Banknote design should be based on everyday banknote usage. It is remarkable that there is little known about human behaviour during a cash payment. Although several studies have been carried out, such as public surveys, in-depth interviews, focus groups and perception studies on how the eye scans a banknote, an interrelationship between these studies is missing. Therefore I developed the Model of the Key User Functions of Banknotes. This is a clear model, providing insight to banknote designers and can be explained on the back of a beer mat or coaster. Therefore it started its life as the Coaster-model.

FROM TECHNOLOGY-DRIVEN DESIGN TO USE-CENTERED DESIGN

Banknote designers search for a balance between user-friendliness and technology. This balance is not in equilibrium and often tips towards technology. The central bank’s attitude of ‘We know best what type of banknotes the people would like to have’, is a variant on Henry Ford’s quote: “Any customer can have a car painted any colour that he wants so long as it is black”. A century after Ford’s statement, this approach to customers has turned 180 degrees, as formulated by the late foreman of Apple, Steve Jobs: “User experience is the only thing that matters”.

In line with this school of thought, modern banknotes should first of all be designed for its users, the general public and retailers. This is not the case, as today’s banknotes are the result of a technology-driven design policy, focusing on security features, durability and production costs. In contrast, a use-centered design policy would put the users in front.

Instead of a focus on customers it is more appropriate to analyse the use or usage of banknotes by its primary users – the public. Such an approach is covered by use-centered design, without an r, which has been coined by Flach and Domicinguez (1995). On their turn, these authors have built further on the work of Donald Norman (1988), who was the first to introduce the term user-centered design, with an r. User-centered and use-centered are relative new terms, but the thoughts behind it were already familiar to designers as ‘human factors and ergonomics in consumer product design’. Although Norman is the advocate of user-centered design, Gould and Lewis (1985) laid the foundations. They unveiled three basic design principles:
- an early focus on users and tasks,
- empirical measurements,
- an iterative design process.

A use-centered design policy has also been laid down in an ISO-standard on human centered design processes, defining usability as the extent to which a product can be used by specified users to achieve specified goals (ISO, 2010). Effectiveness, efficiency and user satisfaction are the main criteria in this ISO-standard.

Central banks may argue that they follow a ‘stakeholder approach’, but this is not similar to a use-centered design approach. Stakeholders are all parties involved in the supply chain of banknotes, mainly manufacturers, like banknote printers and commercial banks. Today, the manufacturers of banknote devices receive most attention. These are often called the Banknote Equipment Manufacturers or BEMs.

Two representative examples are provided of technology-driven banknote design. The first concerns the security features. People would like to see similar features within a series of banknotes, but instead central banks divide the series in low and high denominations because of the production costs of security features. In a use-centered design approach such a split, if any, would follow the relevant usage situations, like a split in ATM-notes and payback notes. The authenticity of payback denominations is to the users of more interest than the authenticity of ATM-denominations (as all banknotes coming from an ATM are genuine). Such an approach would also assist the blind, as they are first of all interested in the correct values of payback notes (tactile blind marks are on the 200 and 500 euro of the first series of euro banknotes and not on the low denominations). A saving or hoarding denomination is seldom used for daily payments and such a denomination should follow a design policy suitable for its specific use. A last example is increasing durability, which is not relevant to everyday users of banknotes, but is another cost factor to the central bank.

SEARCH FOR USER FUNCTIONS

Of course, the very first user function of a banknote is access, since without access banknotes are useless. Once people have access to a cash payment system, every banknote designer will be able to name some user functions of banknotes, like a banknote should be secure and should be nice to look at. When making a study on user functions of banknotes the inspiration often came from designers developing websites, computer games and apps. These designers, often referred to as ‘screen’ or ‘interaction designers’, are typical designers of a 2D-product, like banknote designers are. User functions are key to interaction designers and around the year 2000 they opted for the terms UX and UI, abbreviations commonly
applied to User Experience and User Interface. ‘User Interface’ finds its origin in the 1970s in the domain of Human Computer Interaction and the term ‘User Experience’ was coined by Don Norman (1988). Their design is called respectively User Experience Design (UXD) and User Interface Design (UID). Similar to these existing terms UXD and UID this model introduces two novel terms UXF and UFF, representing respectively a User Experience Function and a User Interface Function.

This approach brought clarity in the largely unknown domain of human interface and perception of banknotes. Breaking down banknote’s user functions, the user interface functions (UIFs) were found first (figure 1a). It took some effort to list the identified UX- and UI-functions in the presented Model of Key User Functions of a Banknote. As this concise model was for the first time explained on the back of a beermat (figure 1b), the popular name is the Coaster-model. Indeed, user functions are key to banknote design as people will perceive a banknote from their user function mode, the user function of their interest. For example, when people search for a specific denomination in their wallet, they are in recognising value mode. People will operate in UX-functions when a banknote is just rolled out or when it is new. For example, when people say that they find the new banknote beautiful, they perceive the banknote in aesthetic mode. Or when they like the portrait or picture, they operate in the main image mode. A separate article in this edition of IBDA Insight entitled, “The 4M-model for Banknote Designers”, explains the user function modes in more detail.

FROM USER FUNCTIONS TO DESIGN REQUIREMENTS

Banknote designers will know “Form follows function”, the famous adage formulated in 1896 by Louis Sullivan. To arrive from banknote user functions to design requirements is a four step process as illustrated in figure 2. On the basis of user functions, functional requirements have to be listed first. For example, a user function is ‘recognising value’ and its functional requirement is ‘50’. To have a readable numeral, is a next step and user requirements will have to be formulated. To list user requirements, knowledge has to be gained on user needs. This knowledge is commonly obtained via literature or by performing dedicated studies. In the case of the numeral 50, typographic parameters have to be set, like the height of the numeral and its contrast to the background. All collected information will be analysed and will lead to an instruction to the banknote designer in the form of design requirements.

Translating user functions into design requirements is the task of the central bank. The role of the banknote designer is to provide an aesthetically pleasing design based on the design requirements set by the bank. By tradition, the printer is the contractor of a new banknote design. In a use-centered design approach the contractor role may be better served by an independent contractor, who will have more eye and knowledge for the final users like retailers and public and who will be less focused on details of production issues.

**UXFS**

Predictability and simplicity are typical user experience functions to screen designers. For example, a visualised path keeps track of the search actions carried out. An on-going time bar may indicate how much time is left before the video is finished. And, popups should appear in a logical sequence and attract attention. For example, a design element may start blinking on the screen. UX-functions of interest to banknote users are listed in figure 1a. People seem to be interested first of all in their own banknotes and not that much in banknotes from other countries. Therefore the UXFs start with experiencing identity (UXF1), as people will immediately notice whether the design represents their nation. Second, within a fraction of time, people will have a judgement ready on the aesthetics of a new banknote design. They either find the new banknote beautiful or ugly. For this reason judging aesthetics is listed as UXF2. Whether the new design looks like a valuable banknote or a cheap coupon is a matter of keeping confidence, function UXF3 (figure 3). Furthermore, the main image of the new design is noticed instantly, is it a portrait, a bird or a tower? Reacting on the main image is therefore one more user experience function (UXF4). There are two upcoming user experience functions, the first is expecting sustainability; people expect their banknotes to be ‘green’ (UXF5). The latest function is linking to information technology, listed as UXF6; people expect that a banknote can do ‘something’ with information technology, like checking a banknote by using a smartphone.

**UIFS**

Having completed the user experience functions, people may actually use the new banknote for a payment. Searching in their wallet, people are interested in their value. Also when they receive a banknote as change, people are first of all interested if the correct denominations are offered as change, in recognising value (UIF1). Subsequently people will take the banknote, arriving at the second usage function, named handling (UIF2). When people do not trust the banknote they are offered, they may want to do a self-check on its authenticity (UIF3). Receiving a communication message is the fourth identified usage function, as people may be interested in the themes, features and images displayed. The four UI-functions were prioritised by the Dutch in the order as given in figure 4 (Visser and Dijkers reporti, 2013), recognising value and
handling as the two most important user interface functions supporting evidence for this ranking is delivered by a study reporting that people find it more easy to distinguish and handle euro banknotes than euro coins, respectively 94 % and 79 % (European Commission, 2014).

MEASURING USER SATISFACTION

The public’s appreciation and knowledge of banknotes has been measured and reported by De Nederlandsche Bank since 1983 (De Heij, 2002). Following the model provided by the Coaster-model the indicators measured can be reported, including a usability score for the UI-functions. A usability score has been calculated by taking the average of the report marks for each UI-function (figure 4). Along the lines of the Coaster-model, user satisfaction of the Dutch for the euro banknotes can now be reported as follows (Randsdorp and Zondervan, 2015):

- UIF1 + UIF 2 + UIF 3 + UIF 4 - Usability score of banknotes: 6.4 (2013).
- UIF3 - Checking authenticity: Public knowledge of authenticity features: average 1.9 (2015).

These measurements are a benchmark for new banknote designs and may also be used to compare the user satisfaction of banknote users in other countries. In the future measurable indicators could be developed for the user functions that are missing.

CONCLUSION

It appears that all design elements of a banknote can be accommodated in the Coaster-model.

By following this model the central bank is assured of a use-centered design approach. The model also serves as a stepping stone to organise publications and communication on banknote design. The model may also be applied to organise a portfolio of development projects for new banknotes, covering all user functions. Furthermore, the model is suitable to structure design requirements for a new banknote and the chapters within a Programme of Requirements (PoR) could follow the user functions. Finally, the model offers indicators to measure user satisfaction of banknotes.

References


Figure 2
Schematic representation of the derivation of user functions to design requirements. First user functions should be identified, followed by functional requirements. The functional requirements have to be transferred into user requirements, based on preferences of the different user groups. Subsequently the user requirements have to be translated in design requirements.

Coaster–model - Key user functions of a banknote

<table>
<thead>
<tr>
<th>UXF User Experience functions</th>
<th>UIF User Interface functions</th>
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<tbody>
<tr>
<td>1. Recognising identity</td>
<td>1. Recognising value</td>
</tr>
<tr>
<td>2. Judging aesthetics</td>
<td>2. Handling</td>
</tr>
<tr>
<td>3. Keeping confidence</td>
<td>3. Checking authenticity</td>
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<tr>
<td>4. Reacting on main image</td>
<td>4. Receiving the communication message</td>
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<tr>
<td>5. Expecting sustainability</td>
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<tr>
<td>6. Linking to information technology</td>
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</tbody>
</table>

Figure 1
a) Model of the Key User Functions of Banknotes or Coaster–model. User functions are split in user experience functions and user interface functions.
b) Explanation of the model of user functions on the back of a coaster in café Bloemers, Amsterdam (14 January 2015).

Figure 3
Two examples of vouchers.
a) Template for a Gift Voucher (2014).