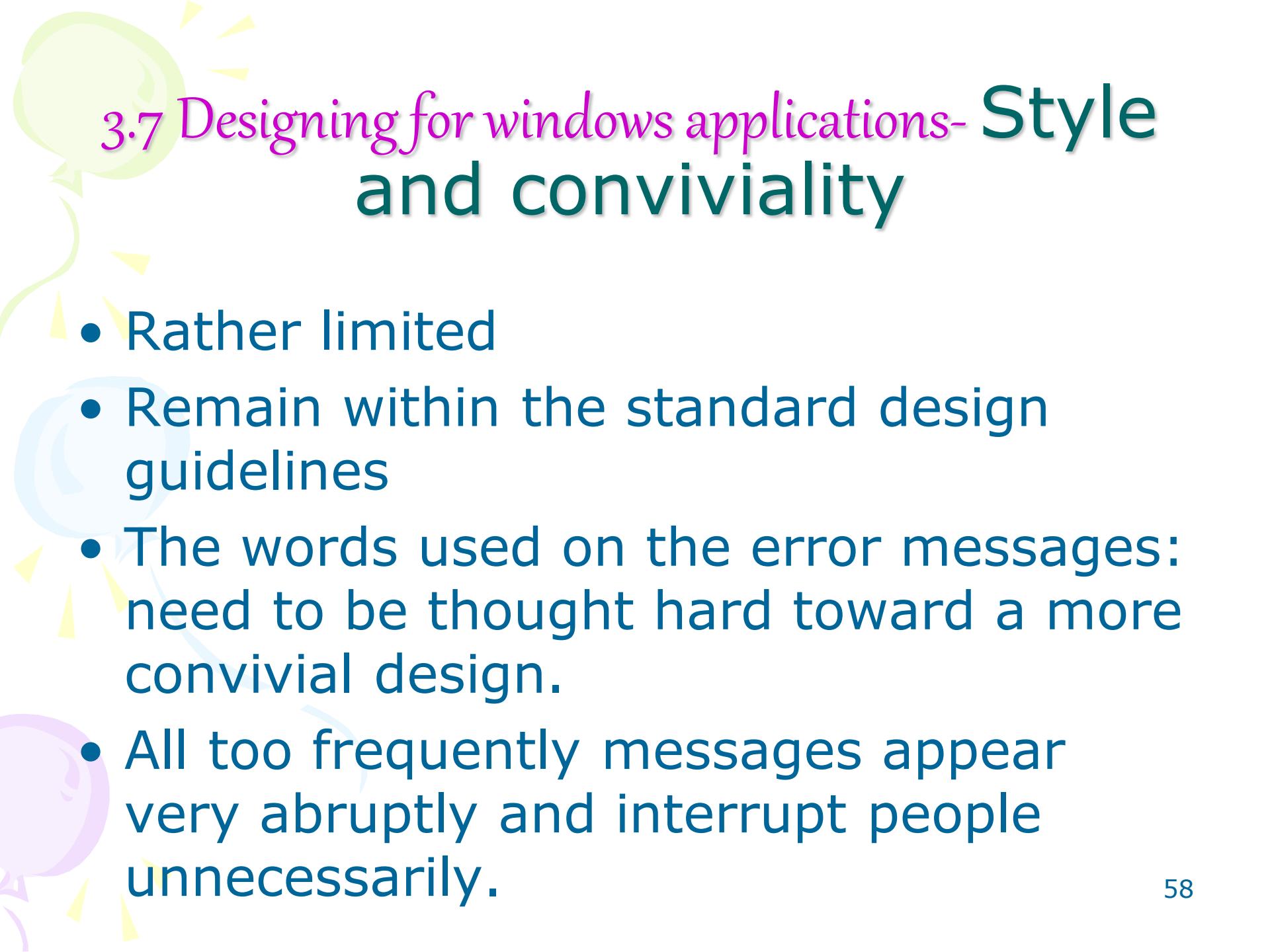
## 3.7 Designing for windows applications- Feedback

- Provided in a variety of ways:
  - “bee” symbol, or “egg timer”: to indicate that the system is busy
  - Counters and progress bars are used to indicate how much of an operation is complete.
  - Sound: a beep when a message is received on an email system, or when a file has been safely saved.



## 3.7 Designing for windows applications- Flexibility

- Short-cut keys allowing more expert users to use combinations of keyboard controls in place of using menus to initiate commands and navigate through the system.
- Many applications allow the users:
  - To set their own preferences
  - To configure features such as the navigation bars and menu items and to disable features that are not often used.



## 3.7 Designing for windows applications- Style and conviviality

- Rather limited
- Remain within the standard design guidelines
- The words used on the error messages: need to be thought hard toward a more convivial design.
- All too frequently messages appear very abruptly and interrupt people unnecessarily.



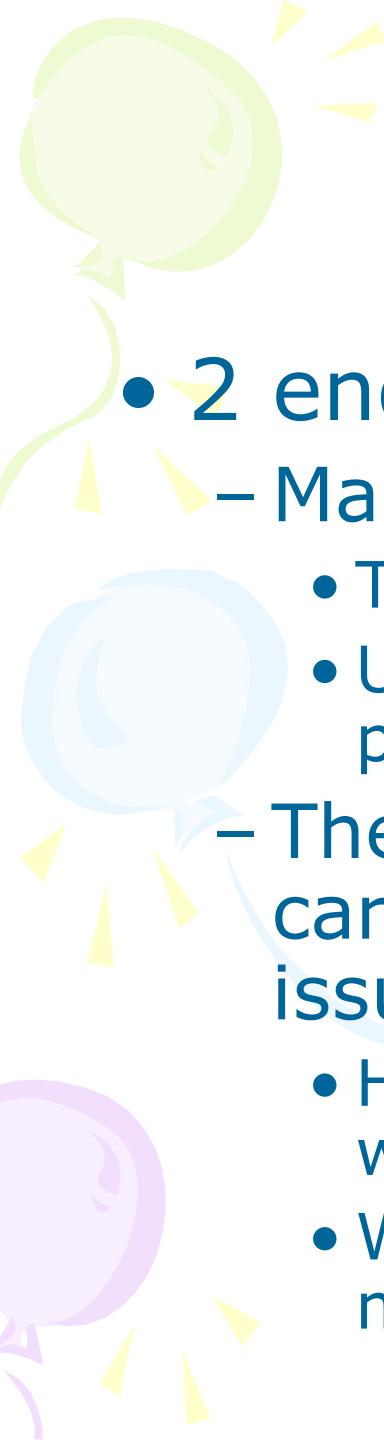
## 3.8 Designing websites

- One of the most likely things that interactive system designers will design is a website.
- 4 main genres of websites ([Badre, 2002]):
  - News
  - Shopping
  - Information
  - Entertainment
- Each genre has several sub-genres
- Within a genre, certain design features are common.
- Combination of sites are common.



## 3.8 Designing websites (2)

- The development of a website involves far more than just its design.
- A lot of pre-design activities:
  - Establishing the purpose of the site
  - Who it is aimed
  - How it fits into the organization's overall publicity strategy.
- In large organizations, there will be plenty of disagreement and arguments about all these issues; and these internal politics often affect the final quality of the site.



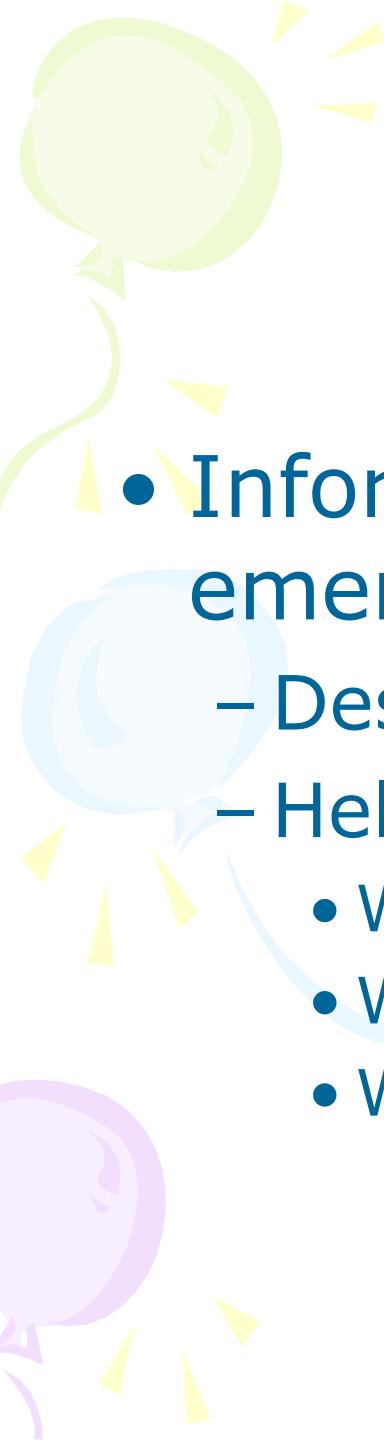
## 3.8 Designing websites (3)

- 2 ends of the process:
  - Many sites finish up too large
    - To serve too many issues
    - Usability and engagement come the list of priorities
  - The launch of the site has to be carefully managed; other infrastructure issues will need to be addressed:
    - How, when and by whom the content is written and updated
    - Who deals with e-mails and site maintenance



## 3.8 Designing websites- Navigation

- Even if a site is well focused, it will soon get large ⇒ how to move around a website ⇒ *navigation* is a central concern here.
- Support to enable people:
  - To discover the structure and content of the site
  - To find the way to a particular part of the site



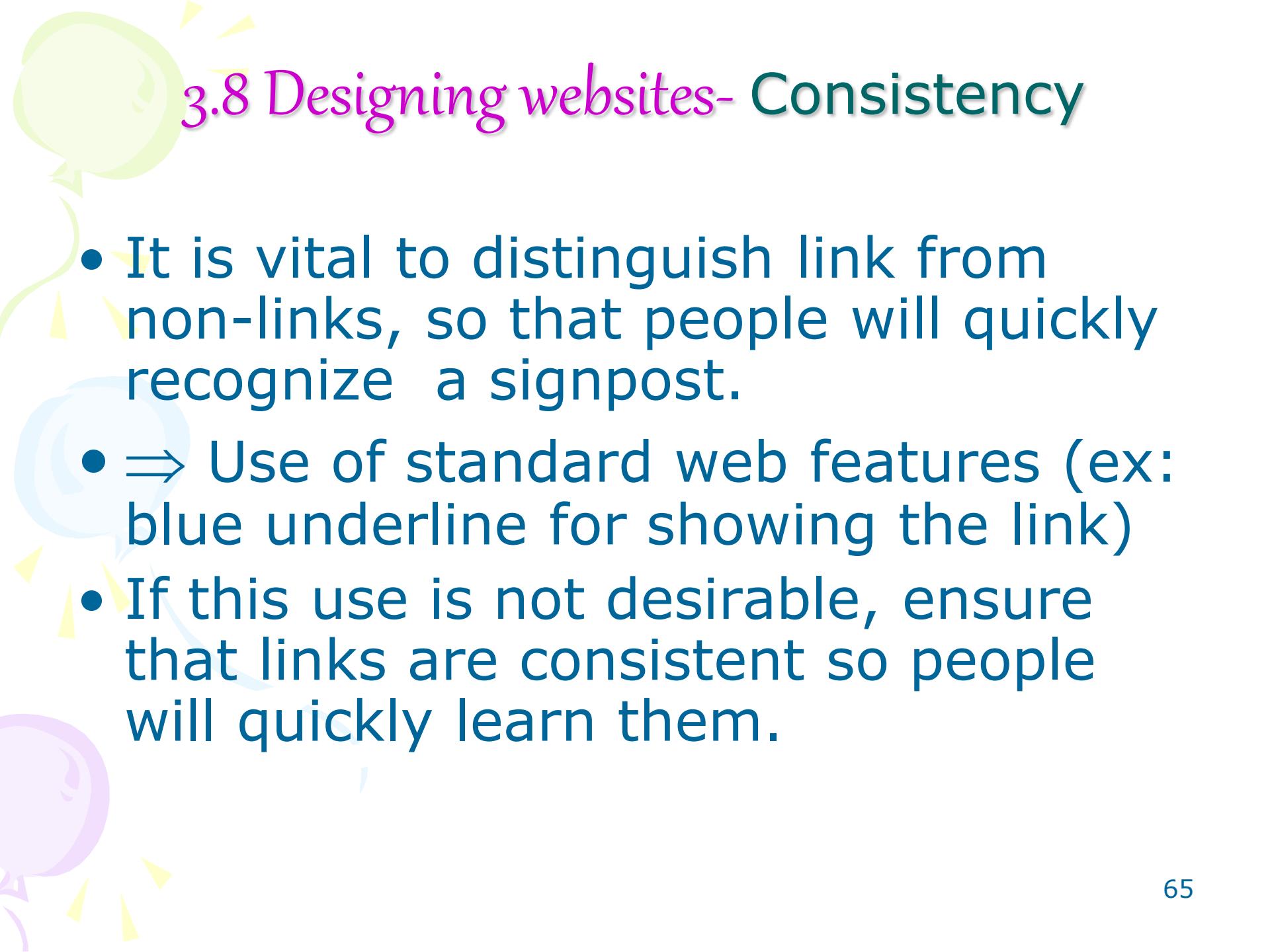
## 3.8 Designing websites- Navigation (2)

- Information architecture is an emerging area of study devoted to:
  - Designing websites
  - Helping users to answer questions:
    - Where am I ?
    - Where can I go ?
    - Where have I been ?



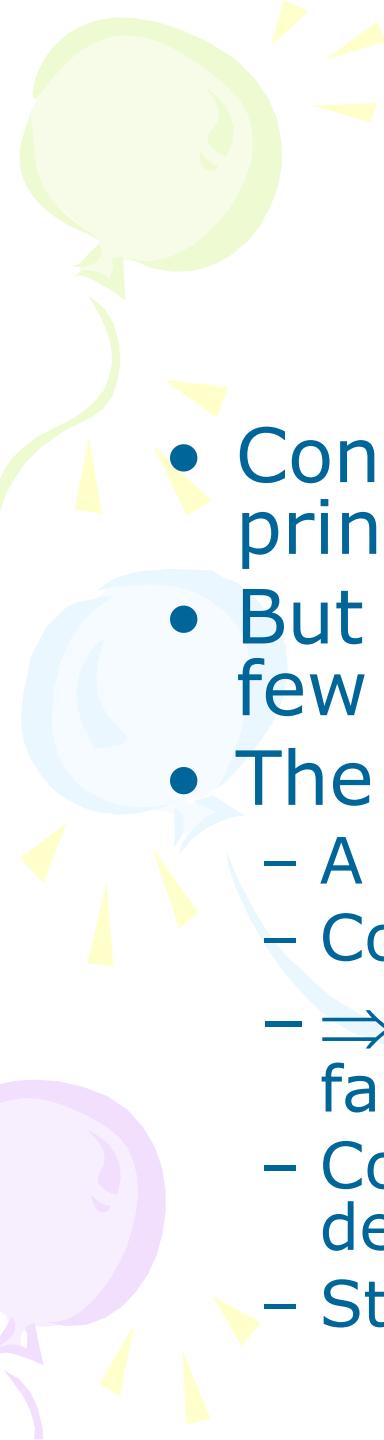
## 3.8 Designing websites- Navigation (3)

- The emerging standards:
  - Top banner: lets people know *where they are*, through clear and obvious labeling
  - Navigation bar: down the left-hand site tells people *where they can go*.
  - Some form of “path” at the bottom to let them know *where they have been*.
- ⇒ Through these, people will develop a clear overall “map” of the site.



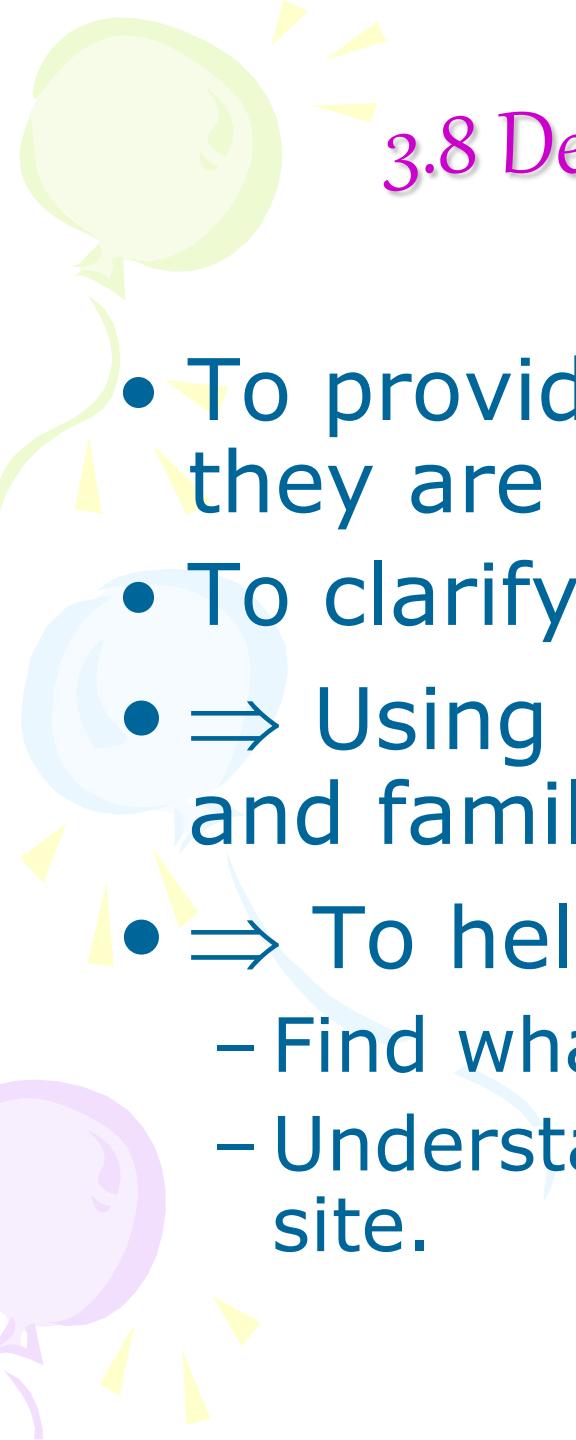
## 3.8 Designing websites- Consistency

- It is vital to distinguish link from non-links, so that people will quickly recognize a signpost.
- ⇒ Use of standard web features (ex: blue underline for showing the link)
- If this use is not desirable, ensure that links are consistent so people will quickly learn them.



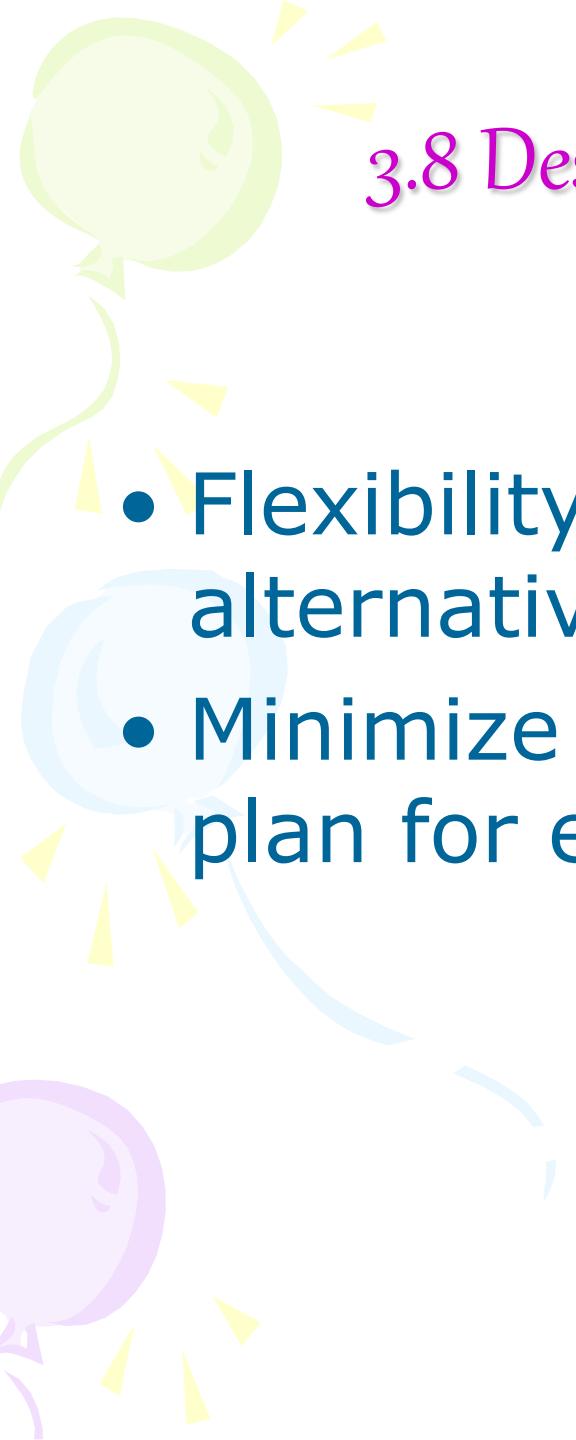
## 3.8 Designing websites- Consistency (2)

- Consistency is always a key design principle
- But unlike window applications, there are few overall standards to be followed.
- The designer has to establish:
  - A consistent design language
  - Consistent use of colour, positioning, text ...
  - ⇒ people can quickly learn and become familiar with.
  - Consistent naming of links, sub-sites and other details.
  - Style sheets



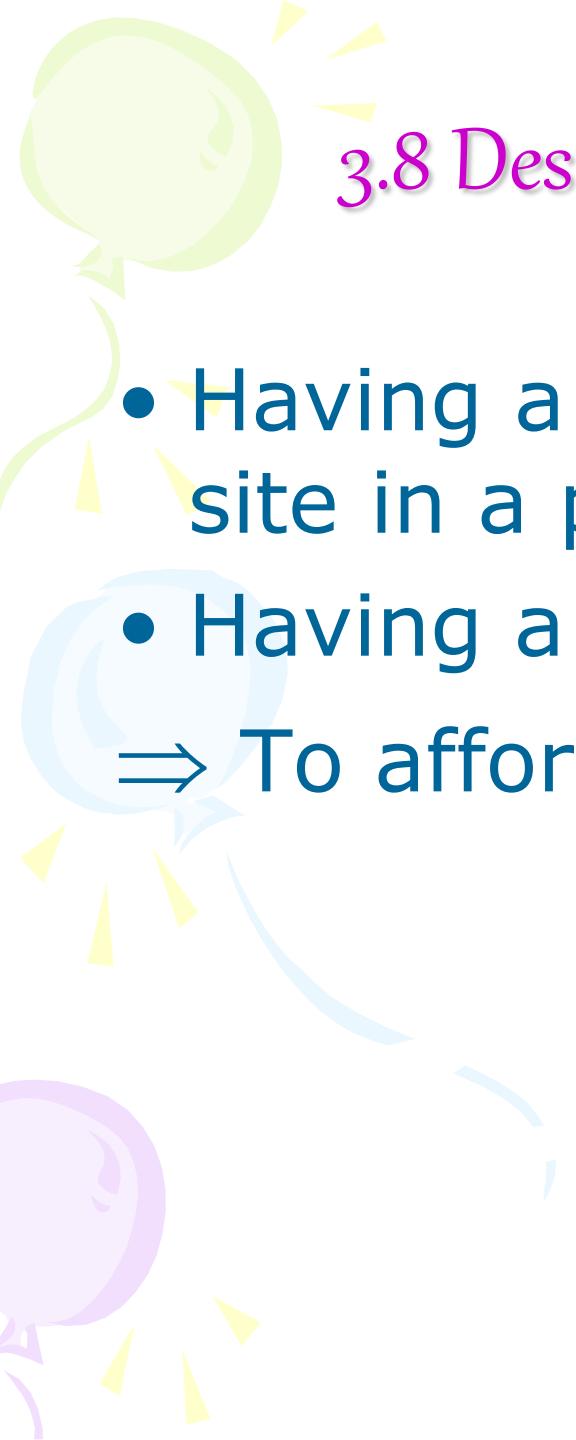
## 3.8 Designing websites- Feedback

- To provide information on where they are in the site.
- To clarify contexts and content.
- ⇒ Using meaningful Web addresses and familiar titles
- ⇒ To help people:
  - Find what they are looking for
  - Understand what other content in the site.



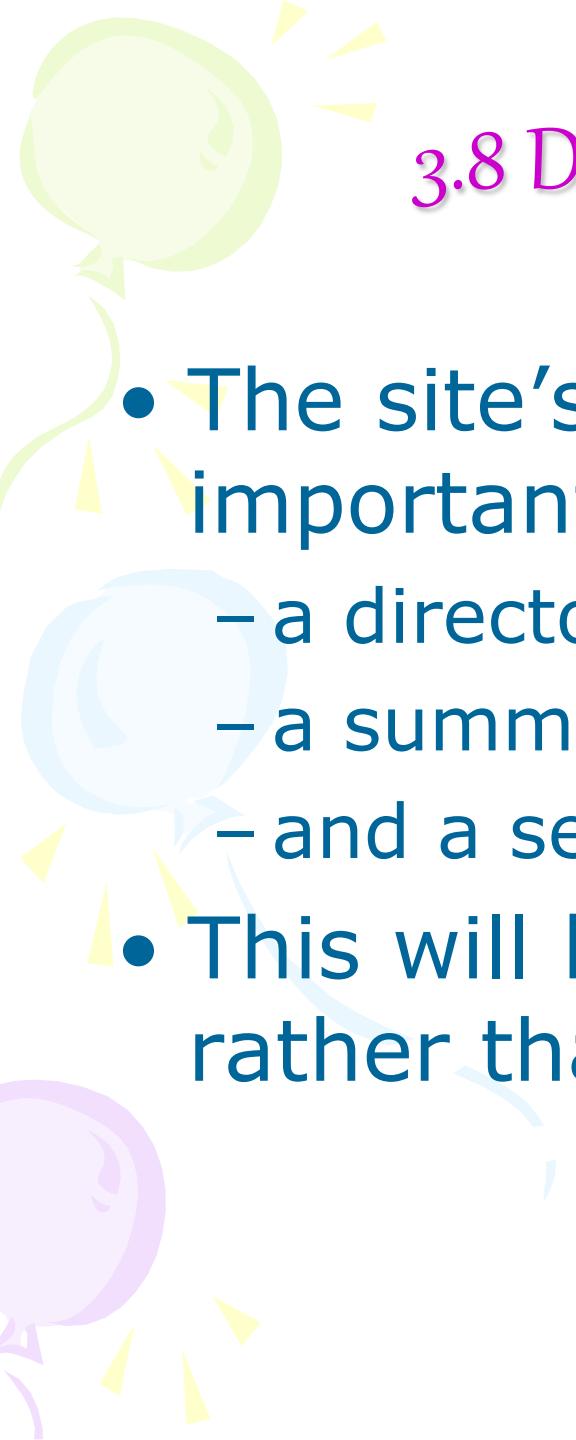
## 3.8 Designing websites- Flexibility

- Flexibility of navigation: by providing alternatives for people.
- Minimize the need for scrolling and plan for entry at any page



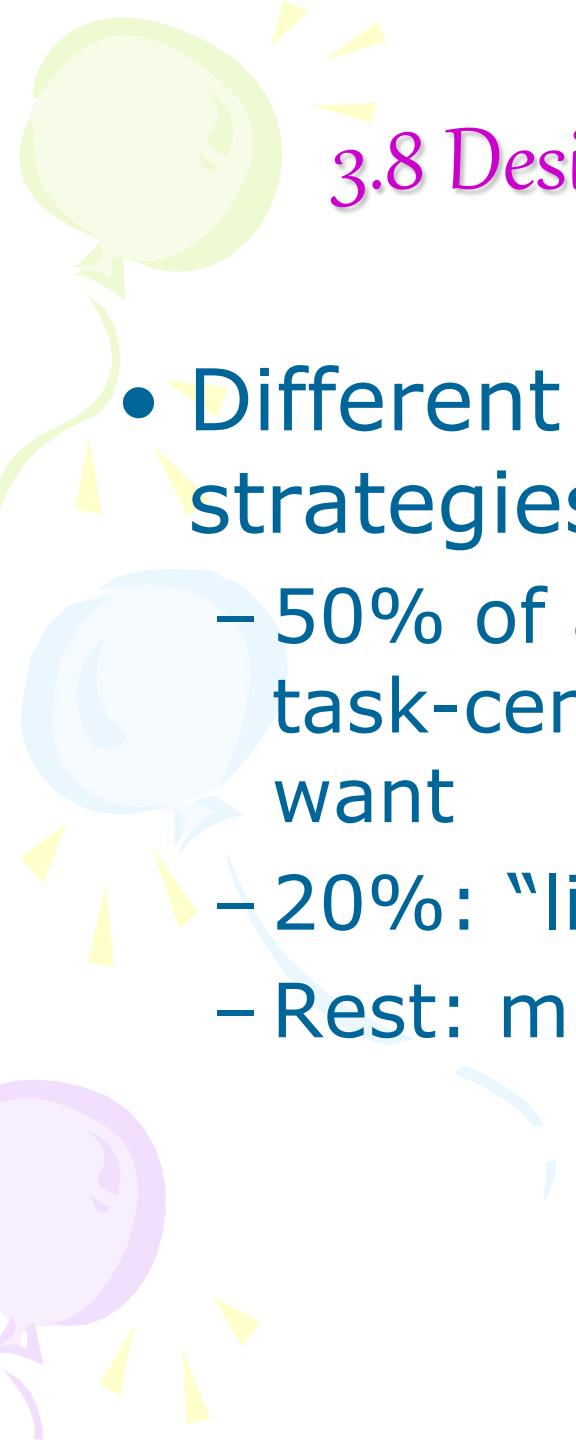
## 3.8 Designing websites- Affordance

- Having a link to the home page of a site in a prominent position
  - Having a site map
- ⇒ To afford people getting oriented.



## 3.8 Designing websites- Control

- The site's home page is particularly important and should feature:
  - a directory,
  - a summary of important news/ stories
  - and a search facility
- This will help people to feel in control rather than feeling lost.

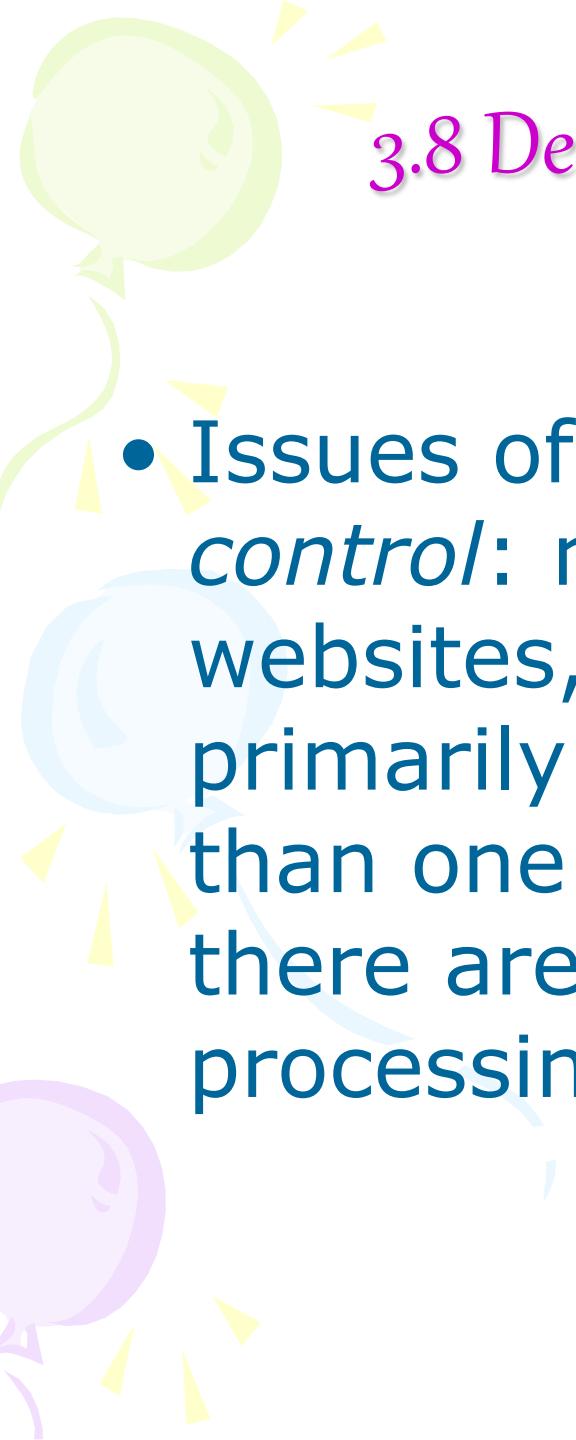


## 3.8 Designing websites- Control (2)

- Different people have different strategies on websites.
  - 50% of all users: “search dominant” => task-centred and want to find what they want
  - 20%: “link dominant”
  - Rest: mixed

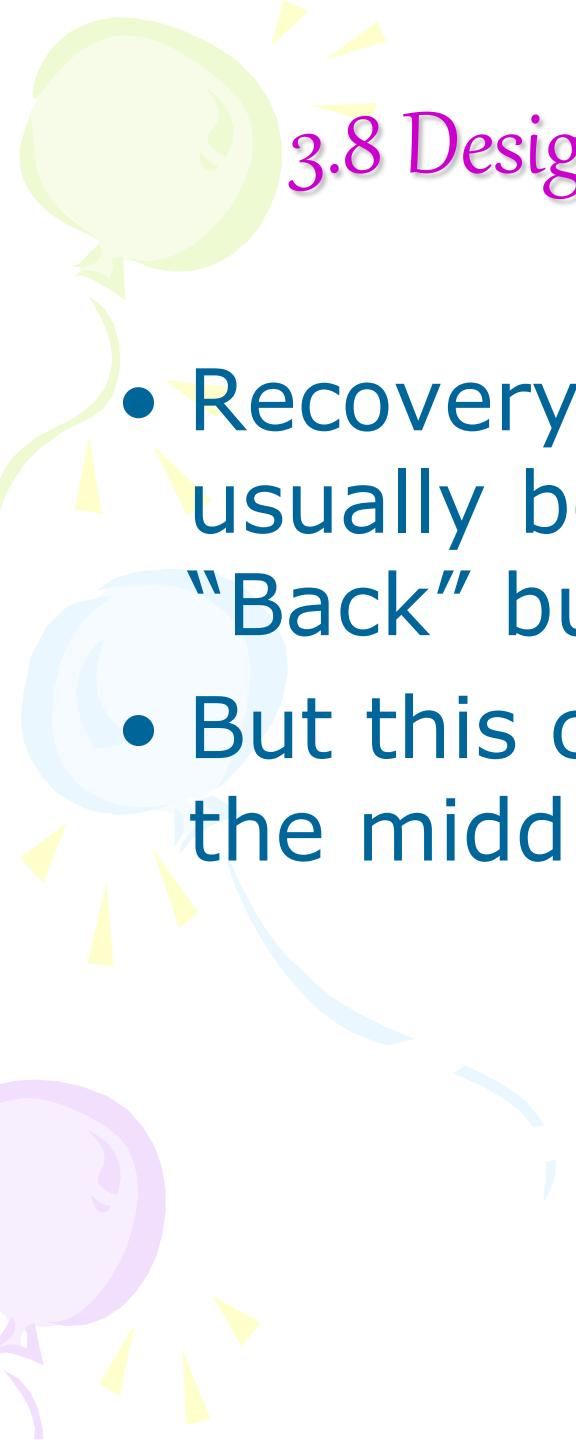


More happy to browse around



## 3.8 Designing websites- Recovery

- Issues of *recovery, feedback and control*: most highly in shopping websites, because the web is primarily a publishing medium rather than one with lot of functionalities, there are often long pauses when processing things (ex: payment).



## 3.8 Designing websites- Recovery (2)

- Recovery from an erroneous click can usually be provided through the "Back" button
- But this can go wrong if the site is in the middle of a transaction.



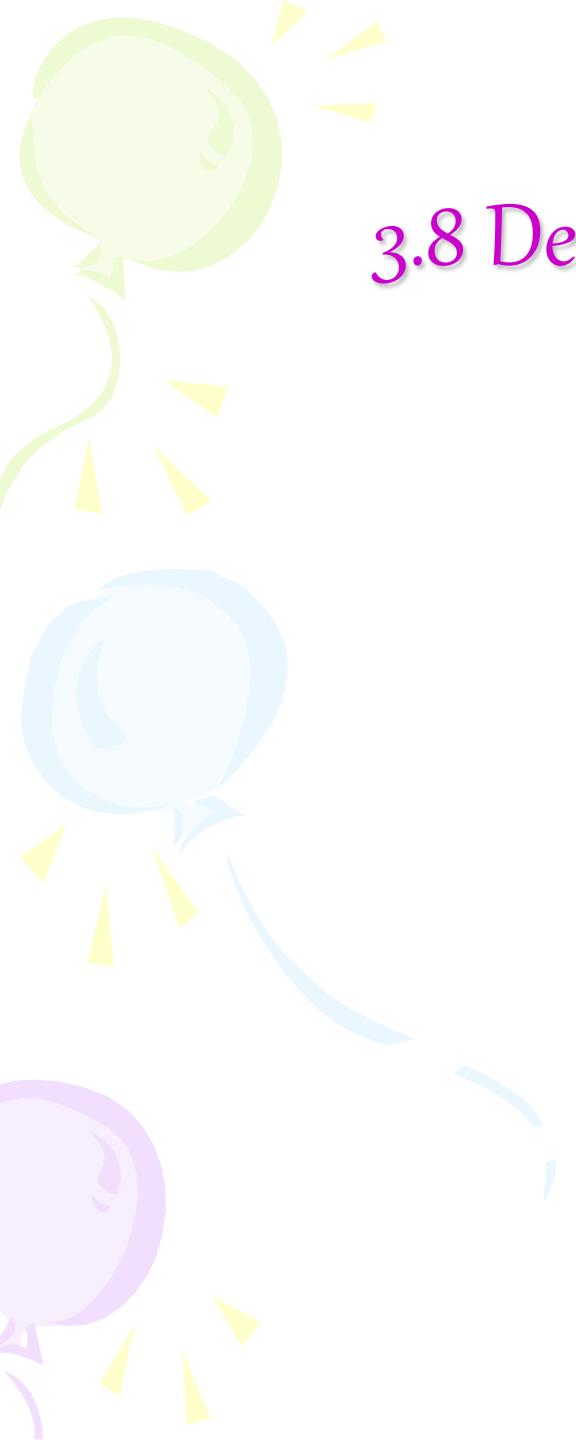
## 3.8 Designing websites- Conviviality

- By allowing people:
  - To join in,
  - To support
  - To create communities.
- Unlike window application, website can easily connect people to people.



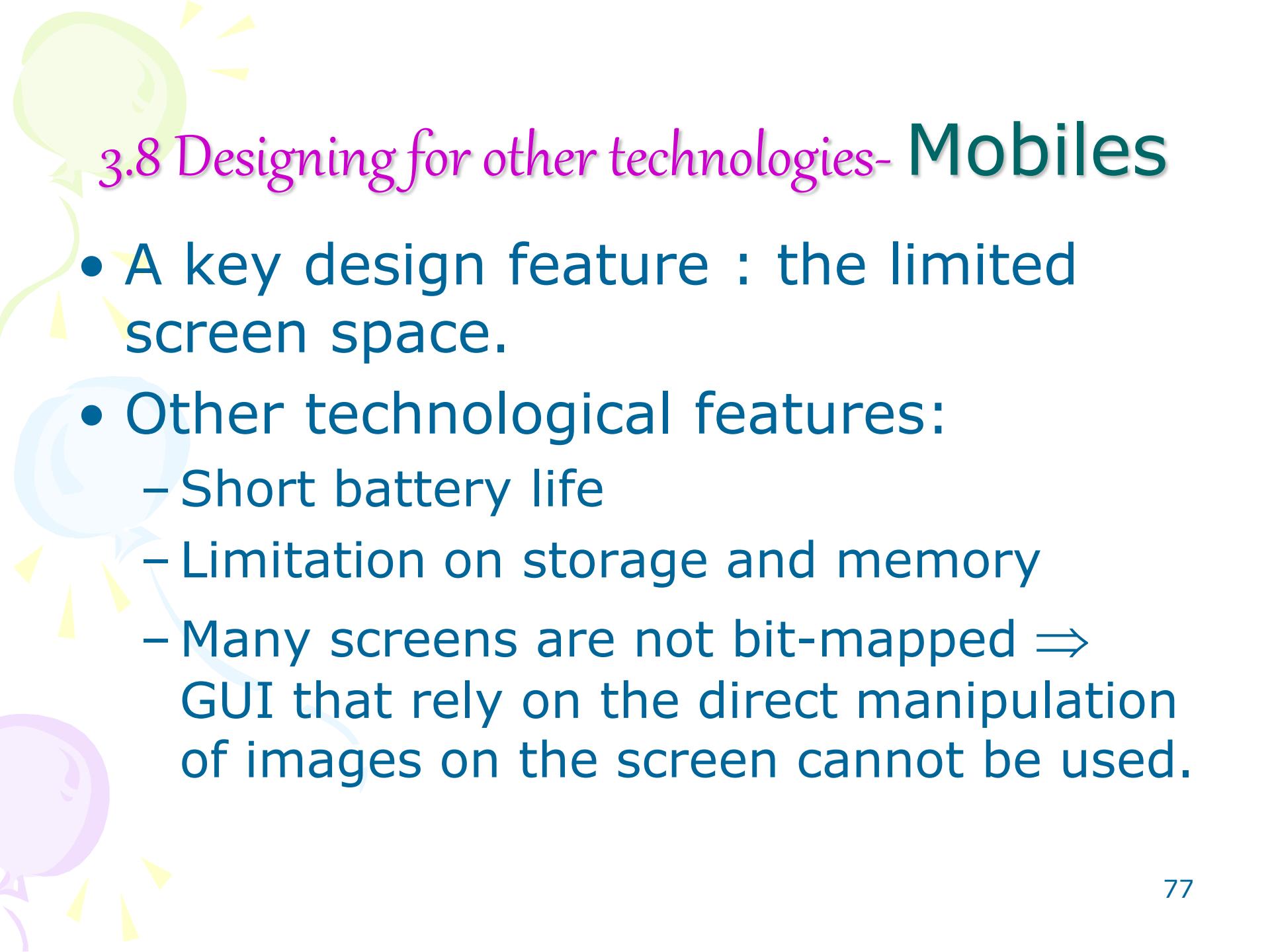
## 3.8 Designing websites- Style

- Is also key to websites
- Offers the most opportunities for designers to demonstrate their creative flair.
- ⇒ The use of the animation, video and other design features can really develop a whole sense of engagement with the site.



## 3.8 Designing for other technologies

- Mobiles
- Ubiquitous computing



## 3.8 Designing for other technologies- Mobiles

- A key design feature : the limited screen space.
- Other technological features:
  - Short battery life
  - Limitation on storage and memory
  - Many screens are not bit-mapped ⇒ GUI that rely on the direct manipulation of images on the screen cannot be used.



## 3.8 Designing for other technologies- Mobiles (2)

- Users: all sorts of people
- ⇒ Device is used in all manner of physical and social contexts
- ⇒ Designers cannot design for specific people or context of use.

## 3.8 Designing for other technologies- Mobiles (3)

- Visibility: difficult to achieve because of the small screen
- Navigation: difficult because the functions have to be tucked away and accessed by multiple levels of menu.
- Control:
  - It is not room for many buttons so each button has to do a lot of works
  - ⇒ the need for different “modes”
  - ⇒ difficult to have clear control of the function
- Feedback: generally poor, people have to stare into the device to see what is happening.

## 3.8 Designing for other technologies- Mobiles (4)

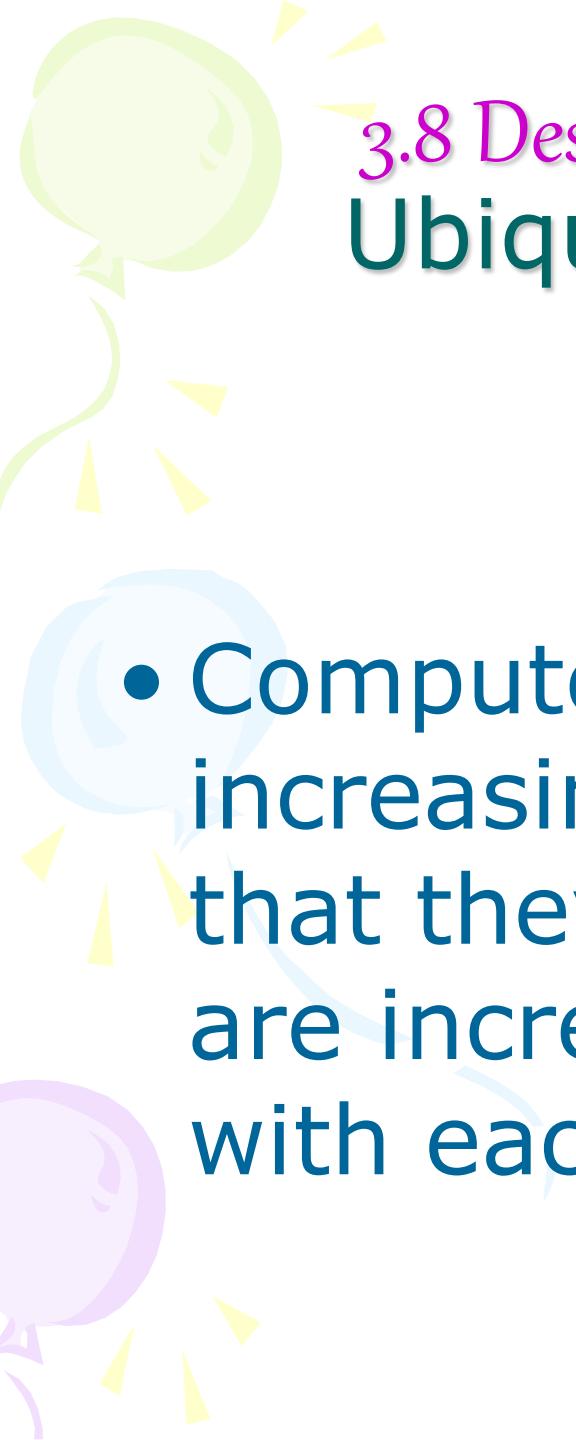
- Consistency: no consistency in the interfaces.
- Flexibility:
  - provided to a limited extend (ex: press any key to answer a call)
  - Generally not possible to personalize things such as menus.
  - To personalize mobiles:
    - Physically swapping the covers
    - Select different ring tones

## 3.8 Designing for other technologies- Mobiles (5)

- Style: very important.
- Conviviality: Many mobile devices concentrate on the convivial nature of the physical interaction (ex: the size, the weight of the device).
- Affordance: The physical buttons afford pressing, but:
  - There is little in most of graphical aspects interface that afford any thing
  - The obscure symbols on many buttons do not easily convey any meaning.

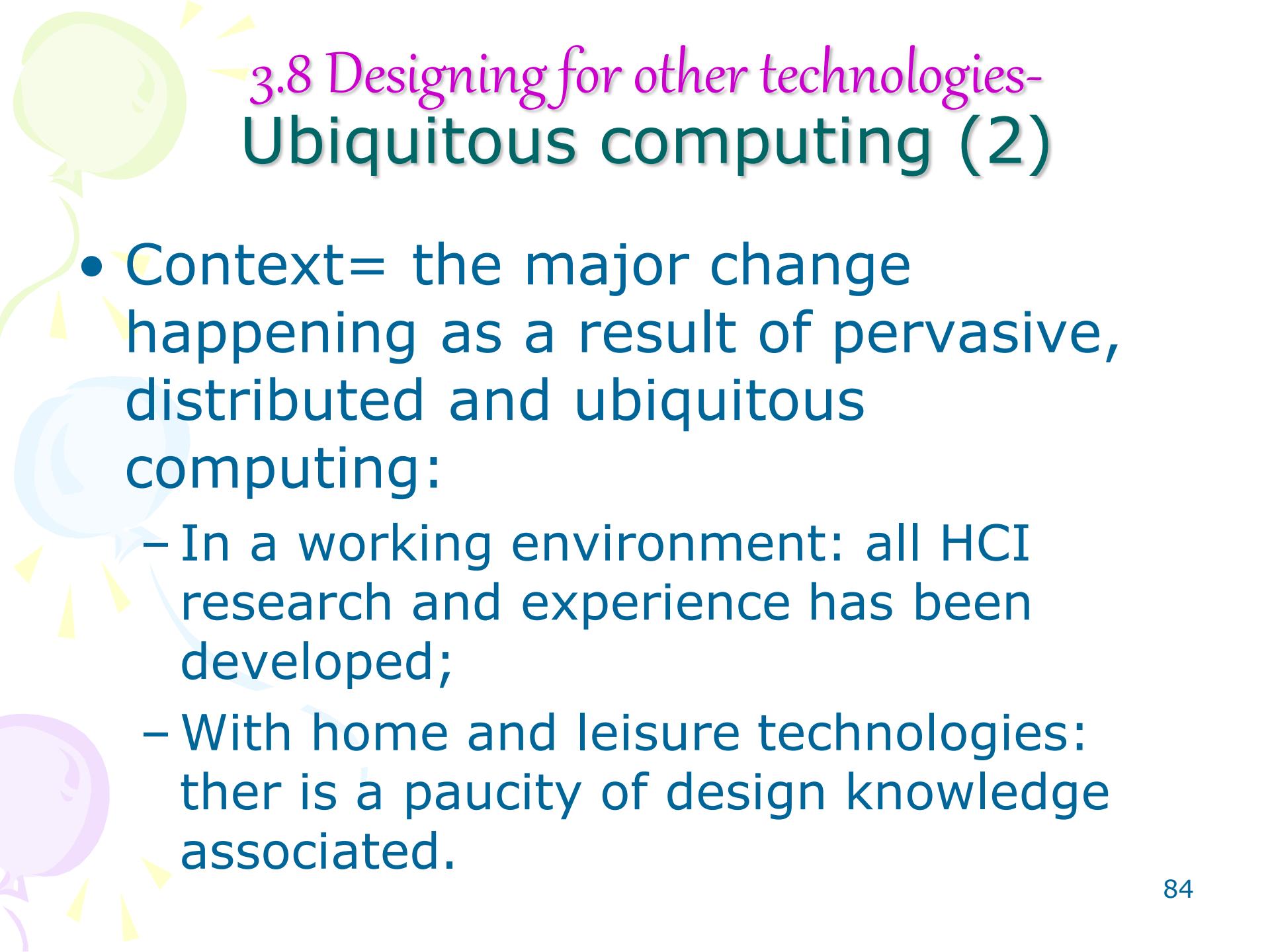
## 3.8 Designing for other technologies- Mobiles (6)

- Familiarity:
  - Although those growing up with mobiles might be familiar with much of the terminology and where to find things,
  - this is not the case for newcomers.



## 3.8 Designing for other technologies- Ubiquitous computing (1)

- Computers are becoming increasingly small, so much so that they are wearable, and they are increasingly able to communicate with each other autonomously.



## 3.8 Designing for other technologies- Ubiquitous computing (2)

- Context= the major change happening as a result of pervasive, distributed and ubiquitous computing:
  - In a working environment: all HCI research and experience has been developed;
  - With home and leisure technologies: there is a paucity of design knowledge associated.



## 3.8 Designing for other technologies- Ubiquitous computing (3)

- Design for the whole range of people:
  - Old persons => understandability
  - Children => safety
  - ...
- Design principles:
  - Visibility
  - Feedback
  - Control
  - Affordances
  - Recovery

# Chapter 3

- 3.1 Introduction
- 3.5 Engagement
- 3.6 Design principles
- 3.7 Designing for windows and applications
- 3.8 Designing websites
- 3.9 Designing for other technologies

Summary