Banknote opinion polls:
a method for collecting customer feedback on banknote design

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1. Introduction

Every two years DNB commissions an opinion poll on euro banknotes. Started in 1983, today 13 similar polls have been held, first on the guilder notes (NLG) and from 2002 onwards, on the euro banknotes. These polls delivered essential feedback for the design process of new banknotes. Two examples: tilt features and especially optical variable inks (OVI) are not popular. And the Dutch public is unable to tell the theme of the euro notes, e.g. Renaissance architecture on the euro 50 (for more examples, see Appendix).

Apart from such essential information for the design of new banknotes, the opinion polls provided DNB with unique time series on the general public’s:
- knowledge of security features (average 1.9 in 2007),
- confidence in banknotes (6.9 in 2007),
- appreciation of the banknotes (70.5 % beautiful for the complete series, 2007),
- quality of the notes in circulation (86 % clean for the whole series, 2007).

Such time series demonstrate that a central bank respects its customers and is interested in their opinions. It also makes banknote management as part of a central bank’s remit transparent to the public. A central bank gains from providing this kind of marketing figures in addition to figures on counterfeit notes, as it enhances its reputation as banknote circulation guardian.

Figure 1.
A unique timeline of the average public’s knowledge of Dutch banknotes security features over the years 1983 - 2007. Thanks to banknote design and information campaigns, the average number of correctly named security features increased from 1.03 in 1983 to 1.9 in 2007. The introduction of the euro in 2002 increased the knowledge of correct answers due to the information campaign.
DNB’s example not followed

DNB practically always published the results of their opinion polls as well as the design benefits of such polls [e.g. 8, 17, 29, 33, 38, 46]. However, so far no other central bank followed suit. This is deeply puzzling. It is as if conducting a survey of the kind under consideration depends on an individual central bank employee (a cashier, or staff from the study or communication department) taking the initiative towards this end, rather than this being part of a central bank’s policy. A patronizing central bank attitude is often the case, not using or interested in public input. It seems that there are hardly any printing works that initiate customer feedback, since for printing works the central bank is the client.

Central banks that did conduct polls are the Bank of Canada (‘public confidence score’ [31] and ‘retail survey’[11, 32]) and the European Central Bank, e.g. the ‘cash handlers’ surveys’. But there are also others like the US Bureau of Printing and Engraving. The results of the ECB polls are not made public, but are available to central banks [23, 41].

If other central banks would adopt DNB’s approach, findings could be compared. Such benchmarking of banknote users’ information would permit a comparison between banknotes issued by different central banks. A very first exercise to this end was carried out in 2003, when the public’s appreciation of the euro banknotes in Austria (A) and the Netherlands (NL): (EUR A) x (EUR NL) was compared. These results were also compared with the public’s appreciation of the US dollar (USD) and the Canadian dollar (CAD). This made it possible to compare the public’s appreciation of 4 different banknote designs (see Table 1 [10, 17]). DNB could also compare the design of the final series of NLG banknotes with the new euro banknotes.

<table>
<thead>
<tr>
<th>Attractiveness</th>
<th>1999</th>
<th>2002</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>NLG- Abstract Series (in the Netherlands)</td>
<td>79.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>USD - Series 1996</td>
<td></td>
<td>73%</td>
<td></td>
</tr>
<tr>
<td>CAD - Canadian Journey $5 and $10</td>
<td></td>
<td></td>
<td>79%</td>
</tr>
<tr>
<td>EUR – Ages &amp; Styles (in Austria)</td>
<td>77.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EUR – Ages &amp; Styles (in the Netherlands)</td>
<td>66.4</td>
<td>65.7</td>
<td></td>
</tr>
</tbody>
</table>

Table 1.

Scores assigned to the attractiveness of 4 banknotes: Dutch guilder notes (NLG), US dollar (USD), Canadian dollar (CAD) and the euro (EUR) in both Austria and the Netherlands. This was the first time that the public’s appreciation of banknotes from different currencies was compared: (NLG) x (USD) x (CAD) x (EUR A) x (EUR NL).

Figure 2 shows two extreme scores in the Netherlands. The highest score measured (NLG 250, 1999) and the lowest (EUR5, 2007). Also the US and Canadian dollar designs are incorporated in this figure.

Low costs

The costs of an opinion survey can be no reason for not following DNB’s example. The costs are low, around EUR 25,000 for 1,500 interviews, including the report. You are invited to copy the template of the DNB questionnaire provided in ‘A method for measuring the public’s appreciation and knowledge of banknotes’ [8].

Quantitative and qualitative consumer research

Periodic opinion polls provide quantitative feedback to the central bank towards improving the following note design. Next to such opinion polls, a central bank may initiate qualitative research like in-depth interviews, focus group research or other types of user research. Such research would be most effective during the design process (see also paragraph 2.2, Figure 6).
2. Sorts of feedback on banknote design

Over the years DNB has conducted many studies on public behaviour and preferences in different payment systems, including cash, e.g. by Kippers, Jonker, Brits and Winder [20, 21, 25, 30]. The DNB opinion polls on banknotes are a separate chapter, since they focus on the banknotes.

One of the greatest difficulties about banknote development is the lack of a test market. Without the introduction of specific tools, there is no feedback from the customer, i.e. the general public and the retailers. How can a central bank minimise the risk of disappointment or misunderstanding by the public? Feedback from customers is just as essential for good banknote design as it is for any industrial product design.

The following four paragraphs provide some more insight:
2.1 Life cycle definition for banknote design,
2.2 Methods to receive feedback on banknote design,
2.3 Target groups,
2.4 Menu for customer research on banknote design.

2.1 Life cycle definition for banknote design

Most producers can infer the success of their product from the number of articles sold. A typical life cycle for an industrial product, based on the volumes sold, is given in Figure 3.
On the other hand, being a monopolist, a central bank cannot deduce the appreciation of a new model from the circulation figures. The popularity of denominations is reflected by the circulation figures. In the past, DNB withdrew denominations that were no longer popular, like e.g. NLG 20 in 1961, and NLG 50 in 1960. This last denomination returned in 1982, on the basis of an opinion poll conducted in 1978! Today, based on the circulation figures in numbers the euro 50 is the most popular banknote in the Netherlands and also in the euro zone.

One size fits all!
The public cannot choose between different models of one denomination, except when the model is replaced by a new one. The public has no choice between a dynamically styled modern banknote or a senior model with a bigger letter type, for the motto is: one size fits all. There are a few exceptions, though. In Hong Kong and Scotland, for example, each denomination comes in three models, each one issued by a different bank.

Appreciation of NLG 100/Snipe
Appreciation (A) of a banknote model x could be presented as a function of time: \( A_x(t) \). For banknotes, central banks would like to have a more-or-less constant (C) appreciation over the years: \( A_x(t) = C \). Figure 4, which illustrates this statement, should be compared with the typical life cycle as shown in Figure 3.

The NLG 100/Snipe is the first banknote model for which the public’s appreciation was measured over the note’s full life cycle: 1981 - 1993 (see Figure 4). As may be clear, the NLG 100/Snipe matches the ideal curve.
Normally, a central bank satisfies the demand for banknotes and refrains from stimulating market demand for a specific denomination. The public does have influence on the relative success of a denomination, though. In the Netherlands, for example, the NLG 100 note was by far the most-used denomination. In 2001, circa 38% of the notes in circulation were NLG 100 notes. The most successful design was the NLG 250 note or *Lighthouse*, which was found attractive by 91% of the Dutch in 1999. This denomination was not used much, though. To be precise, it made up a little over 4% of all the NLG-notes in circulation. In terms of circulation, the euro 50 note holds the same position in the euro zone as the NLG 100 used to in the Netherlands: around 40% of the euro notes in circulation are euro 50 banknotes. This is in line with the situation before the introduction of the euro, when around 40% of the guilder notes were 100 NLG notes (about EUR 45). However, in the case of the euro banknotes, there is no clear winning design. There is a loser though; the 5 euro note lost again appreciation in 2007, being found ugly by 56% of the Dutch.

**2.2 Methods to receive feedback on banknote design**

Over the years, DNB has developed the following methods to gain feedback from the public:
- design studies, e.g. on new production techniques (double offset, barcode number),
- perception studies, e.g. realistic versus abstract designs [2, 38],
- consumer survey, specifically for the blind [4, 5],
- research to colour blind vision of euro banknotes and upgraded euro banknotes [28],
- in-depth interviews for a public friendly foil design [27, 33],
- focus group research for counterfeit detection [16],
- quantitative research on the ability of the general public and cash handlers to distinguish counterfeit from genuine euro banknotes [35],
- ….

Figure 6 describes the different consumer tests that can be performed from the very first design phase until the issuance of a new banknote.
During the different development phases there are different methods to receive feedback on new banknote designs. Once the note has been issued, feedback from the opinion polls may be used for the next design.

**Design studies**
Designer Robert Oxenaar and his assistant Hans Kruit twice proposed a so called ‘colour and shape study’, preliminary design studies. The first study was done in 1980 for the new NLG 50/Sunflower note to verify heavy intaglio printing (heart of the sunflower) and special gratings for the offset images. A second colour and shape study was done in 1983 to prepare the NLG 250/Lighthouse. This note was special because it was fed twice through the offset press (spectrum of lighthouse on the front, metameric colours on the reverse).
In 1987 a design study to metameric colours was done for the new NLG 25/Robin. For the introduction of the barcode on this banknote some design studies were done to the printed backgrounds of the barcode.
However, these design studies were not meant to be tested by a user test group.

Real public users were invited to test foils with public appeal, was a design research project for new euro notes. The public prefers to tilt the note in North-South direction and not in East-West, is one of the results found in this DNB project for the Eurosystem. Repetitive elements in security features like euro 20, euro 20 do not encourage people to perform a check, was one of the other findings. People do not know where to look or which one to check. Should all elements be checked? Should they all be the same? Should I start at the top or just pick one? This design research made it also clear that the public prefers two images flipping from one to the other. One of the images should be a portrait; the other image could be e.g. a music instrument like a grand piano [27, 29, 38].

**Perception research**
Perception research can be very effective if conducted prior to a new banknote design project. This kind of research measures the effectiveness of certain design principles. One of the first lessons learnt by DNB from perception research was that the name of the main image should be printed close to the public security features. People do not know where to look or which one to check. Should all elements be checked? Should they all be the same? Should I start at the top or just pick one? This design research made it also clear that the public prefers two images flipping from one to the other. One of the images should be a portrait; the other image could be e.g. a music instrument like a grand piano [27, 29, 38].

In 1985 - 1986, DNB conducted perception research to test the recallability of figurative and abstract image elements in complex pictures. In this test, the respondents were shown a main image and smaller, surrounding items, in both a figurative and an abstract version. The outcome was that the figurative pictures were more easily
recalled than the abstract ones. Any relation between the main figure and the items was found to be of no influence [37].

A design study to ‘way finding features’ or communication symbols on the banknotes was done by DNB in cooperation with Professor Paul Mijksenaar in the years 2001 - 2003 [24]. The developed designs were tested by public users on comprehensibility [26].

Other questions requiring more perception and design research are:
- Where do people place their fingers when taking hold of a banknote? On the short left-hand edge? In the middle of the upper long edge?
- How much time do people spend checking out the front of a banknote? After how many seconds will people check the reverse side, if at all? For retailers, this would be around 2 seconds. Most check 2 features.
- Would clustering the features with the same function facilitate public checking? Is it appreciated when all tilt features are located in one area of the note? Does this also apply to the look-through features?
- …

**Opinion poll on denominations or banknote themes**
The first opinion poll by DNB on banknotes was done in 1963 to investigate the public need for a new denomination of NLG 5. In 1978, the need for the re-introduction of a NLG 50 was researched, and in 1981 the Bank wanted to know which denomination could best fill the gap between 100 and 1,000 guilder: 200, 250 or 500 guilder (the outcome was 250).

To ensure that a new banknote design meets with the public’s approval, in 1999 the Bank of Canada asked the public for their favourite note theme. Even though the selected theme was only used on the reverse side, the response to the new banknote, the CAD 10 issued in 2001, was positive (Figure 7).

![Figure 7. First banknote issued with a theme proposed by the public: CAD 10, issued in 2001. The selected theme on the reverse (on the right) is ‘remembrance and peacekeeping’ (cf. the role of Canada during the World War 2).](image)

However, this approach is no guarantee of a positive response to the eventual banknote, because such response also depends on the design. A popular theme may be translated into an ugly design and vice versa. A good designer possesses the talent to turn any subject, no matter how dull, into a good design!

It is relevant to note that the public’s opinion on banknote design can only be measured after the new notes have been printed or issued. Asking the public about design subjects before the banknote has been designed will yield no reliable information, since every respondent will visualise a different image.

**Public opinion poll on design contest**
The euro banknote design contest in 1996 delivered 44 entries, divided over two categories: ‘Ages and Styles of Europe’ and ‘Abstract’. A jury selected ranked 5 designs in each category. The selected 10 designs were presented to the public. Within this scope, 1,896 interviews were held in 14 EU countries (not in Denmark). The preferred aesthetic design was ranked as number 10 by the public. The choice of the public was clearly on the designs made by Mrs. Maryke Degryse (National Bank of Belgium). The Governing Council finally selected number 2 on the public list: the designs by Robert Kalina [38]. See Figure 8.
Figure 8.
Public preference for new euro banknotes in 1996: Maryke Degryse (National Bank of Belgium): 52 %. Finally the designs by Robert Kalina - number 2 with a public score of 30 % - were selected by the Governing Council

Publish all banknote designs on the Internet; exhibit at central bank (before design selection is made)
To avoid direct involvement of the public in the design selection process, central banks opt for the indirect method, as was recently done by the Swiss (2005) and Danish central banks (2007). Both central banks published all the designs entered within a closed competition (Figure 9). In the case of Switzerland, 12 designers were invited, and in Denmark, 8 designers took part.

Both central banks said that they selected two or three designs for further print study, keeping the final decision open. This is good practice, for the public is informed about new banknote designs without being involved in the eventual selection. Public and media reactions can be taken into account. Early 2007 both central banks published their designer’s choice. Quite often, the runner-up in a banknote design competition is eventually selected as the winning design, as was the case in Switzerland. In the 1970s this also happened in Switzerland, and in the 1980s in the Netherlands. As was in a way the case with the selection of the euro designs in 1996.

Figure 9.
Examples of design contest results published on the Internet as input for the final design selection:
Left: draft proposal for new Swiss banknotes from Manuel Krebs (2005).
Right: draft proposal for new Danish banknotes from Kaspar Bonnen (2006).
Both central banks put the designs on display by means of an exhibition and by posting them on their websites. The Swiss central bank was not afraid of a biased public discussion on the embryo featuring on the winning design for the new 100 franc note.
Figure 10.
The 5 coin designs for the national side of a new 2 euro coin, offered to the European public in January 2008. The selection was open to all EU citizens and residents. Each person could vote only once and was closed after one month. The winning design is the second one from the left, receiving 41.5 % of the 141,675 votes (including one of your author). The design is made by Mr. Georges Stamatopoulos, engraver of the National Bank of Greece (www.ec.europa.eu).

Voting on designs by the Internet
Recently, the European public was invited by the European Commission to vote for a new design of a commemorative 2-euro coin with a common design to be issued in early 2009 on the occasion of the 10-year anniversary of the launch of Economic and Monetary Union (EMU) and the birth of the euro. The coin will be issued in all euro-area countries. The public could choose from 5 designs, which were pre-selected by the Mint Directors (Figure 10).

Publish all banknote designs after the selected designs have been issued
‘They picked the wrong one!’ To overcome such criticism, central banks tend to publish the alternative designs after the issue of the new banknote series (or the new single note design). This policy was followed by, e.g., DNB in 1999 [7] and the ECB in 2003, see Figure 11 [13]. Once the public has become familiar with the new designs, they are used to the images and - generally - will prefer this one over others. From a psychological point

Figure 11.
Example of publication of the results of the design contest after the selected designs have been issued as banknotes.
Left: Exhibition of all the 44 euro banknote designs entered in 1996 at the European Central Bank in Frankfurt, September 2003 (photo by author).
Right: two of the seven designs made by Robert Oxenaar on behalf of the Nederlandsche Bank (1996). The theme of these designs is ‘European fairy tales’.
of view this can be explained by the cognitive dissonant theory; people feel more comfortable when they can feel positive about their own banknotes, including the most recent issue [8]. And people react positively to a picture they already know. Art galleries usually have no difficulty selling a work of art that is known from posters, for the buyer was already familiar with it before setting eyes on the real thing. And what is known will - in general - receive more appreciation. But was it the best piece of art available?

**Aesthetic advice**

Up to 1978, DNB used to seek aesthetic advice for each new design from a well-respected person in the world of Dutch design. In 1986, DNB asked their designer, Professor Oxenaar, to advise on the selection of a new designer for the guilder banknotes. From then on, aesthetic advice regarding new designs within the series was no longer felt to be required.

Also for the selection of the euro designs, aesthetic advice was obtained as said before. A jury drew up two shortlists of the five best design series for each theme, and subsequently, chose the designs in the category Abstract/modern (by Klaus Michel and Sanne Jünger) as the best entry.

**Individual in-depth interviews**

Banknotes are products that do not generate much public involvement; the public never grows excited when discussing banknotes, except perhaps when it comes to counterfeits or when a new design is issued. With such subjects, in-depth interviews are advisable, as they often provide a detailed insight into deeper conscious and subconscious individual processes. In-depth interviews are also the most suitable method if they include asking respondents to do a test based on individual decision-making, like a security check on a banknote or an opinion of a new banknote design. A one-to-one relation of respondent and interviewer will in such a case provide the most realistic output.

Another advantage of in-depth interviews is that they permit the use of a fairly large amount of stimulus material, e.g. up to around 15 different banknotes. People are very well able to react to a range of products, but, on the whole, are not very apt at responding to (orally presented) concepts.

**Offer designs or proofs for public testing**

Showing designs or proofs to the public is best done during in-depth interviews. The development stages might be shown to a representative group of about 12 - 15 people (man/woman, old/young, high-killed/low-skilled education), who are subjected to in-depth interviews involving various techniques.

The new proof could be shown as one in a range of other banknotes, e.g. the previous note and other recent notes issued, and perhaps some foreign notes. The interviewee should first be asked to take out the one he likes the most and explain why he thinks it so attractive. Subsequently, the interviewee is requested to replace the design on the table and take another one. This procedure must be repeated until the interviewee has singled out every design. After a break, the interviewee is invited to take another look at the banknote he chose as his favourite one, and asked if it is still the one he likes best. Some questions should also specifically relate to the new design. For each interviewee about 30 to 45 minutes should be reserved.

Again, such research methods should be applied with caution. It is better to approach the public with two or three complete proofs and study the interaction of the respondent with this note, while applying in-depth interviewing techniques. In-depth interview techniques are more suitable for this kind of situation than focus groups are, because in a focus group there is always someone who takes the lead. In the case of new designs, the other people might tend to follow this group opinion leader. It is better to ask the people on an individual basis. And it should be borne in mind that the results are qualitative and not quantitative, although conclusions such as ‘the majority find this-or-that’ are allowed.

**Focus groups**

Focus groups are usually deployed in order to generate ideas on a broad level, and are more common in the Anglo-Saxon world. They are essentially idea-generating vehicles. Focus groups are also preferred when a rough overview of opinions, beliefs and associations is required. In focus groups, however, the interaction stimulates respondents to keep giving new answers. A disadvantage is that a strong opinion leader in a focus group might influence the group discussion. Therefore, it is advisable to use the individual approach, especially when children and elderly persons are involved.

The limitations of any qualitative research must be kept in mind. Respondents are selected on a non-random basis and the results cannot be quantified or projected to any specific population or cohort or universe. The information obtained may be viewed as indicative of the prevailing attitudes but not to the extent that they may be considered representative of any defined population.
In 2003, DNB gained its first experience with focus groups related to banknotes. For one euro research project, it received feedback on different foil applications on banknotes through focus group meetings, besides in-depth interviews. One year later, in 2004, DNB organised two focus group meetings, one with consumers and one with retailers, to receive feedback on the counterfeit crisis then prevailing in the Netherlands.

Table 2 contrasts the most important differences between focus groups and in-depth interviews.

<table>
<thead>
<tr>
<th>Focus Group /Target Group</th>
<th>In-depth interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td>- more common in Anglo-Saxon world</td>
<td>- more common on the continent of Europe</td>
</tr>
<tr>
<td>- for strong opinions, high public involvement</td>
<td>- for low public involvement</td>
</tr>
<tr>
<td>- interaction between participants</td>
<td>- no interaction between participants</td>
</tr>
<tr>
<td>- no individual test possible</td>
<td>- test of individual, daily use</td>
</tr>
<tr>
<td>- opinion leader might influence others</td>
<td>- real opinion of one person</td>
</tr>
<tr>
<td>- idea generating</td>
<td>- not conducive to many new ideas</td>
</tr>
<tr>
<td>- less suitable for reaction to range of products</td>
<td>- reaction to range of products</td>
</tr>
</tbody>
</table>

Table 2.
Some differences between focus/target groups and in-depth interviews.

Conjoint analysis
Relatively new quantitative tools in marketing research are the conjoint analyses, first used around 1985. A prototype, e.g. a complete proof of a new banknote, can be researched, each time with two parameters being changed. For example, one version contains watermark design A, while in the second print watermark design B is used. Respondents will indicate their preferences and will be asked for their reasons. Respondents cannot effectively process more than about 6 attributes at a time, with nine levels each. The final outcome could be a matrix of 6 x 6, with, e.g., six different public features on the one axis, and, on the other axis, attributes like **clear - unclear, this I can check - this I cannot check, or beautiful - ugly**.

As far as known to the author, this type of consumer research has not yet been used for banknote design.

Opinion poll of general public
Searching for a method to gain feedback, in 1983 DNB decided to make use of a so-called *omnibus survey*, provided by NIPO, an established market research company in the Netherlands. This public opinion poll measures the public’s knowledge and appreciation of the latest banknote design, ensuring objective feedback that can be used as input for the next design.

The ECB commissioned an opinion poll on several aspects of the euro, including the euro banknotes. This poll was conducted twice: in 2004 and 2006 [18, 36]. As far as the euro banknotes concerns these polls confirmed DNB’s findings.

Opinion survey for visually handicapped
In 1986, DNB decided to commission a large-scale experiment to investigate the true effectiveness of the tactile marks for the blind on the NLG notes in circulation. It was found that about half of the blind could correctly describe the marks. Almost half of the participants declared that they never checked the marks in practical situations. Marks on new notes were effective. With used test notes, the marks were less effective. A dramatic increase in the identification score was achieved after the participants were trained to recognize the marks. At the end of the main experiment with each of the 40 participants, a list of questions was read to them. The same list of questions was also put to another 60 blind people, who did not participate in the experiment but who were polled by telephone [4, 5].

In 1995, the National Research Council published the study ‘Currency Features for the Visually Impaired People’, based on several worldwide interviews and studies [6]. The Bank of Canada conducted several studies on the features for the visually impaired (legible numerals) and the blind [e.g. 9]. See also Figure 7.
In 2005 DNB conducted for the ECB a study focussing on the colour blind. Around 8% of the male are colour blind and around 0.4% of the female. The way colour-blind people see a banknote can be made visible for the most common colour-blindness factor (red-green), as is done in Figure 12 [28, 33].

**Opinion surveys for cash handlers**
Both the Bank of Canada and the European Central Bank have conducted opinion surveys to explore the behaviour and interests of cash handlers like retailers. DNB never commissioned a separate cash handlers’ survey since the sample size of 2,000 people always included retailers or other people dealing with cash because for their profession.

In 2003 the Bank of Canada performed a telephone survey. The sample size was 2,076 respondents, divided over general public (818), bank tellers (232) and cash handlers (513) [11, 14]. The survey performed by the ECB covered 13 countries of the Euro area, and consisted of interviews with 250 cash handlers per country, working in 5 different sectors, 50 in each sector [23, 41].

One may question if cash handlers are really more knowledgeable as the general public. The DNB-polls for example concluded that the percentage of correct answers to the watermark-related questions as given by cashiers is not significantly higher compared to other respondents. Also for other banknote questions the cash handlers’ seem to be hardly more knowledgeable as the general public.

**Measuring emotions**
In addition to the regular telephone survey, in 2005 DNB conducted an additional survey - for the first time - to measure the emotive opinion of the euro banknote designs. To do so, DNB employed a new instrument developed by TNS NIPO, called PrEmo (Product Emotion measurement instrument). PrEmo is a non-verbal, dynamic instrument measuring emotions evoked by designs of products, packages, advertisements, etcetera. The emotions are not measured in a verbally cognitive way, but by means of a set of animations. A drawn character represents a specific emotion by its motions and sounds.
If future euro banknotes should have a higher emotional appeal, desire, boredom and contempt are the aspects most in need of improvement. To achieve this goal, TNS NIPO recommended alterations be made to the design to minimise boredom. ‘Appealing colours and pictures can make the euro banknotes more attractive and less dull. Also the size of the notes may want to be changed. The euro banknotes’ appearance should be changed at some (of these) points to evoke more and more positive emotions’ [29, 33].

Feedback from media
After the issue of a new note, its design can no longer be changed. Today, attention is more focussed on the complete note than it used to be, especially compared to the predecessor of the new design. Is the new design better? Is the design appreciated? Which design and text elements are recalled? Which security features can consumers name? The most effective way to find answers to these questions is an opinion poll. Detailed feedback on the design is of little use. Besides conducting an opinion poll, the central bank may collect all comments made in the media, as is DNB’s policy. It is useful to monitor the feedback on the banknote designs for test notes, promotion notes or other purposes, e.g. ‘regional money’. A recent example of this type of feedback is the selection of two banknotes by banknote collectors (Figure 13). It is remarkable how often collectors have a preference for animals on banknotes.

![Figure 13. Two banknotes selected by collectors. Left: Note of the year 2007 selected by the readers of ‘Münzen & Sammeln’ (Faeroe Islands, 200 Kronen 2003) [45]. Right: Note of the year 2007 selected by the International Banknote Society (Comoros, 1000 francs 2005, designed by Roger Pfund) [42].](image)

Switch mode research (combination of ‘spontaneous answers’ and written answers)
A survey may also combine questions asking for spontaneous answers (‘by heart’) and written answers. TNS NIPO calls this switch mode research. With this method, which is used for willing respondents (from a special database), respondents first answer the ‘spontaneous answer’ questions by phone and, subsequently, the other ones in writing, using the internet. This would make it possible to invite people’s reaction to images of banknotes. As far as known to the author, this type of research has not been done yet for banknote design.

2.3 Target groups
Market research usually starts with an analysis of the target group or stakeholders. Before deciding on the test method to be used, it is important for the central bank to identify the test groups.

Banknote customer and user groups identified by ECB
The European Central Bank has published several reports on its stock-taking of customer requirements: ‘The focus is on the different kinds of customers and users: the general public (including the visually impaired), cashiers, vending machines, banknote processing machines, cash handlers, law enforcement authorities and the note-issuing authority itself. Each category has different needs in terms of convenience, authentication, efficiency, resilience and cost, and these needs also differ for low, medium and high denomination banknotes’ [19, 36, 39].
Target groups
A detailed overview of the banknote stakeholders is given in ‘Public feed back for better banknote design’ [33]. The most important groups are:
- the general public (man in the street),
- consumer associations,
- visually impaired (colour-blind, poor-sighted, blind),
- associations representing vulnerable groups (persons experiencing economical or social hardship, senior citizens, persons suffering from a physical, sensory or mental handicap),
- retailers (supermarkets, small shops, restaurants/bars, detail non-food, petrol stations and fashion/shoes),
- professional cash handlers (commercial banks, casinos, cash-in-transit companies, …),
- tourism and travel industry (including international airlines and airports),
- equipment manufacturers (cash processing equipment, …),
- detectors (staff operating at commercial cash centres),
- detectors (staff operating at central bank sorting machines),
- counterfeitters (crooks armed with copiers, scanners etcetera),
- police forces (at the national level and Europol and Interpol),
- experts (forensic, specialists),
- …

<table>
<thead>
<tr>
<th>TYPE OF CUSTOMER RESEARCH</th>
<th>Research time incl. report</th>
<th>Cost indication in EUR</th>
<th>Effort central bank</th>
<th>By central bank</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Periodic poll, every 1, 2, 3 or n years</td>
<td>3 months</td>
<td>25,000</td>
<td>Low</td>
<td>Netherlands (1983 - 2007), Europe/ECB (Wave measurements 2000 - 2002, Cash Handlers 2004 - 2007), Canada (Retail surveys 2006, 2007), …</td>
</tr>
<tr>
<td>3. Focus group</td>
<td>1 month</td>
<td>10,000</td>
<td>Low</td>
<td>Canada (2003), USA (2002), Europe/ECB (2006, 2007), …</td>
</tr>
<tr>
<td>4. In-depth interview</td>
<td>1 month</td>
<td>20,000</td>
<td>Medium</td>
<td>Netherlands (2003), Europe/ECB (2006, 2007), …</td>
</tr>
<tr>
<td>5. Observing with camera (handling new design)</td>
<td>1 month</td>
<td>15,000</td>
<td>Medium</td>
<td>…</td>
</tr>
<tr>
<td>6. Eye movement registration</td>
<td>1 month</td>
<td>15,000</td>
<td>Medium</td>
<td>England (2005), …</td>
</tr>
<tr>
<td>7. Pupil width</td>
<td>…</td>
<td>…</td>
<td>Medium</td>
<td>…</td>
</tr>
<tr>
<td>8. Brain activity (MRI)</td>
<td>…</td>
<td>…</td>
<td>…</td>
<td>…</td>
</tr>
<tr>
<td>9. …</td>
<td>…</td>
<td>…</td>
<td>…</td>
<td>…</td>
</tr>
</tbody>
</table>

Table 4.
Overview of ‘menu consumer feedback’. Often, a central bank does not publish any information on its customer research other than by way of a power point presentation for a limited audience.

1) For 1,500 respondents, around 25 questions. By telephone.
2) For 1,500 respondents, around 25 questions. By telephone.
3) For 12 respondents, 2 hours.
4) For 15 respondents, 1 hour per person, 15 samples.
5) For 5 respondents, 30 minutes per person.
6) For 3 respondents 20 minutes per person.
Relationships between test groups and stakeholders
Make sure that the test groups represent the stakeholders. Central banks may outsource such testing to an established consumer research/test organisation, or a retail organisation, in the case of retailers. In the case of the visually impaired, the national organisation of the visually impaired should be consulted. It is also advisable to inform police officials and find out their opinion.

ISO 9001: What do the customers think of the new design?
Testing during the different banknote development phases is also in line with ISO 9001: verify if your customers are satisfied. They could be offered one single proof print, or several ones. During the design phase, three variants of the same banknote design could be developed, e.g., with different sets of security features (packages A, B and C) and/or with different design options (e.g. packages A1, A2 and A3, B1, B2, C1 and C2). Public testing will make clear which option is the favourite [43].

2.4 Menu of customer research for banknote design
In 2007, the Bank of Korea approached DNB for information on consumer tests during the design phase of a new high Won banknote denomination. Within the scope of this request, Table 4 was made: an overview of different types of consumer research suitable for banknote design.

3. Opinion polls
In 1983, DNB started to conduct opinion polls. In those days interviewers, went out on the streets, pressing doorbells of randomly selected addresses. In 2001, NIPO decided that time had come to abolish this face-to-face approach, as families had become smaller and homes were more and more often found unattended. From then on, it was telephones that rang, instead of doorbells!

Hard to find willing respondents (by telephone): one contact out of six trials
Today telephone interviews are harder to realise than before. Especially, the young male group is the most difficult to get on the phone. It takes six trials on average before a willing respondent is found. Another reported development is that more and more young people have mobile phones, whose numbers are not in the database of TNS NIPO. As a consequence, the weighting of the young male group was increased in the 2007 survey. To overcome these trends, it is possible to move to another research method, using a database. TNS NIPO has created a large selected group of respondents willing to answer questions by phone.

Sample size
Back in 1983, DNB started with a sample size of 2,000 respondents. When the findings proved to be in the same range over the years, the sample size was decreased in 2005 to 1,500 respondents. This number might be further reduced to 1,000. For an observed percentage of e.g. 50%, the accuracy would drop from +/- 2.5% to +/- 3.1%, meaning that if 50% of the polled population of 1,000 persons answered yes, the accuracy for the entire population would range between 46.9% and 53.1% (with a reliability of 95%).

In the future, the sample size might be even further reduced to 500 or 300 respondents. Marketing people often use even fewer respondents: ‘Ask just 3 persons and you will find 75% of the product defects. Ask 9 persons and it is already close to 100%!’. 

Single or periodic surveys?
One of the most common criticisms on the opinion polls is: You may conclude anything from a survey. This may be true for one single survey, but not for repetitive, periodic polls. The level of a measurement might be too low or too high, but successive polls will clearly indicate trends. Furthermore, it has been proven that DNB’s surveys are qualitatively equal to other (single) surveys.

Time series, longitudinal research
Studies in time are time series or longitudinal studies. Telephone companies and railroad companies, but also political parties, measure their customer satisfaction using this type of study. Consumer confidence, interest rates and unemployment rates are well-known economic time series. While at first sight, time studies of happiness may seem less serious, they are named here because the following quote equally applies to measuring banknote design appreciation worldwide. One of the world’s foremost happiness experts, Professor Ruut Veenhoven: ‘For decades there were all sorts of theories, but we need to conduct proper scientific research to see if the
<table>
<thead>
<tr>
<th>Happiness</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>8.2</td>
</tr>
<tr>
<td>Switzerland</td>
<td>8.1</td>
</tr>
<tr>
<td>Austria</td>
<td>8.0</td>
</tr>
<tr>
<td>Iceland</td>
<td>7.8</td>
</tr>
<tr>
<td>Finland</td>
<td>7.7</td>
</tr>
<tr>
<td>Netherlands</td>
<td>7.5</td>
</tr>
<tr>
<td>Tanzania</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Table 5.
Overview of comparable average happiness scores, on a scale of 0 to 10, in some countries (1995 - 2005).
Source: R. Veenhoven. World Database of Happiness, Trend in Nations. Erasmus University Rotterdam, Available at: www.worlddatabaseofhappiness.eur.nl/trendnat (+ year)

The happiness score is based on a mark that people give themselves, on a scale of 1 to 10. The happiness level of the Dutch has remained the same for the past ten years, i.e. a steady 7.5 out of 10. The Danes on the other hand, have become happier over the past decade, with their score rising to 8.2. See Table 5.

Information known by heart
One important aspect of opinion polls is the way people are approached. Are they asked to react to a product held in front of them or to draw on their memory? The method used by DNB asks people to do the latter. As in doing so, it measures the public's real basic knowledge, the poll proceeds from a worst case situation.

Latent knowledge: repeated questions
Apparently, as it is not required for daily life, banknote knowledge seems to be stored in the back of people’s minds. In other words, knowledge of e.g. security features of banknotes is latent. That is why it is advisable to repeat questions and encourage the interviewee by asking Do you know any more? Repetitive questions yield more answers than non-repetitive ones. The more time respondents take to reflect on a question, the more knowledge they come up with on banknotes. In comparing surveys, it should be borne in mind that the questions used are often not alike. In the DNB public poll the basic question reads Which security features in a banknote do you know?

Point out
As is known, people have difficulty putting security features of the banknotes into words. This is why respondents could be asked to mark the features they know with a pen in a black-and-white copy of the relevant banknote. Pointing out stimulates the memory. On being shown the note in question, people are able to recall significantly more security features than when asked repetitive questions. Instead of responding by heart, respondents might be helped if shown e.g. a black-and-white picture of the banknote in question. This is done in the so-called cash handlers’ surveys of the ECB [23, 41].

Opinion polls measure a combined effect from banknote + media
Using an opinion survey, not only the banknote is measured, but also all other pertinent information and sentiments (see Figure 13). When the euro was introduced in 2002 and the exchange rate to the dollar dropped, people tended to feel negative about the euro. This sentiment was reflected in the rather negative appreciation of the euro banknote designs, which were quite new at the time. An other example is the incidental media attention for counterfeits, usually when the number of counterfeits has been found to rise (a decrease does not receive much media attention). Such a situation may of course affect the public’s confidence in the banknotes.

Central banks may be interested in the effectiveness of their communication efforts. What is the impact of the adverts? Did the public see the flyer? Did they read it? Did retailers use the DVD? Do people recall the slogan? What do police officials know? What is the opinion about the style of the campaign?
The Dutch opinion polls are designed to measure response to (new) banknotes and the effectiveness of any media tools used for the introduction of new banknotes. The banknote and media tools are regarded as a black box and the total effect of the banknote is measured as shown in Figure 14.

**Figure 14.**
The public gathers banknote-related information both from banknotes and through media tools. Market research can focus on banknotes, on the media tools, or on both.

**Public information increases knowledge**
In the period 1983 - 2007, the public’s knowledge of NLG-notes’ security features increased by about 84%, from 1.03 features in 1983 to 1.9 in 2007! Although the individual effects of the various media tools listed in Figure 14 was not measured, there is some evidence that these media tools helped increase public knowledge. In February 2002, DNB organised an additional poll in view of the introduction of the euro. As expected after the massive Euro 2002 Introduction Campaign (80 million euro) and the extensive national campaign conducted in the Netherlands, public knowledge of security features in the Netherlands turned out to have increased from an average of 1.7 for the NLG notes in 1999 to 2.3 for the new euro notes. This increase was predicted in 2001 [8].

There is also proof that the DNB information at the time of the guilder notes increased the public knowledge. In 1987, the effects were measured of the first large-scale edition of leaflets accompanying the launch of a new banknote, i.e. the NLG 250/Lighthouse, and of a 35-minute television programme about the NLG-notes. It was found that respondents who had read the leaflet and watched the programme could name an average of 0.5 security features more than those who had not. It was also found that 7.5% stated that they had read the leaflet on the NLG 250 note.

**Maintain the information flow**
Of course, information about banknotes should be a continuous activity for a central bank, and not be confined to the period right after the launch of a new banknote. The information campaign may be adjusted on the basis of feedback obtained through subsequent polls. Lesser-known features might be given extra attention. Bearing in mind that it takes a long time for the public to learn new security features, central banks should be careful about altering or leaving out features to which the public has grown accustomed.

**Large group that does not know any feature**
The average number of security features spontaneously produced by the Dutch public appears to be 1.9 in 2007. To increase this average, communication should focus first of all on the 15 - 20% (see Figure 15) of citizens unable to tell one single security feature. In general, these people are found among elderly citizens, citizens in the lower social classes, the less-educated, women, and people who do not deal with money (‘non-retailers’) on a daily basis.
Also in other countries there is a large group of people not able to tell any security feature. The National Bank of Romania reported in 2006 that 24\% have no idea of any security feature\[34\]. Within the euro area around 30\% of the population can not recall one single security feature; in some euro zone countries even more than 50\% of the population\[18, 37\]. A similar figure was found in 2003 by the Bank of Canada: 37\% of the general public was not aware of any security feature on the new CAD 5 or 10 note (unaided); for the old notes (20 and 50 dollar) it was even higher: 43\%\[11\].

Declining incidence of wrong and partly wrong answers

Around 15\% to 20\% of the Dutch cannot name one single security feature by heart, while many of those able to produce an answer are mistaken. Over the years, the gap between the categories correct and including wrong answers has clearly narrowed (Figure 1), owing to the decrease in partially wrong answers regarding blind marks, banknote numbers and type of paper over the years 1983 - 2007.

3.1 Single opinion poll

One or more measurements?

Central banks often focus on the effect of the media tools used, forgetting about the banknote itself. This is the reason why usually only one measurement is performed, i.e. shortly after the issuance of a new banknote. These single measurements are more useful if reference material is available like data from previous surveys (zero measurement), or if the results may be compared with the survey results of another central bank. A single measurement may yield misleading results. Anything may be proven with just one survey.

3.2 Periodic opinion polls

The 2-year periodic research is important to DNB, because of the valuable information it provides on changing views. Both the methodology and the questions remain unchanged so as to facilitate comparing findings and ensure maximum reliability of the trends perceived. As the questionnaires are identical in set-up, the guilder-related findings and the euro-related findings can be compared as well. One of these findings was that the appreciation of the euro notes was lower than for the guilder notes.

The European Commission periodically polls the European public on a wide variety of subjects, including the euro, every six months publishing the findings as Eurobarometer. There are also dedicated, so-termed Flash Eurobarometer surveys, e.g. 'The Euro, 3 Years Later', characterized by an open and transparent reporting style.

Research frequency

The NLG-banknotes were developed, originated and issued one by one. As, basically, once every two years a new model was issued, a series of 6 denominations was renewed once every 12-15 years. This permitted new techniques to be implemented quickly while ensuring feedback on issued notes. For this reason, the research frequency was fixed at once every two years.

Figure 15.

Overview of Dutch respondents (in\%) not able to recall one single security feature over the years 1983 - 2007.
Adding specific questions
Specific questions can be added to follow the standardised questions about knowledge and appreciation. This will not affect the comparability of the final results (see Figure 16). Over the years DNB added specific questions (see the Appendix for some examples).

![Figure 16.](image)
The standard, basic questions should be asked first. Specific, non-periodic questions are optional, and should be asked after the basic set of questions.

Other central banks conducting periodic public surveys
Bank of Canada and the European Central Bank are two central banks conducting periodic surveys (See the recent ECB study ‘Survey among cash handlers in the euro area’ [41].

Canada: public confidence score
The Bank of Canada reports the ‘public confidence score’ on their website. This score is the aggregated result of the responses to four ‘attitudinal’ questions. Each year, around 2,000 people are interviewed by telephone.

3.3 Time series coming from periodic opinion polls
Apart from feedback that is crucial for the design of future banknotes, the opinion polls provide the central bank with time series on customer satisfaction. Today, DNB is able to offer the following 4 time series:

1. The public’s knowledge of security features
Most important for DNB is the knowledge of the public security features as shown in Figure 1. This figure shows the right trend.
Since 1983, DNB has measured the public’s knowledge of security features. As said before, this knowledge increased from an average of 1.03 in 1983 to 1.9 in 2007 (see Figure 1). There seems to be room for further improvement. People in the 18-35 age bracket can memorize on average 2.8 features (2005), and those aged 55-plus, 1.5. Knowledge of security features also seems to be correlated with gender and wealth. Men can name more security features than women (2.4 against 2.0).

People in the highest social class are able to mention 2.6 features on average, while those in the lowest social class do not know more than 1.3 on average. If banknote design and public information were further optimized, the awareness target could be set at an average public knowledge of 3 security features.
In 2005, research by the European Commission’s Anti-Fraud Office (OLAF) reported an average knowledge of 1.3 security features, concluding that there was a ‘lack of knowledge about banknote security features aimed at the general public’. No link was found between knowledge of a security feature and the ability to identify genuine banknotes [22].

2. Confidence in euro notes
In 2005, DNB started measuring the perceived security (Figure 17). Confidence in the euro banknotes increased from 6.8 in 2005 to 7.1 in 2007. It seems that confidence in euro notes correlates with the number of counterfeits, since the average knowledge of security features dropped by 0.3 and confidence in the euro notes increased by 0.3.
Figure 17.
Confidence in euro banknotes in the Netherlands and Canada. In 2007, confidence went up in the Netherlands, while the number of counterfeits declined (scale 1 to 10). For Canada the figures are put on a 10-point scale instead of a 100-point scale.

The second perceived security question is a report mark for the protection of the euro banknotes against counterfeits. This report mark rose from 6.5 to 6.9 in 2007.

In 2004, both the Bank of Canada and the ECB started researching the confidence in euro banknotes. The Canadian scores in 2004, 2005, and 2006 were 55.7, 53.1 and 54.0, respectively, on a 100-point scale. This caused the Bank of Canada to conclude that confidence in Canadian banknotes is close to neutral, between ‘somewhat’ and ‘not very’ confident [31].

The ECB question is: ‘Do you think that the euro banknotes are sufficiently secure against counterfeiting?’ In 2004, 30% the cash handlers’ answered this question with a yes. In 2007, the euro notes were judged as more secure (51% think that they are absolutely or quite secure) [23, 41].

3. Appreciation of euro banknotes
While the Dutch appreciation of euro banknotes has gone up somewhat (see Figure 18), it seems to be stabilising at around ‘70% beautiful’ for the complete series. The 5 euro note performs the worst, with 56% of the Dutch finding it ugly, against 55% in 2005.

Figure 18.
Appreciation (beautiful in %) of the euro banknotes - complete series - in the Netherlands. Dichotomic method. Stabilising to around 70% beautiful?

4. Quality of euro notes in circulation
The circulation quality of euro banknotes in the Netherlands was stable over the years 2003 - 2007 (Figure 19). According to the dichotomic method, almost 9 out of 10 respondents (86%) regard the banknotes on the whole as
Neatness in % of 5 and 50 euro notes and of the full series over the years 2003 - 2007, as measured by DNB using the dichotomic method.

The 50 euro note is considered clean by significantly more respondents (93%) than the 5 euro note (61%). In 2007, the opinion of the cleanliness stabilized compared to 2005.

The ECB has also measured the neatness of the euro notes in circulation twice [18, 37]. Since the question and the mathematical methods are not the same, the answers are not comparable in quantitative terms. Qualitatively, the outcome is the same for the DNB and ECB methods. The answers suggest that the fitness level of sorted euro banknotes is set too high; the European public would probably accept euro notes that are less neat.

4. Conclusions and Recommendations coming from opinion polls

4.1 Conclusions

4.1.1 Central banks have a knowledge gap concerning the public’s awareness of banknotes. The only way to collect significant insights on the effectiveness of banknote designs and the public security features is to invest in market research and especially in consumer research.

4.1.2 Central banks should publish more - and preferably in the public domain - about their customer research.

4.1.3 All opinion polls on banknotes reported on point in the same direction. Major contradictions are not found.

4.1.4 Central banks should do more efforts to understand the basic principles of banknote design from a public or customer point of view and should leave their - still - patriarchal attitude towards banknote design behind them. The way to go is phrased by ‘from design by committee’ to ‘design based on public input’.

4.1.4 Periodic polls are preferred over single polls, since the results of such surveys are indicative of a trend.

4.1.5 Such periodic polls will provide time series demonstrating that the central bank respects its customers and is interested in their opinions. It also makes this part of the central bank’s work transparent to the public.

4.1.6 After 2 or 3 periodic polls - delivering similar findings - the sample size may be reduced.

4.1.7 Internet voting on images for new banknote designs - or parts of it - is a new option to collect public input.

4.1.8 The public is not able to recall more than 4 security features.

4.1.9 …
4.2 Recommendations

General

4.2.1 An attractive design is achievable when there is first a communication strategy developed. Base this strategy on the outcome of opinion polls. People seem to like a mix of the following design philosophy items, reflecting human existence:
- people and animals
- some happiness
- a little smile
- a little provoking
- …

4.2.2 Communicate 3 public security features. In the note 6 public features could be designed: 3 active and 3 sleeping. The sleeping features are awaked in case of failing of one or more of the active features.

4.2.3 Tilt features are not popular. Especially colour changing inks like OVI and iridescent.

4.2.4 Features on the reverse of a banknote are not recalled.

4.2.5 Information campaigns will increase the number of correct features recalled, but will not decrease the given wrong features.

4.2.6 Information campaigns should focus especially on the 20 % group unable to mention any feature.

4.2.7 Portraits on banknotes are unknown to the people.

4.2.8 …

For the euro banknotes

4.2.9 Attractive new euro designs could be achieved by first analysing the present series (strength/weakness analyses). And secondly, ask the European public what they want:
- Upgrade policy like e.g. with US-dollar,
- Completely new series design, which is more the European culture.

And third: ask the public about theme preferences for the new series.

4.2.10 Introduce life in the euro banknote designs (people, animals).

4.2.11 If upgrades are made, simplify and reduce the themes of the euro designs. Use only the bridge theme on the front; delete the gate/windows theme. Strengthen the Ages & Styles themes like e.g. Renaissance. Delete the map of Europe.

4.2.12 Introduce additional colour in euro 5 (next to grey). Make euro 50 less brown. In general use brighter colours (by creating more solid areas).

4.2.13 The fitness level of the euro notes is set too high. From a public point of view less neat euro notes may be found in circulation.

4.2.14 …

Acknowledgements

I would like to thank Mr. Fred Collens (DNB) for editing the English text and my colleagues from the Cash Policy Department (DNB) for their suggestions.
ANNEX

Results of opinion polls on new banknote designs

This annex sets out the implications for new banknote designs, as based on the results of the opinion polls conducted by DNB and others on banknotes. Time series like knowledge of security features are not part of this Annex. We start with an overview of the awareness of the denominations.

1. Awareness of denominations

Table 1 provides an overview of the spontaneous awareness of the NLG and euro denominations.

<table>
<thead>
<tr>
<th>Denomination</th>
<th>Year of measurement</th>
<th>Spontaneous awareness in NL</th>
</tr>
</thead>
<tbody>
<tr>
<td>EUR 5</td>
<td>2007</td>
<td>92</td>
</tr>
<tr>
<td>NLG 10</td>
<td>1999</td>
<td>97</td>
</tr>
<tr>
<td>EUR 10</td>
<td>2007</td>
<td>97</td>
</tr>
<tr>
<td>NLG 25</td>
<td>1999</td>
<td>98</td>
</tr>
<tr>
<td>EUR 20</td>
<td>2007</td>
<td>95</td>
</tr>
<tr>
<td>NLG 50</td>
<td>1999</td>
<td>87</td>
</tr>
<tr>
<td>EUR 50</td>
<td>2007</td>
<td>95</td>
</tr>
<tr>
<td>NLG 100</td>
<td>1999</td>
<td>96</td>
</tr>
<tr>
<td>EUR 100</td>
<td>2007</td>
<td>89</td>
</tr>
<tr>
<td>NLG 250</td>
<td>1999</td>
<td>93</td>
</tr>
<tr>
<td>EUR 200</td>
<td>2007</td>
<td>57</td>
</tr>
<tr>
<td>NLG -</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>EUR 500</td>
<td>2007</td>
<td>61</td>
</tr>
<tr>
<td>NLG 1,000</td>
<td>1999</td>
<td>95</td>
</tr>
</tbody>
</table>

Table 1. Overview of the spontaneous awareness of the denominations of the guilder notes (NLG) in 1999 and the euro notes in 2007 (in %). The denominations are clustered, e.g. EUR 5 and NLG 10, because for the Dutch a euro denomination equals about twice the value of a guilder note (the conversion rate for the guilder was 1 EUR = 2.2031 NLG).

Predominance of denominations 1, 10, 100, 1,000

Banknotes with face values starting with 2, like the 20 and 200, are often less popular than banknotes with face values starting with 1, like 10, 100 or 1,000. Table 5 supports this statement. The popularity of the 5, 50 and 500 euro notes values seems to be somewhere between these two. In 2007, as many as 7% of the Dutch believed there is a 1,000 euro banknote!

A survey of the ECB prior to the launch of the euro also led to the conclusion that denominations starting with the figure 2 were the least known banknote values (the 2-cent and 2 euro coins and the euro 200 banknote). The 10-cent coin and the euro 10, 50 and 100 banknotes were known the best.

Already 80 years in circulation, but still one of the least popular notes is the USD 2 (Figure 1).
For art directors the most popular denomination is the 100 euro. This note is often used to express money or value. This is remarkable, because the general public hardly use this denomination. As a result, the Dutch people know the euro 100 banknote better from advertisements than from their daily payments. Professor Franses even said that the 100 euro denomination could be done away with: ‘it is not a bad thing if little use is made of the euro 100 notes, because this shows that this denomination is less needed for efficient payments than the fifty or twenty euro notes.’ [40].

Figure 2.
Four examples of the use of the 100 euro banknote to express value (The Netherlands, 2007).
2. Positive correlation between appreciation and knowledge

The surveys conducted by the DNB have shown that:
- there is a positive correlation between the appreciation of a banknote (beautiful or ugly) and the knowledge of its security features, its picture and text elements;
- the more people like a banknote, the more they know about it, including its security features.

The more attractive banknotes are, the greater the knowledge of their security features.

3. Colour best known

Euro banknote colours are the features best recalled (Table 2). This was also the case with the last NLG Abstract series, which directly evoked associations with the main colour rather than the main image [29, 33].

<table>
<thead>
<tr>
<th>Picture elements euro 5 recalled by the public by heart</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Grey, grey shades</td>
<td>37 %</td>
</tr>
<tr>
<td>2. Other colours</td>
<td>26 %</td>
</tr>
<tr>
<td>3. Blue, blue shades</td>
<td>15 %</td>
</tr>
<tr>
<td>4. (part of) building/historical building</td>
<td>7 %</td>
</tr>
<tr>
<td>5. Green shades</td>
<td>8 %</td>
</tr>
<tr>
<td>6. Bridge</td>
<td>6 %</td>
</tr>
<tr>
<td>7. Gate or door</td>
<td>4 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Picture elements euro 50 recalled by the public by heart</th>
<th>2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Orange, orange shades</td>
<td>39 %</td>
</tr>
<tr>
<td>2. Other colours</td>
<td>31 %</td>
</tr>
<tr>
<td>3. Brown, brown shades</td>
<td>29 %</td>
</tr>
<tr>
<td>4. Hologram/foil</td>
<td>9 %</td>
</tr>
<tr>
<td>5. (part of) building/historical building</td>
<td>9 %</td>
</tr>
<tr>
<td>6. Bridge</td>
<td>5 %</td>
</tr>
<tr>
<td>7. Gate or door</td>
<td>5 %</td>
</tr>
</tbody>
</table>

Table 2.
Overview of euro 5 and 50 banknote pictures named the most (not covered by 2007 poll).

The front should be more colourful than the back

Apparently, a banknote's front should be more colourful than its back, judging by the fact that the NLG 100/Snipe's reverse side was often displayed as the front, e.g. at exhibitions or in publications. The reason for this error is probably the Snipe’s back, which, unlike the reverse sides of other banknotes, is more colourful than its front.

Public dislikes pale colours

Market research conducted in 1996 to test the public’s response to 10 designs selected for the euro banknote design contest showed that a banknote’s colour is the element the public respond to first when judging a banknote design. In response to the question 'What is attractive at very first sight?' people answered: the colours. In the majority of cases, designs were thought unattractive for being too pale. Other experiences, too, indicate that colour is among the picture elements recalled the best. Often, notes that have been out of circulation for many years are first of all remembered by their colour: 'Oh, that old grey, 2.50 guilder note!' (see Figure 2).

Figure 2.
Left: Old Dutch banknote of 2.5 guilders, issued by the Ministry of Finance in 1949. No colours yet!
Right: Monopoly Money: optimised for quick value recognition, using bright monochrome colours.
The comparative paleness of the first series of euro banknotes was certainly noticed by the Dutch, who had grown accustomed to brightly coloured notes. In a similar vein, a survey conducted in Canada showed that the most noticeable change to the design of the new Canadian Journey series had been the use of brighter colours (34 %) [15].

Monopoly money
Monopoly money is optimised for quick value recognition during the game, using bright monochrome colours and large numerals. Of course, real banknotes should also be secure.

Nicknames are often based on colour
Nicknames for Dutch banknotes quite often refer to a colour, like geeltje (little yellow one) for the 25 guilder note or rode rug (red back) for the 1,000 guilder note. The best-known nickname for a banknote is green back, because of the lack of colour on the front of the US dollars (see Figure 3).

Discrimination of denominations by colour
The colour scheme of the euro series makes discriminating between the denominations easy (see Figure 2). This proposal by DNB was also based on the feedback DNB obtained through its opinion polls.

Figure 3.
Left: colour scheme of the euro (1996).

In an opinion poll organised by the Central Bank of Venezuela in 2003, some denominations were criticised for their colours. In the opinion of those consulted, the colours of some denominations should be changed. Among the reasons given was that owing to the similarity of the colours used on the Bolivar 2,000 and 20,000 notes, these denominations were easily confused (45.8%) [12]. In the new series, developed within the scope of a currency redenomination process (introduction of the Bolivar Fuerte in 2008), the colours of the series have improved.

4. No more than 4 text elements, picture elements and security features

One of the most important survey findings is the fact that the general public cannot memorise more than 4 text elements, 4 picture elements or 4 security features. Four seems to be the maximum. Most people are able to recall about 2 text elements and about 2 picture elements. On the basis of this finding, DNB decided in 1985 to limit the number of the public security features in a banknote to 4. For Euro Series 2, the target has been set at 6
[43]. This also implies that the communicative and narrative elements on a banknote should be simple (but well designed!).

5. Knowledge of security features

The banknote feature best recalled in the Netherlands is the watermark, followed by the hologram/silver foil and security thread. The findings are quite stable over a number of years, and comparable to other researches (ECB, Olaf) [22, 33].

While the NLG notes did not feature security threads, the Dutch - 31% in 2002 - named this element after the massive euro introduction campaign in 2001. However, awareness of this feature fell to around 13% after one year already.

Table 3 provides an overview of the security features known by the general public. Special inks like OVI should be used with moderation, if at all.

<table>
<thead>
<tr>
<th>Euro banknote security features</th>
<th>DNB</th>
<th>DNB</th>
<th>DNB</th>
<th>DNB</th>
</tr>
</thead>
<tbody>
<tr>
<td>(only NL)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Type of research</td>
<td>Periodic</td>
<td>Periodic</td>
<td>Periodic</td>
<td>Periodic</td>
</tr>
<tr>
<td>Research done by</td>
<td>TNS NIPO</td>
<td>TNS NIPO</td>
<td>TNS NIPO</td>
<td>TNS NIPO</td>
</tr>
<tr>
<td>Number of respondents</td>
<td>2,002</td>
<td>2,015</td>
<td>1,501</td>
<td>1,506</td>
</tr>
<tr>
<td>Method</td>
<td>recalled by heart</td>
<td>recalled by heart</td>
<td>recalled by heart</td>
<td>recalled by heart</td>
</tr>
<tr>
<td>Watermark</td>
<td>70</td>
<td>65</td>
<td>68</td>
<td>65</td>
</tr>
<tr>
<td>Hologram/silver foil</td>
<td>61</td>
<td>52</td>
<td>49</td>
<td>43</td>
</tr>
<tr>
<td>Security thread</td>
<td>31</td>
<td>13</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>Special ink: glossy stripe (iridescent gold)</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Special ink: colour changing ink (OVI)</td>
<td>5</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>See-through register</td>
<td>7</td>
<td>5</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Raised ink, relief</td>
<td>7</td>
<td>5</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>Micro text</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Type of paper</td>
<td>7</td>
<td>8</td>
<td>10</td>
<td>7</td>
</tr>
<tr>
<td>Ultraviolet (UV) total</td>
<td>11</td>
<td>16</td>
<td>23</td>
<td>18</td>
</tr>
<tr>
<td>- dull paper</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>- fluorescent fibres (red, blue, green)</td>
<td>5</td>
<td>9</td>
<td>12</td>
<td>7</td>
</tr>
<tr>
<td>- ink brightens up (front, e.g. flag, sign.)</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>- ink brightens up (rev. e.g. bridge, map)</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>- no specification, hold under uv light</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>Infrared (IR)</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>3</td>
</tr>
<tr>
<td>Don’t know any security feature</td>
<td>11</td>
<td>18</td>
<td>15</td>
<td>19</td>
</tr>
<tr>
<td>Average knowledge of security features</td>
<td>2.3</td>
<td>2.0</td>
<td>2.2</td>
<td>1.9</td>
</tr>
</tbody>
</table>

Table 3.
Knowledge of the security features of euro banknotes in the Netherlands in the period 2002 - 2007 (in %, except ‘Average knowledge of security features’).

6. Main theme best recalled picture element

From the ‘House - tree - animal’ series, colour was not the most recalled design element, but ranked second directly after the element named first by most respondents, i.e. the chief mages: Snipe, Sunflower, Lighthouse (Figure 4). This series was the most popular one ever to be issued by DNB. People could quite easily recall the main image, which was chosen from different main themes, one for each model. This seems to account for the poor recollection of the main images of the euro; they are variants on one theme: buildings. However, also the quality of the design itself will be of influence.

When the images within a series are not enough distinguishing from each other people will recall the colour of note first (and not the main image).

7. Portrait not known (NLG 10)

A survey conducted in Austria in 1987 showed that 25% of the respondents stated they recognised the face value of a banknote by the portrait featured on it [3]. Inspired by this outcome, a similar question was added to the 1995 poll about the portrait of Frans Hals on the NLG 10 note issued in 1968. The name Frans Hals was printed quite clearly on the note (see Figure 5). After 27 years (!) of using this low denomination, the Dutch public was asked to name the person depicted on this note. Only 14 managed to come up with the right answer; more than half (53) did not know, and 9% gave an incorrect answer. The remaining 24 gave answers that were only partly right: historical person (16), painter (7) or man (1).

8. Theme of the watermarks: not known

Each DNB poll contains two questions on the watermarks in the euro series; one concerns the euro 5 and the other the euro 50 banknote (see Figure 6). The vast majority of the interviewees prove unable to recall these watermarks: 94% is not aware of the watermark subject in the euro 5, and 93% cannot tell the subject in the euro 50 (2007). Those that come up with an answer, often say ‘an old building’. For both banknote models (around 1%). A wide variety of words is used to describe the watermark: a Greek building.
Figure 6.
Watermarks in euro 5 and euro 50 notes: Classical gate and Renaissance window. These themes are not known by the Dutch. Best answers are 'gate or door’ scoring 1 % for the euro 5 and 3 % for the euro 50 (2007).

porch, window, doors, church, chapel, balcony, niche, alcove, gate, and altar. The correct style period is seldom mentioned; people are not familiar with the Ages & Styles periods (see below). For the public at large, all structures featured are old buildings, except perhaps the one on the euro 500 design.

It is remarkable that the incorrect answer bridge is given in the same order of magnitude as the answer an old building: also about 1 %. This supports the view set out before, i.e. that the bridge on the reverse side of the euro notes communicates better than the ‘window and gates theme’ on the front [29, 33, 38]. However, also guessing might play a role.

Watermarks in NLG notes
Unlike the watermark images on the euro banknotes, those in the NLG notes differ from the main images on the printed sections (see Figure 7).

Figure 7.
Left: Large billboard poster for the Amsterdam Zoo (Artis), using the watermark of the NLG 100/Little Owl (1993). Best free publicity!
Middle: Watermark bee in NLG 50/Sunflower (1982).
Guessing about the watermark

Table 5 provides an overview of the different watermark designs used since 1981. This table shows first of all that for all series, awareness of the watermarks is quite poor; most people have no clue. The table also shows that some respondents make a guess about the watermark subject, e.g. flower for the NLG 50/Sunflower. By 1999, many people had forgotten about the watermark rabbit in the NLG 250 (only 4 % of the answers were correct) and 4 % of the public guessed that the watermark was a lighthouse. As said, the answer bridge for the euro banknotes also seems to be merely guesswork.

The correct answers snipe and a bird’s head for the NLG 100/Snipe in 1993 was the highest score measured given by 26 % of the respondents.

<table>
<thead>
<tr>
<th>Watermark</th>
<th>Year</th>
<th>Best correct answers</th>
<th>Wrong answer</th>
<th>Don’t know</th>
</tr>
</thead>
<tbody>
<tr>
<td>NLG 50/Sunflower</td>
<td>1985</td>
<td>Bee: 6 %</td>
<td>Flower: 8 %</td>
<td>83 %</td>
</tr>
<tr>
<td>NLG 100/Snipe</td>
<td>1991</td>
<td>Snipe: 17 %</td>
<td></td>
<td>71 %</td>
</tr>
<tr>
<td>NLG 250/Lighthouse</td>
<td>1987</td>
<td>Rabbit: 10 %</td>
<td>Lighthouse: 1 %</td>
<td>86 %</td>
</tr>
<tr>
<td>NLG 10/Kingfisher</td>
<td>1999</td>
<td>Kingfisher: 6 %</td>
<td></td>
<td>82 %</td>
</tr>
<tr>
<td>NLG 25/Robin</td>
<td>1991</td>
<td>Robin: 7 %</td>
<td></td>
<td>86 %</td>
</tr>
<tr>
<td>NLG 100/Little Owl</td>
<td>1999</td>
<td>Little owl: 11 %</td>
<td></td>
<td>76 %</td>
</tr>
<tr>
<td>NLG 1000/Plover</td>
<td>1997</td>
<td>Plover: 4 %</td>
<td></td>
<td>91 %</td>
</tr>
<tr>
<td>Euro 5</td>
<td>2002</td>
<td>Same picture as print: 4 %</td>
<td>Bridge: 1 %</td>
<td>89 %</td>
</tr>
<tr>
<td>Euro 50</td>
<td>2002</td>
<td>Gate or door: 4 %</td>
<td>Bridge: 2 %</td>
<td>86 %</td>
</tr>
</tbody>
</table>

Table 5.
Overview of knowledge of watermarks in different guilder and euro banknotes. The years in the ‘year column’ are the years in which the best scores of the entire period were measured. The polls yielding these results were often conducted shortly after the banknotes in question were issued. After some time, the knowledge decreases, but not in all cases (e.g. not for Snipe and Little Owl).
- = less than 1 %

Watermarks in abstract series

Watermarks in the last Abstract series scored relatively well. Lacking a general printed image, these notes were named after their watermarks. The general bird theme helped the public remember that there should be a bird’s head in the watermark, although most people could not tell which bird. Another plus of this design philosophy was that the answers given were at least not incorrect.

9. Euro note themes: not known

As people proved unfamiliar with the watermark design, a similar question was asked in 2007 about the main image, the windows and the doors. The results found are very poor, as people are often unable to give an answer. ‘You can stop summing up the periods, for I really don’t know’ was the remark heard several times. Finally 82 % of the respondents could not name any theme from the 50 euro note. The correct answer Renaissance was only given by 1 %. The 5 euro note scored a little better: 77 % could not name one theme and 2 % gave the correct answer: Classic period. See also Figure 8.
10. Themes proposed by the Dutch for euro series no. 2

In line with the question on the euro note themes, in 2007 DNB invited suggestions for themes to be used for the new euro note series. Suppose you were the designer of the next euro banknote series. Which of the following themes (with a European character) would have your preference?

The Dutch seem to be ready for the use of European images, like the Eiffel tower or the Acropolis, on the euro notes (Table 6). A famous European person was proposed by 11%. From other research it emerged that this person need not be Dutch, but might equally well be Copernicus or Leonardo DaVinci.

<table>
<thead>
<tr>
<th>Preferred themes on a new series of banknotes</th>
<th>Score in %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pictures of well-known European buildings like the Eiffel tower, Acropolis etc.</td>
<td>37%</td>
</tr>
<tr>
<td>2. Pictures of animals</td>
<td>17%</td>
</tr>
<tr>
<td>3. Pictures of plants and flowers</td>
<td>12%</td>
</tr>
<tr>
<td>4. Portraits of famous European</td>
<td>11%</td>
</tr>
<tr>
<td>5. Pictures of bridges, windows and gates</td>
<td>7%</td>
</tr>
<tr>
<td>6. Something abstract, no representation</td>
<td>7%</td>
</tr>
<tr>
<td>7. Pictures of a musical instrument</td>
<td>5%</td>
</tr>
<tr>
<td>8. Don<code>t know, it doesn</code>t matter</td>
<td>3%</td>
</tr>
</tbody>
</table>

Table 6. (Prompted) themes preferred by the Dutch for a new series of euro banknotes.

11. No main image

The Dutch banknote designer Jaap Drupsteen is not in favour of a main image on a banknote. His statement is that a main image is not necessary, not wanted because it distracts from the two main functions of a banknote: 1) Value recognition, 2) Security features.

A main image could - as we have seen - also give a wrong clue for guessing on e.g. the watermark image. Furthermore a main image can be seen as patronizing, especially portraits.
Mr. Drupsteen proved his statement with the Abstract Series, the latest guilder series. The watermark in this series was the main subject and provided the note’s name.

12. More study is needed

Banknote designs should exude some happiness, so is the Dutch design policy. But also some humour, a little smile will help the appreciation by the public. An imaginary 5-point scale is presented in ‘Public feedback for better banknote design 2’ [38] to illustrate the humour parameter in 5 selected banknotes. Next to happiness and humour some more design communication parameters could be distinguished, like e.g. dull - shocking. The designs made by Mr. Manuel Krebs for the Swiss National Bank received much attention because of its unconventional subjects like a potato, a skull and an embryo. The parameters to be addressed in a communication policy could be made visible by putting designs in a two-by-two matrix like done in Figure 9 for some banknote designs and in Figure 10 for some watermarks.

![Figure 9](image)

Figure 10.  
Two by two matrix for watermark designs on the parameters ‘dull - shocking’ and attractiveness.  
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