3 Aim 1: Adapting communication to individual users[5]

3.1 Introduction

One of the central aims of user profiling is to make the communication between an organisation and its public more usable by adapting the messages and the interfaces of applications to user segments or even to individual users (cf. chapter 1). This chapter provides an overview of the user characteristics relevant to usability. The aim of the chapter is to answer two related questions:

- *Which features of content, messages and interfaces can be adapted on the basis of user-related information that is stored in user profiles?*
- *Which kinds of user-related information are needed to effectively adapt content, messages and interfaces?*

3.2 Main concepts

Adaptation of applications to users can best be framed within the concept of *usability*. ISO standard 9241 describes usability as a overall concept with three components. *Usability* is the effectiveness, efficiency, and satisfaction with which specified users achieve specified goals in particular environments (Table 3.1).

Effectiveness	The accuracy and completeness with which specified users can achieve specified goals in particular environments.
Efficiency	The resources expended in relation to the accuracy and completeness of goals achieved.
Satisfaction	The comfort and acceptability of the work system to its users and other people affected by its use.

Table 3.1: Usability; effectiveness, efficienvy and satisfaction

There are many features of applications that affect usability and there is a extensive body of literature (advisory works and empirical research) about their effectiveness. The features can be summarised in the following clusters:

- *Content* of information, e.g. in websites or direct e-mails. Many applications use a kind of building block system or data-based content elements. Only those elements that are relevant to a particular individual or group are presented.
- *Functions* of the application. In many applications the functions that are offered can be adapted to particular users of groups. Well-known examples are administrative systems that allocate particular functions (e.g. data entry, approval, report generation) to different employees or officials in an organisation.
- *Structure* of information or interfaces. For instance, the grouping and sequential order of menu options in an application can be adjusted to the frequency with which they are used by particular groups or individuals on the basis of their specific needs or their previous use of these options.

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- *Presentation* of information in text, tables, graphics or animations. For instance, numerical data can be presented in tables for users who need to study details (e.g. accountants and controllers) or as graphics for users who need to see trends (e.g. managers).
- *Interaction,* e.g. the way the user gets access to information or enters information in a system. For instance, the use of selection menus, hyperlinks, radio buttons, selection boxes or free response can be adapted to the cognitive style or the (dis)abilities of users.

The relationship between user-related data (user profiles) and the adoption of applications for increased usability is represented in the model of figure 5.1. This model shows how the interaction between a user and an application is influenced by the usability of the application, with effectiveness, efficiency and satisfaction as usability criteria. These criteria can be influenced by adaptation of content, functions, structure, presentation and interaction.

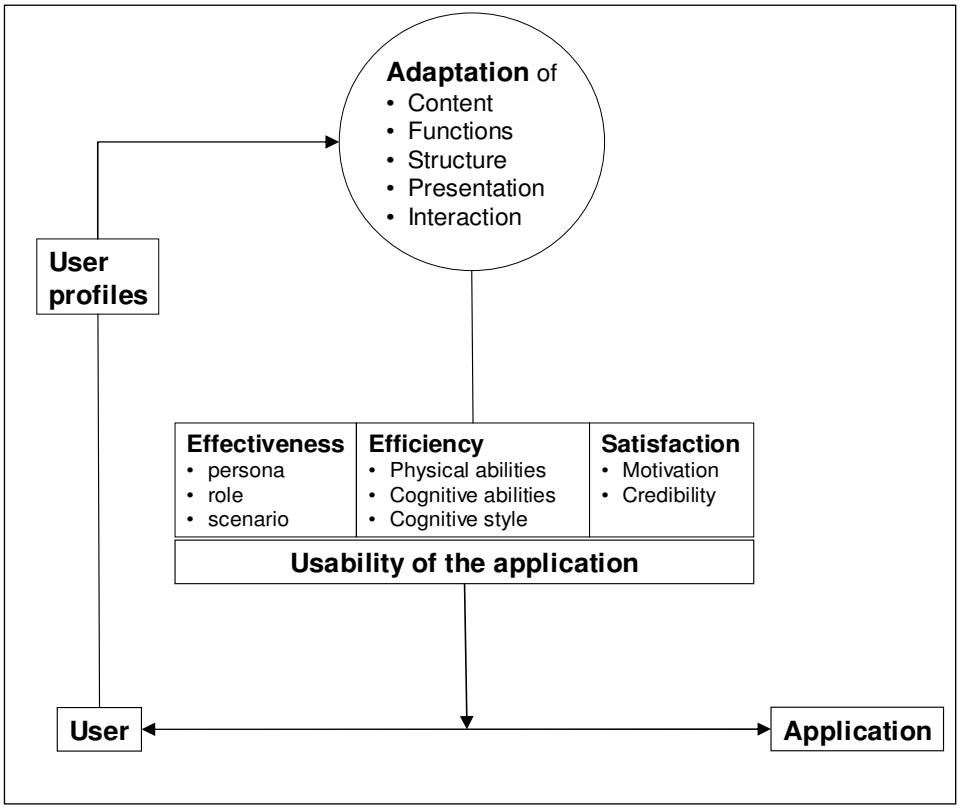

Figure 3.1: Usability influenced by adaptations influences the interaction between user and application

3.3 Preview of this chapter

Sections 3.3 to 3.6 will give an overview of what is known from the literature in the field of communication design about the relationship between user characteristics and effectiveness, efficiency and satisfaction respectively, and how these criteria can be enhanced by adapting certain aspects of the application on the basis of user characteristics.

In section 3.7 to 3.9, the possibilities of adaptation will be sketched in four functions that are frequent and important in applications used for communication between an organisation and its public: data entry (particularly in electronic forms), information seeking, and online help.

3.4 Effectiveness

Effectiveness is defined as the accuracy and completeness with which specified users can achieve specified goals in particular environments. The essential components of the definition are the specification of the users, their goals and the environment in which the application is used.

It is obvious that a good fit between the goals and environment of the users and the features of the applications is essential for success. However, it is not easy to create a good fit between the two, particularly if the application is intended for external users of an organisation. The goals of both parties are often compatible, e.g. a customer wants to buy a product and the organisation is willing to sell it, or the IRS wants to obtain essential information about a taxpayer, and that taxpayer is not unwilling to provide it. However, on a lower level of abstraction, goals, needs, preferences and ideas of users may be considerably different from those of the organisation.

Concepts such as *user role, user persona*, and *scenario* are often used in the literature to 'build the bridge' between application designers and users (e.g. Cooper, 1999). However, there is no uniform approach to user modelling. Terms such as *audience, user roles, scenarios* and *user personas* are often used loosely, without clear definitions. The following is an attempt to synthesise the existing literature and to clarify the most important concepts used.

3.4.1 User roles

User roles are defined by categories of real-life tasks that (groups of) users have to perform with the application. These categories of tasks are generally defined by the position of these particular users in the organisation. For instance, the University of Twente's home page offers a set of roles as a basis for navigation in a menu: prospective students, visitors, students, employees, press, alumni and entrepreneurs. A clear and complete definition of user roles is important as they define the purposes for which the application is designed. In other words: they define what (different groups of) users can do with the application.

In most cases, a set of user roles of an application is not defined by means of collecting empirical data among (possible) users of the applications, but by an analysis of the structure of an organisation, and by defining priorities in the organisation's policy. Taking the UT's website as an example, the user roles of (prospective) students, employees and alumni are intrinsic to a university. They are 'awarded' by the very nature of the organisation. The decision to address the website also to user roles such as the press and entrepreneurs is in following with the policy of the university. The choice to address the website to all these user roles is not dictated by analysing the user characteristics of the website's visitors, but by the organisational goals and policies.

3.4.2 User personas

In the literature on usability design, it is suggested to 'create' a (limited) number of user personas as prototypical users of an application. A user persona is a description of a typical user of an application, with as many relevant qualities as a designer can think of. User personas are usually created on the basis of available statistical data on the prospective users of an application, but they are seen as imaginary individuals who (will) use the application. User personas can be defined abstractly by summing up their

characteristics, but in user-centred design it has become common to create concrete *narrative* descriptions of user personas than can serve as a guide to the application developers (e.g. Cooper, 1999).

Within the same user *role*, users can often be distinguished in different *personas*, each defined by a number of relevant characteristics. For instance, within the generic role of customer in a grocery application, users may differ in age, income, family situation, preferences for certain categories of products and shopping frequency, but also in computer skills, motivation and trust.

Although user personas may be created by 'intuitive' techniques such as brainstorming, an empirical approach may be more reliable. User profiles can be very helpful to describe and analyse characteristics that lead to the creation of user personas.

3.4.3 Scenarios

A scenario is a description of a goal-oriented group of interactions between a user persona and the application. A scenario can be formulated as an answer to the classic 5W-questions: *who does what, when, where and why?* Just like a user persona, a scenario is a prototype: it reflects a 'typical' way of using the application for a 'typical' goal. The collection of different scenarios guides the functionality (what the application can do) and the structure of the interface. Just like user personas, scenarios are thought to be concrete and narrative. Central to a scenario is a textual description or narrative of a use episode. The scenario is described from the user's point of view and may include social background, resource constraints (e.g. disk space, time) and background information. The scenario may describe existing practices or it may model new ones.

Although general user *roles* can serve as a useful starting point to define scenarios, it is generally advised to use the more concrete user *personas* as they reflect the diversity of the possible users better than roles do. However, in practice it is impossible to take the full diversity of user personas into account. Generally, a limited number of 'prototypical user personas' will serve as the key to the design of the scenarios.

By using a narrative it is possible to capture more information about the user's goals and the context the user is operating in. This context might include details about the workplace or social situation, and information about resource constraints. This provides more help in understanding why users do what they do.

Just as user profiles can help to create useful and realistic personas, they can also help to create realistic scenarios.

3.4.4 Using personas, roles and scenarios in design: the rhetoric of messages and interfaces

Although in the design process of an application many different roles, personas and scenarios may be discussed, only a limited number of them can be implemented in the final application in terms of available functions, menu structures, forms of interaction, text, graphics, etc. From a communication perspective, the choices that designers make can be characterised as rhetorical in the sense that they relate to the way information is presented to the audience.

The consequence of choosing only one or a limited number of personas is that the actual user of an application has to accommodate him-/herself to the role(s) and persona(s) that are created in the application. Although this 'rhetorical role playing' (Coney & Steehouder, 2000) is important for a successful use of the application, it has barely been studied.

In their focusing on websites, Coney and Steehouder (2000), make a distinction between:
- The *real visitors to* a website: the persons that actually visit the website and, for whatever reason, read the information it contains;
- The *target visitors* or *target audience:* those people the website is aiming at;
- The *user persona*: the role that is 'created' in the website.

Within this framework, a website is not directed at an individual visitor or at a group of visitors but at an imaginary or fictitious person: the user persona. The real visitor to a website is expected to adapt him-/herself to that persona, or to 'play the role' of the persona. For example, if parents of prospective students visit the UT's website to find information about the future learning environment of their children, they will not find a section that is directed at them. Nevertheless they can decide to act ('play') as if they were prospective students (like their children), and access the information from their point of view (including their interests, values, preferences and taste). In fact, most people are quite capable of 'playing a role' to find, access and process the information offered by communication means such as a website.

This rhetorical theory suggests that it is not always necessary to adapt an application to the individual user. Human beings have a high capacity to adapt themselves to the personas and roles that are presumed in the design of an application. In some cases, it can even be advantageous not to adapt an application to users but to 'force' them to play a role that the application imposes. The theory of *altercasting* provides a framework for this viewpoint.

3.4.5 Altercasting

Altercasting means that we can 'force' an audience to accept a particular role that makes them behave in the way we want them to. This psychological process is caused by social pressure; the social environment expects individuals to behave in a manner that is consistent with their social role. This role also provides the person with selective exposure to information consistent with that role.

Pratkanis (2000) distinguishes two basic forms of altercasting:
- *Manded altercasting* means that we 'tell' people who they are (or are supposed to be) by:
  - making an existing role salient (e.g. remind someone of being a alumnus of a university to persuade him/her to donate to the university foundation);
  - placing others in a particular role (e.g. address someone as an expert in a particular field to persuade him to join an advisory committee);
  - asking people to *play* a role (cf. the famous Harvard experiment where students were asked to play guards and prisoners. The participants adopted these roles so strongly that the experiment had to be cancelled because the participants became too violent towards one another).
- *Tact altercasting* means that we put ourselves as senders in a role that 'evokes' a natural counter-role for the other. Some common role sets are for instance expert–unknowing public, helper–dependent, etc.

Taking into account the theory of altercasting, it can be questioned if it is always an advantage to fully adapt applications to the individual user. For many purposes, it may be more advantageous to let the user 'play a role' that encourages him/her to behave in a particular way. Some examples:

- Advertisers know very well that a stylish setting in a commercial will 'sell' products better than a commonplace setting will, even though the latter is more real to the majority of the customers. By 'altercasting' the customer in the role of an elegant and wealthy persona, the corresponding behaviour (buying the product) is encouraged more effectively;
- In an educational setting, role playing has proven to be a very effective means of training certain behaviours and promoting attitudes that the learner does not (yet) have.

3.4.6 User profiles, effectiveness and role playing

The previous subsections suggest that user data can contribute to the effectiveness of an application because it helps designers to construct a reliable user model. However, there are some caveats with regard to a drastic adaptation of messages and interfaces to individual users or target groups.

- In the design process of applications, user roles, user personas and scenarios are created to ensure that applications indeed have the functionality that users need, and hence can be effective.
- User roles are generally not created on the basis of user data but on the basis of an analysis of organisational goals and functions.
- User personas and users scenarios are not directed at individual users but are a narrative description of prototype users and their tasks. User profiles can contain data that are useful to create realistic and adequate user personas and scenarios.
- From a rhetorical viewpoint, it is not always necessary to adapt applications fully to individual users or groups as human beings are very capable of accommodating themselves, or 'playing the role' that is imposed on them by the application. Sometimes, it might even be more effective to use the strategy of altercasting to elicit a particular behaviour of the user.

3.5 Efficiency

After effectiveness, the second component of the ISO usability concept is effectiveness, which primarily refers to the ease of using an application and to the accuracy and completeness of its use.

Ergonomics, Human factors research, and Human Computer Interaction (HCI) are fields that focus on the characteristics that human beings bring to bear when using ICT systems or devices. Human factors research is often concerned with the physical characteristics of users, particularly when using hardware (such as their abilities to read displays or push levers), whereas HCI focuses more on the software design and particularly on the cognitive characteristics of users that influence effective and efficient use both of the software, and of the information or transactions that are mediated through it. These cognitive characteristics can be used to adapt information, presentation and interaction to its intended users and thus make the communication between organisations and users more efficient and more effective. In other words, the next few sections describe user characteristics, abilities and traits that could be included in user profiles as a basis for adaptation.

Section 3.5.1 focuses on physical (dis)abilities, section 3.5.2 on cognitive (dis)abilities of users, and section 3.5.3 on users' preferences for a particular cognitive style.

3.5.1 Physical abilities

The effectiveness and efficiency of computer use is influenced by the users' abilities and limitations with regard to:

- Visual perception, including acuity, abilities to see contrast, colours, etc.;
- Perception of sound;
- Fine movements with arms and hand.

Of the population at large, 10–15 percent experiences some kind of limitation or impairment that severely affects the ease of use and the accessibility of applications. It is estimated that in Europe alone, 37 million people have a disability that excludes them from using particular products, services or information (Diffuse, 2002). The physical limitations, such as reduced hearing, reduced sight and reduced ability to see colour luminance and contrasts, or increased effort to make small and precise movements, occur much more often among the elderly than in younger segments of the population. However, limitations in ease of use and accessibility might also be created by the environment and context in which an application is used. When electronic information is accessed while driving a car or through a small telephone display, the users temporarily share many problems with people who have more permanent dexterity problems or limited vision.

Electronic information is simultaneously a benefit to people with physical disabilities and an aggravation of their problems. Instead of having to go out for information and services, disabled users can summon the information where, when and how it suits them best. They can use their assistive technology that help them 'see' or hear the information, and change the default settings of their computer to accommodate their special needs. But even then, much information is presented in ways that make it inaccessible. For example, navigation in displays often relies on images and screen layout options that are hard to see for people with limited vision or colour blindness. Interaction with websites and other ICT applications requires both mouse handling, with might be problematic for people with fine motor dysfunction, and looking at a screen, which might be problematic for people with a visual impairment.

Most countries have laws or regulations in place that require the accessibility of web applications, especially for public (government-)related information and applications used for or within the workplace. The current standard is to comply with the Web Accessibility Initiative Guidelines (priority 1) of the World Wide Web Consortium W3C. The sixteen checkpoints at highest priority level are particularly focused on making websites accessible for and with assistive technology, such as screen readers.

It is easy to see that user profiles can be quite beneficial to people with physical limitations, whether or not they are using assistive technologies or non-default browser settings. If the user profile were to contain information about the users' preferences, special needs or assistive technology used, the presentation on screen could be adapted to the physical characteristics of the individual users.

3.5.2 Cognitive abilities

Physical abilities to perceive and access information are an essential condition for the individual, cognitive processing of the information. Cognition is an umbrella term for all kinds of processes that 'go on in our heads' when we perform everyday activities such as having a (mediated) conversation, conducting our banking affairs or making a shopping list. Cognitive processes include *attention*, *perception*, *memory*, *learning* and *language*.

Attention – the process of selecting things to concentrate on, at a point in time. Attention is triggered by signals that we perceive through our senses, in interfaces mostly visual (including verbal) or auditory signals. Attention allows us to focus on what is relevant to what we are doing and at the same time to filter out what appears not to be relevant. Adaptive interaction and interface design should present relevant information as more salient (attention-drawing) in its environment, for particular user goals and/or contexts of use.

Perception – the process by which information is acquired from the environment through the different sense organs, and transformed into experiences of objects, events, sounds and tastes (Roth, 1986). Perception interacts closely with other cognitive processes such as memory, attention and language. Vision is the most dominant sense, followed by hearing and touch. When information is presented in multiple modalities, e.g. both in text and in images, the processing of that information might cause extra cognitive load but often results in a deeper understanding or better learning. Essential is that the multimodal information is combined or linked carefully; even a slight delay in time between, for example, the visual information (e.g. a moving face) and the auditory information (e.g. speech) will make it difficult to perceive and to process the information. Adaptive interaction and interface design should present information in the perception modality that a particular user prefers or is more accomplished in (e.g. visual instead of verbal).

Memory – the storing and recalling of various kinds of information, encoding it into knowledge which enables us to act upon it at a later date. The more attention paid to a piece of information, and the more it is processed by perceiving it in multimodal forms, thinking about it, acting with it, comparing it with prior knowledge, the more likely that information is to be remembered later. The context in which a piece of information is encoded, influences the ease with which we can retrieve that information from memory. It is difficult to retrieve information that we have encoded in a different context than the one we are currently in.

People are much better at recognising things than at recalling them. Particularly our sense of visual recognition is highly developed compared with other types of memory. We recognise visual patterns (such as the grid of a web page or a logo) very easily, and expect that similar information or similar situations will be presented in a similar visual pattern. This means that most people prefer recognition-based scanning (e.g. backtracking through a series of linked web pages) to recall-directed search (e.g. recalling a particular word or information element from the desired page and then jumping to it with a search engine).

From the point of view of adaptive interaction and information design, it means that the presentation of information could be adapted to what the system 'knows' that the user has done before, or where the user has been before. It is important to note that the expectations of users and their established visual patterns are heavily influenced by

experiences and knowledge that they have acquired in situations other than during use of the ICT application. This is called a mental model of the 'world', which includes the tasks and goals users have in the 'world'. The mental model that users have or develop for the 'system' and the functionality of the system should match their mental model of the 'world' and their goals and tasks in the 'world'. Adaptive interaction and interface design should not only take into account what the user has done before in the 'system' but also what they have done in the 'world'.

Learning – is the process of acquiring new knowledge, competence or skills. Most learning related to the use of ICT applications takes place in an informal, unstructured setting, in which users learn new things by doing it (trial and error), or by requiring support from manuals, help systems or support staff when they encounter problems while performing intended activities. Adaptive interface and interaction design should present information in ways that take into account the knowledge and skills that the users already have when using the system initially, and are acquiring through recurrent use.

Language – Information delivery and interaction in ICT applications is realised with verbal and visual means, thus appealing to the users' verbal and visual language competence. Users can differ considerably from one another in their verbal language competence. Even on an individual level, the level of oral competence of a person (listening, speaking) can be very different from the level of written competence, just as the level of productive competence (speaking, writing) can be quite different from the level of receptive competence (listening, reading). User-related characteristics that are related to language competence are amongst others: being a native/non-native speaker of the language, individual cognitive abilities, education and opportunity to learn, topical knowledge including jargon and terminology, and context knowledge about the situation of language use. There is extensive evidence that verbal information is more easily processed and understood better when the language used is well adapted to the level of language competence of the receiver of the information. Hence, it seems advisable to include information about the individual user's *language preference and competence* in a user profile system, and to use those user-related data to adapt the verbal presentation to the users' needs and abilities.

The standard for human-computer interaction at present is the graphical user interfaces (GUI). Although GUIs are much more graphical and visual than their predecessors, they rely heavily on users' language abilities. Much of the language used in the interface is 'computerese': jargon that pre-supposes a quite extensive topical knowledge of ICT and software. Also, many words used in the interface are in English or 'Dunglish', even if the interface is Dutch (e.g. home, website, file, scrollen, surfen, etc.). These terms are well-known and hence effective for experienced computer and website users but can be quite confusing to people who have just started using computers and/or have little mastery of English. It is well conceivable to include user data in a user profile system about the *users' experience with computers*, websites and (computer-related) *English*. This information could - again - be used to adapt the verbal presentation to the abilites, needs and preferences of individual users.

Graphical user interfaces not only rely on users' verbal language abilities but also make extensive use of a visual 'language', consisting of icons, buttons, bars, screen areas, etc. Although a large part of this visual language is by now developing into a set of conventions and standards, almost every ICT application also contains idiosyncratic elements which derive their meaning solely from the context in which they are used or from a text label that explains its function. Users must have the ability to 'read' and

understand both the conventional and the application-specific visual elements. Their ability is determined by their *experience with computers*, which can be acquired in formal or informal learning situations. If user-related information concerning the users' mastery of the visual language of ICT applications was available in a user profile system, the software interface could be adapted to the users' abilities, needs and preferences.

3.5.3 Style preferences

People have preferences for how they process information, think and learn. These preferences are called their cognitive style. Cognitive style is a part of a person's personality. It is an individual trait that, like all personality traits, cannot be changed at all or can be changed only over a longer period of time. It is conceivable that a user profile system would contain data about the individual's cognitive style and use it to adapt information or an interaction to the cognitive style of that individual user.

Cognitive style is a container concept for several individual preferences for thinking and learning. The two dimensions of cognitive style that have been investigated most are:

- Individual preference for processing information in visual or verbal form;
- Individual preference for holistic or analytic style of information processing.

Other personality traits, such as locus of control also seem to be related to the individual user's actual behaviour with computers. Locus of control is an individual's belief whether the outcomes of our actions can be attributed to what we do (internal control orientation) or to events and factors that are beyond our control (external control orientation). This personality trait appears to be particularly influential when users meet problems using computer systems, influencing how they go about finding solutions to their problems.

Many researchers in the field of adaptive hypermedia agree on the importance of modelling and using individual traits in the design of adaptive systems (Brusilovsky, 2001). Until now, the focus has mainly been on adapting the content, the presentation or the navigation to users' preferences or needs.

If we wanted to include data on user traits (such as cognitive style) in a user profile system, an important question would be how to collect data that are valid and reliable. Personality traits cannot be extracted with a few simple questions in a questionnaire, or inferred from user behaviour (Chin, 2001). Personality traits are measured with specially designed psychological tests, often to be administered under controlled conditions and to be analysed by trained analysts.

Two widely-used tests measuring cognitive style dimensions are the Group Embedded Figures Test for scoring whether someone has a 'visual or verbal' cognitive style and the Myers-Briggs Type Indicator, which distinguishes 16 'style types' on the basis of four dimensions of information processing style. Including data on cognitive style in a user profile would imply that the users are willing to take a test in order to be recognised as having a particular cognitive style. It is unlikely that users would be willing to take such tests unless they see clear advantages of the time and effort they have to invest.

3.6 Satisfaction and other affective factors

Although users may be expected to be satisfied already if an application is effective and efficient, it is widely recognised that affective factors are relevant as well. A related

concept is *Designing for pleasure*, as advocated by many human factor specialists (e.g. Jordan, 1999). Recently, the term *user experience* is also often used to refer to the affective aspects of usability. Satisfaction, according to ISO 9241, refers to the comfort and acceptability of the work system to its users and other people affected by its use.

In this section we will focus on two concepts that are important to satisfaction: motivation and credibility.

- *Motivation* refers to the choices that people make as to what experiences or goals they will approach or avoid.
- *Credibility* refers to the degree of trust that is raised by an application. There are many factors that influence credibility. In this section we will focus on the role of the message and the interface.

3.6.1 Motivation

Motivation refers to the magnitude and direction of behaviour. According to Keller (1983, p. 389), it refers to 'the *choices* people make as to what experiences or goals they will approach or avoid, and the *degree of effort* they will exert in that respect'. As such, motivation is a rational process that is influenced by many internal and external aspects, which have been studied profoundly.

Keller gives an extensive overview of research conducted in the area of motivation. His ARCS Model of Motivational Design was aimed at making instruction motivating and it has been applied and tested by numerous researchers ever since.

Keller developed his ARCS Model to make instruction (both classroom and CAI or computer-assisted instruction) more motivating. In other words, the model was developed to be applied in a reading-to-learn setting. Using an application and maintaining a user profile are tasks in a reading-to-do or even a reading-to-learn-to-do setting. Nevertheless, we believe that the motivational strategies proposed by Keller may increase motivation outside a reading-to-learn setting as well. Research is necessary to study the effects of these motivational strategies outside this setting and more particularly in the setting of user profiling and applications adapted to user-related information in user profiles.

The ARCS Model of Motivational Design defines four major conditions that have to be met for people to become and remain motivated. Each of these conditions subsumes several areas of psychological research:

1. *Attention*: arousing and sustaining curiosity;
2. *Relevance*: linking to learners' needs, interests and motives;
3. *Confidence*: helping learners develop a positive expectation for successful achievement;
4. *Satisfaction*: providing extrinsic and intrinsic reinforcement for effort.

Attention strategies include using novel, incongruous, conflictual, and paradoxical events. Attention is aroused when there is an abrupt change in the status quo (i.e. banners or pop-ups). However, the extent to which attention can be held with this strategy depends on the frequency and complexity of its use: the unusual can become commonplace and lose its effect. Another way to arouse attention is to use anecdotes and other devices for injecting a personal, emotional element into otherwise purely intellectual or procedural material. Also, giving people the opportunity to learn more about things they already know about or believe in, but also giving them moderate doses

of the unfamiliar and the unexpected can increase attention. Another strategy is using analogies to make the strange familiar and the familiar strange. Finally, attention can be increased by guiding users into a process of question generation and inquiry.

Relevance strategies primarily focus on making the content of information relevant to users. Providing opportunities for choice, responsibility and interpersonal influence can also increase relevance, as can establishing trust and providing opportunities for no-risk, cooperative interaction.

Confidence strategies are applied to increase expectancy for success. This can be established by increasing experience with success, by indicating the requirements for success, by using techniques that offer personal control over success (i.e. individual contracting, assuming that the contract includes criteria for evaluation) and by using attributional feedback and other devices that help learners connect success to personal effort and ability. So, confidence in this respect can be seen as confidence in oneself, in the application and in the expected outcome.

Satisfaction strategies are applied to maintain intrinsic satisfaction. In order to accomplish this, Keller suggests using task-endogenous rather than task-exogenous rewards, using unexpected, non-contingent rewards rather than anticipated, salient, task-contingent rewards (except with dull tasks), and using verbal praise and informative feedback rather than threats, surveillance or external performance evaluation. To maintain quantity of performance, Keller also suggests using motivating feedback following the response, and to improve the quality of performance, providing formative (corrective) feedback when it will be immediately useful, usually just before the next opportunity to practice.

Not all of the above-mentioned strategies will be easily applicable on the basis of user-related information in user profiles. For instance, to *sustain* attention, a response to the sensation-seeking needs of the user is required. The category satisfaction also requires a reaction to the particular, current state the user is in. In order to apply these specific strategies, more sophisticated measures are necessary than the standard information-gathering measures used to create and maintain user profiles. However, the remaining strategies can be adapted to specific users with the help of user-related information in their profiles.

On the basis of user-related information in user profiles, attention strategies can be adapted to the specific user: when current knowledge, interests and beliefs are known, it is possible to give users the opportunity to learn more about things they already know about or believe in, thus arousing attention. When a user profile offers information about what is or is not familiar to the user, it becomes possible to give the user moderate doses of the unfamiliar to increase attention.

If the user perceives the information, using the application, building and maintaining the user profile as relevant, then according to Keller, the user will be motivated to a higher extent. In other words, if content and presentation of information is based on individual user profiles, thus making it more relevant to that particular user, then the user will be more motivated to act upon the information. For example, using an example with parents and children will be more relevant to a user with children than to a user who does not have children. Also, presenting an analogy on the basis of fishing will be more relevant to, work better and be more motivating for users who like fishing and have the required prior knowledge than to/for users who do not. Another example of a relevance-increasing

strategy is to provide the user with the choice for the display of information: not only concerning structure (how would you like the sequential order of menus in the application to be?) but also concerning presentation (would you like these twelve questions presented to you all at once or in chunks of four at a time?).

The same link with motivation applies to confidence: if the user feels that a pre-set goal will probably be achieved in a successful manner, then motivation to pursue that goal will be higher. Confidence can be increased by assuring and persuading the user that he or she is quite able to accomplish a certain goal or that accomplishing the goal is achievable anyhow. When this is done properly, the user will feel more confident, thus be more motivated to act upon the information. Another way of boosting confidence is by offering the information in chunks. This is also a good strategy for users in need of a low cognitive load. User-related information can reveal a user's previous accomplishments, which can be used as comparison: 'You've successfully purchased books from us before, so purchasing another book should be easy'.

So, motivation strategies adapted to the individual needs of a specific user may very well motivate that user to read the information and effectively work with the application. Song and Keller (2001) showed this when they applied the ARCS Model of Motivational Design to a Computer-Assisted Instruction (CAI) setting. This resulted in three motivational conditions of CAI: adaptive (to the varying needs of the user during the instruction), saturated and minimised. The motivationally adaptive CAI showed higher effectiveness, higher overall motivation and higher attention than the other two CAI types. For efficiency, both motivationally adaptive and minimised CAI were higher than motivationally saturated CAI. Apparently, providing users with motivational stimuli they do not need is worse than not providing them with motivational stimuli at all. Assessing which motivational stimuli are needed can be performed on the basis of user-related information in user profiles.

The ARCS Model of Motivational Design does not explicitly reckon with possible influences of emotional appeals from either content itself or presentation of content on user motivation. In our view, behaviour in general and motivation in particular are not purely rational processes: even when reaching a certain goal would be preferable on the basis of rational processes, a user might still decide not to take action towards pursuing it. Here, irrational variables such as emotions probably have an influence as well.

3.6.2 Credibility

In this section, credibility is defined as the features of messages and interface that affect the trust of the users in the quality of the application. There are many other features of applications that influence trust, as well as factors that are not directly related to the applications (e.g. trustworthiness of the organisation, the manufacturer, etc.). These are discussed in chapter 7.

It is important that credibility is not a quality of an application (or its interface) in itself but a quality 'in the eye of the beholder'. First of all, credibility is constructed by the user on the basis of perceptions: there are certain features that are 'seen' or 'not seen' by the user. Moreover, this perception has an intuitive and holistic character. Credibility cannot be calculated as the sum of a number of features of an application. And finally, credibility is based on an evaluation by the user in which different criteria may play a role.

Coney and Steehouder (2000) regard credibility as a quality of the author persona of a website. They argue that, just as the reader persona is not a real person but a fictitious character created in a message (cf. section 3.3.4), the 'speaker' or 'author' of a website is not the real person or organisation responsible for that site but a creation of the designer, an artificial character or author persona. By creating an appropriate author persona, the designer of a website (and probably also of other ICT applications) can enhance the credibility.

Coney and Steehouder, following Alexander and Tate (1999), offer a number of suggestions for features that can increase the website visitor's confidence in that the information is reliable and relevant. Fogg et al. (2001) conducted a large online survey (N=1410) to investigate which elements of websites affect people's perception of credibility. Together, these studies justify the following conclusions:

- First of all, effectiveness and efficiency of an application add considerably to its credibility. Fogg et al. (2001) conclude that ease of use is one of the main factors that create credibility for visitors of websites;
- For websites, and possibly also for other applications, markers of expertise end trustworthiness contribute to credibility. This concept refers to a number of features that indicate the expertise of the person or organisation responsible for the application. Examples are: the mere identity (facts about the organisation) and credentials. Markers of trustworthiness are, for example, a policy statement on the reliability of the content, or a privacy statement. A reverse effect can be expected from excessive 'commercial' (advertising) elements and 'amateurisms' such as unprofessional language or graphic design and spelling errors;
- An interesting conclusion from the Fogg et al. (2001) study is that tailoring the user experience contributes to credibility.

One of the ways user profiles can help to enhance credibility is that they can prevent an *overdoses* of credibility-enhancing features. For instance, when users visit a website for the first time, or only occasionally, markers can be useful to or at least tolerated by the visitor. But when the user sees the same information every time he enters an application or visits a website, it might become irritating and counterproductive. When user data indicate that a user is using the application for the second time, the content can be adapted so information is not repeated.

3.7 Forms of adaptation: electronic forms

Many government agencies and other organisations have recently started to replace their paper forms with electronic forms distributed via websites. Increased efficiency seems to be the most important motive behind this innovation. However, it is also assumed that completing electronic forms is easier for the clients of the organisations, and that electronic forms will decrease the number of forms filled in incompletely or inaccurately.

A number of studies in the 1970s and 1980s have increased our understanding of the way people fill in application forms and of the problems they have with this task (an overview is given in Jansen & Steehouder, 2000). Digital forms are expected to prevent a number of problems that people have when completing regular paper forms:

- *Routing problems* may be eliminated by using a branching program that asks only relevant questions, given the answers to earlier questions;
- *Verifying* calculations may become less important as the computer does all the computation. Moreover, computer programs may contain 'built-in' checks that detect

implausible or contradictory answers to questions. Such features may warn the form filler about possible errors;
- *Terminology* problems may be solved by pop-up definitions and explanations;
- *Explanations* may by available via online help. Some explanations may even be replaced by wizards that do not explain how to find an answer to a question but that guide the user step-by-step to the right answer.

However obvious these advantages may seem, it is not clear whether such features really have the intended effects. There are only a few studies of electronic form filling that permit only very tentative positions on the question whether electronic forms really help, and most of these are quite outdated, using electronic forms that are far below today's standards (Bergen, Scheifes, & Jansen, 1992; Frohlich, 1986). As results of usability tests are generally not published, there is only little evidence available. The only exception is a published study by Steehouder and d'Haens (2000). A usability test was carried out to compare the problems of people who completed a traditional paper Dutch Income Tax form *(E-biljet)* with the problems that were met by users of an electronic tax form *(Aangifteprogramma).* The results showed that there were no significant differences on accuracy, mental load or motivation between completing paper forms and electronic ones, although electronic forms did appear to solve some of the traditional problems of form fillers, such as calculations. However, the users still had many problems related to features that were expected to help them, such as selecting relevant questions and using online explanations of the tax regulations.

The application of *user profiles* for electronic forms seems a big step forward in cutting down on the administrative burden of form fillers. It would even be possible to add answers before the form is filled in, and possible to skip questions if the answer is already known. This is not unique for electronic forms, however. There are examples of paper forms that are pre-filled. For instance, Dutch civil servants receive the form for the *Tegemoetkoming ziektekosten* (compensation for medical expenses*)* every six months to check the data. This form has to be returned only if the pre-filled data have changed in the past period. Other forms use the same principle but have to be signed (in agreement) and returned.

No studies have been published on whether fully or partially completed forms (paper or electronic) are really usable and useful. The available studies of form-filling behaviour suggest some serious doubts:
- Citizens or clients are supposed to check whether the data on the form are correct. However, earlier studies of form filling showed that form fillers do not check the correctness of their answers (they follow a 'kick-and-rush'-strategy);
- Citizens or clients are supposed to be able to signal the necessity to change or add information in the form. To that end, they need quite a high level of understanding of the regulations or the conditions that underlie the questions on the form. Earlier research showed that this understanding is usually lacking, and that most form fillers have a surprisingly low need to know and understand the regulations. Explanations are scarcely read.

3.8 Forms of adaptation: information seeking

Information seeking refers to a variety of behaviours that people apply to get new information out of digital systems, such as databases or the WWW. In their review of research on information seeking on the Web, Choo, Detlor and Turnbull (1999) distinguish four modes of information seeking:

- In *undirected viewing,* the individual is exposed to information with no specific informational need in mind. The goal of broad scanning implies the use of a large number of different sources and different types of sources;
- In *conditioned viewing,* the individual directs viewing to information about selected topics or to certain types of information. The individual has isolated a number of areas of potential concern from undirected viewing, and is now sensitised to assess the significance of developments in those areas;
- During *informal search,* the individual actively looks for information to deepen the knowledge and understanding of a specific issue. The overall purpose is to gather information to elaborate an issue so as to determine the need for action by the organisation.
- During *formal search,* the individual makes a deliberate or planned effort to obtain specific information or types of information about a particular issue. The overall purpose is to systematically retrieve information relevant to an issue in order to provide a basis for developing a decision or course of action.

Several models of the Information Seeking Process (ISP) have been suggested in the literature as frameworks for understanding problems of information seekers and developing tools that support them (e.g. Ellis, 1989; Ellis & Haugan, 1997; Marchionini, 1998; Steehouder, 1994). The following can be considered an integrative model of the ISP. It distinguishes 6 categories of generic information-seeking activities.

Detecting the need for information
Selecting the information source
Formulating the information need
Locating information in the source
Interpreting the information
Evaluating the information

Detecting the need for information – The information process starts with the user's experience of an information need in a particular context (Marchionini, 1998; Steehouder, 1993). Surprisingly, this activity is neglected in many models of ISP (e.g. Ellis, 1989; Ellis & Haugan, 1997). Information needs can be classified in various ways. For instance, the need may be *functional* (information to solve a particular problem), *symbolic*, or *hedonic* (Loeber & Christea, 2003). Functional needs can be classified as (cf. Steehouder, 1994):

- *impasses*: the user does not know how to proceed in a given situation;
- *errors*: the user is 'blocked' or 'surprised' by unexpected events;
- *discoordination*: the user needs an overview or understanding of a certain situation;
- *uncertainty*: the user has an assumption of certain facts and seeks confirmation.

Selecting the information source – The information seeker identifies media and sources of interest that can serve as starting points for the research. There are several theories that predict media preferences:

- The *Media Richness Theory (MRT)* states that people have a preference for so-called *rich* media if their problems are vague, ambiguous, non-standard and complex, and a preference for *lean* media if their problems are standard and relatively simple. Daft and Lengel (1984, 1986) present a media richness hierarchy, arranged from high to low degrees of richness, to illustrate the capacity of media types to process ambiguous communication in organisations. The criteria are: a) the availability of instant feedback; b) the capacity of the medium to transmit multiple cues such as body language, voice tone and inflection; c) the use of natural language; and d) the personal focus of the medium. Face-to-face communication is the richest communication medium in the hierarchy followed by telephone, electronic mail, letter, note, memo, special report, and finally, flyer and bulletin.
- The *Media Features Approach (MFA),* coined by El-Shinnawey and Markus (1998) states that the functionality of a given medium is an important criterion of the preference of information seekers. They showed for instance that e-mail is often preferred to the telephone, regardless of the type of problem at hand, because e-mails do not interrupt others in their activities, allow for some time to formulate problems and thoughts, can be copied to other people, and can be archived.
- The *Social Information Perspective (SIP)* (Suh, 1999) states that media preference is primarily influenced by social factors such as attitudes and behaviours of others: people often prefer the sources advocated by their peers or that are 'in fashion'. Not mentioned by Suh but in line with his approach is the preference for media that create a social awareness. This might explain why people often prefer to discuss their problem in a discussion group on the Internet instead of reading documentation.

Formulating the information need – Most information sources and strategies require the user to find verbal expressions that match his information need. This can happen in many ways. Most common are systems that require the user to insert keywords, often connected with boolean operators (e.g. Google, most library systems). Such systems are based on full text search or on indexation. On the other side of the spectrum are systems that allow users to formulate their problems in their own words, e.g. discussion groups, e-mail helpdesks, or user forums on the Internet. There is only little research on the content and structure of such 'problem statements' (Steehouder, 2002).

Locating information in the source – After the first formulation of the problem, several activities can be applied for locating the relevant information.
- *Browsing* takes place if the application offers chunks of information in a certain structure. Information seekers use content lists, headings, hyperlinks and other devices to find relevant information;
- *Filtering* is the activity of progressive differentiation of keywords and prioritising sources in order to find the (most) relevant information;
- *Extracting* is the activity of systematically working through a particular source or document to identify information of interest.

Interpreting the information – It is obvious that the information needs to be understood by the user. But understanding is often not enough. The user has to apply the information to the problem that was the reason for seeking it in the first place. In many situations, the 'interpretation' of information may cause considerable problems (e.g. knowing that a problem with a computer program is caused by memory overload does not immediately lead to a solution to the problem).

Evaluating the information – Finding the right information is often not enough, an evaluation is needed to know whether the information is reliable, topical and complete enough for the initial problem.

How can user profiles help to facilitate information seeking?

A relevant activity of web users is monitoring: keeping abreast of developments or new information in a particular area. A distinction can be made between:

- *Pull monitoring*, where the initiative is with the user (e.g. by using bookmarked webpages, or revisiting a site);
- *Push monitoring:* receiving alerts, e.g. via e-mail newsletters, setting up a channel or user profile, or subscribing to services.

Choo, Detlor and Turnbull (1999) observed the information-seeking behaviour of 34 web users and the discovered that only very few of them used push monitoring techniques.

3.9 Forms of adaptation: online help

One of the fields in which adaptations to user characteristics has been developed to a certain level, is the offering of online help in applications. Here, help includes all kinds of task-supporting information, not only on the level of syntax (buttons, data entry and menus), but also on the functional level (how to use the system to reach particular outcomes), and as strategic support (how to use the application for 'real life' goals, such as a better administration or publishing articles).

Help systems can be adapted to the user in several ways:

- By being context-specific: the content of the help is selected on the basis of the function the user is working with. This kind of user support is often applied in systems that require data input, such as electronic forms. The user has to put the cursor in a particular field and the system offers help information in a separate field (most often, the user has to call up the help information by pressing a key or clicking a button);
- By layering: the help starts with the essentials and the user can choose to get elaborations or details by clicking hyperlinks. This approach enables the user to get help information that is accommodated to his level of expertise;
- By keeping track of earlier actions of the user. For instance, some systems signal repeated use of certain functions, and after a number of them, they come up with a practical advice or suggestion (e.g. to automate the function or create a macro);
- Wizards support users in performing certain tasks in applications by asking them for specific data or preferences.