PERCEPTION OF PUBLIC SECURITY FEATURES ON EURO BANKNOTES

A Qualitative survey on Confidence and Authenticity

Article by Frank van der Horst, Hans de Heij, Jelle Miedema, Marcel van der Woude, De Nederlandsche Bank NV

Summary *— A qualitative study by De Nederlandsche Bank, in cooperation with Motivaction, showed that the Dutch have confidence in their euro banknotes and that they feel that it is not important for them to check notes for authenticity. People trust the banknotes coming from an ATM or received as change from a retailer. Furthermore, they very scarcely encounter a counterfeit. Therefore De Nederlandsche Bank is of the opinion that security features in banknotes should be 'self-explaining', helpful in authenticating and adding to the confidence. The holographic foil In the Europa series, the holographic foil complies best to this definition. The emerald number feature doesn't comply very well with these criteria*

TINTRODUCTION

People trust their banknotes. In the Netherlands the confidence in euro banknotes is very high (80 % of respondents), while the knowledge of public features is poor, on average less than 2 features are known by heart (e.g. Randsdorp and Zondervan, 2015). Furthermore, people have a poor qualitative knowledge of such features; the Dutch know that there is a watermark in euro banknotes (70 %), but they cannot tell what it represents (2 % correct answers). Security features are meant to cause difficulties for the counterfeiter and are not intended for me, seems to be the public's attitude.

To maintain people's trust in banknotes, central banks have to introduce new banknote series with novel security features.At the start of such a new banknote series a central bank needs to select the feature out of a portfolio of existing security features and also of new, candidate features. A central bank should aim to select public features that add to confidence and that are usable for an authentication self-check. However, how do you study these characteristics?

METHOD

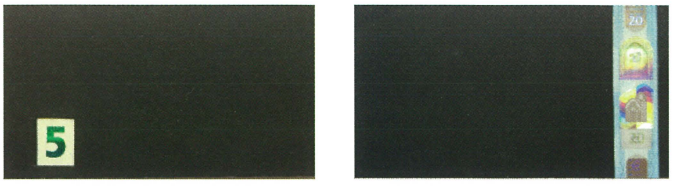
In case of research on public perception, the feature can be offered in a complete banknote or as an isolated feature. Furthermore, the respondents may receive an instruction on how to verify the feature, or they may not receive an instruction and have to rely on their intuition. These four situations are presented in Figure 1.

	Features offered	
	In complete banknote (fantasy or genuine)	Isolated
Instructed	A	B
Intuitive	C	D

Figure 1. Four test situations for authentication.

Literature on perception of banknotes is limited. The role of perception studies in banknote design is introduced by Firth and Balodis (2011). In this study on Canadian banknotes, they presented the results of perception tests carried out on masked features, which had to be judged intuitively by different respondents, an example of category D. Another study reported on the confidence in banknotes from the viewpoint of the perceived resistance of the notes against counterfeiting (Masuda et al., 2015).

Inspired by the Canadian study, DNB prepared a similar type of 'D-test' to evaluate the new security features in the latest euro banknotes, the Europa Series (or ES2). DNB opted for 'D' as normally the public is not instructed and focuses only on the feature and have people not distracted by other elements. These new features were compared to the ones they replaced, the security features in the Euro Series 1 (ES1), named Ages and Styles of Europe. Furthermore the study aimed for the evaluation of a measurement method for completely new candidate features, e.g. for a new series of ES3 banknotes. Figure 2 presents two examples of the used test material with isolated features of euro banknotes. An isolated feature has the advantage that people aren't distracted by other design elements in whole note tests, either genuine or fantasy banknotes.



a) b)

Figure 2. Examples of 'banknote cards' showing isolated security features.
a) Emerald number in EUR 5 of Europa Series (issued in 2013).
b) Foil feature in EUR 20 of Europa Series (issued in 2015).

Similar to the Canadian study, original features were offered next to three different types of counterfeited features, imitations of respectively low, medium and high quality. When possible, the

counterfeits were taken out of circulation, or, if that proved to be impossible, produced within the Reproduction Research Centre in Copenhagen. Unlike the Canadian study, this study also focused on the publics' confidence in a feature.

The study was carried out in 2016 by Motivaction, a well-known Dutch agency providing services on gaining consumer insights. Although 70 respondents being representatives of the Dutch public participated, the study is a qualitative study.
The focus of the study was on the public security features that the Eurosystem communicated when introducing the ES2, respectively a watermark, a glossy foil with a window and holographic features, a printed relief and a colour changing feature. A fifth feature, was added, representing the print quality. People use the colour of the banknote in their authentication process, a finding in a previous study (Van der Horst et al., 2016).

Respondents were split in two groups. The first group (34) participated in the part of the survey that focused on authenticating the security features and the second group (36) focused on the confidence that these features exude. The interview time for both groups was 40 minutes per individual. Minutes were made, as well as video recorded. In both groups, the interview started with some questions on their normal payment behavior.
The first group of respondents, intuitively authenticating isolated features, received a total of 48 cards, representing 12 features, each feature offered in 4 variants (1 genuine, 3 levels of counterfeit). Respondents were asked to judge the authenticity of the cards with security features by sorting them into stacks of 'genuine' and 'counterfeit' notes, one at a time. After this was done for all 48 features, respondents were asked about the motivation behind their choices. Attention was also paid to the difference between the first and second euro series. The authenticity scores where noted down on a scorecard.
The second group on exuding confidence received a total of 30 cards, representing 2 series (ES1 and ES2). Within each series 3 denominations were offered (euro 5, 10 and 20) and 5 features per denomination. Subjects were asked to score the security features for confidence on a scale from 1-10.

Four of these five features were derived from the euro 5 of both series. The fifth, OVI, came also from the euro 5 for the new series, but to be able to compare the OVI with the old series, the ES1, the OVI on the reverse of the euro 50 was used. To see if people intuitively understand security features that they haven't seen before, two candidate features were added (CF1 and CF2).

RESULTS

It is assumed that people normally don't check security features, because of a high confidence in the authenticity (De Heij, 2016). The present study confirmed this assumption.
The study further confirmed that participants had very limited knowledge of the features. Participants explained that they do not think it is necessary to know or check because they think that ATM's and change from a retailer can be trusted, they have no experience with counterfeits and because of a decreasing amount of money in their wallets due to a continuing shift to electronic payments. The watermark is most known, although they don't know how it looks like. Participants hardly used the 'look-feel-tilt' method. A security feature added to the confidence when the participant had the perception that it is difficult to counterfeit.

Although by setup a qualitative study, several quantitative results can be reported. The two perspectives of this study, authenticity sensitivity and confidence, can be related to each other. The authenticity sensitivity is d-prime or d', being a trade-off between hits and false alarms, stemming from signal detection theory (e.g. Heeger, 2007). D-prime is becoming an accepted method to classify security features. For example, the British banknotes are characterized by d'=1.5 (Raymond and Jones, 2016). In another test, banknotes had to be distinguished as genuine or counterfeit delivering a d' of 2.5 (Van der Horst et. al, 2016). In case d'=4, almost all originals will be detected, and no counterfeits will be marked as genuine. When d'=0 people are not able to make a distinction between genuine and counterfeit other than by gambling. A negative value means that participants think that the counterfeit is more genuine then the genuine ones. The horizontal axis in figure 3 is d'. Low absolute values of d' in comparison with above mentioned values, are probably due to the fact that in this test only one aspect of the complete banknote was presented, which makes it more difficult to authenticate.

The measure for confidence is a score on a scale from 1-10. This the vertical axis. The graph can be divided in four parts that which were given a name. A low sensitivity and a low confidence: 'not working'. A high confidence with low sensitivity gives a 'false security'. A high sensitivity that doesn't generate much confidence is named 'trigger feature' and the most desirable part we named: 'intuitive and trusted'. This category contains the security features that we are looking for: generating confidence and helpful in determining the authenticity.

Figure 3 tells that the foil feature receives the highest scores for both the ES1 and ES2. This feature is the only feature located in the section of "intuitive and trusted". The high sensitivity is mostly

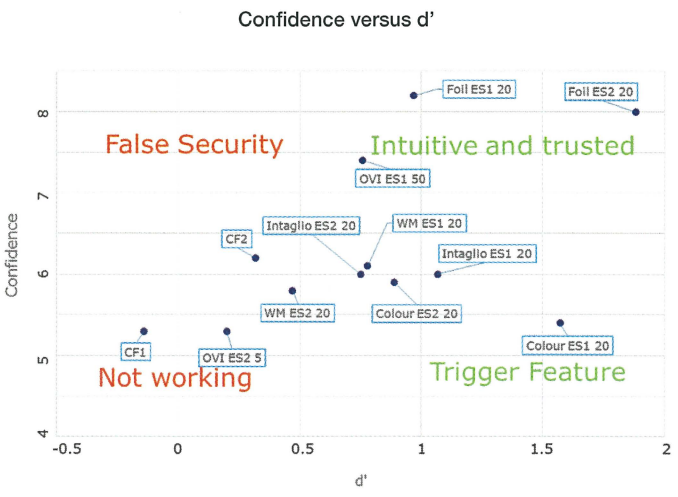


Figure 3. Confidence and Authenticity sensitivity per feature

due to the fact that people hardly assess counterfeit foils as genuine, especially for the new series (5 out of 102) and a bit less to the 'hits': only 20 respondents out of 34 identified the genuine features correctly. The window element in the ES2 foil was hardly noticed, but after pointing out appreciated. Candidate feature CF1 is obviously 'not working' and CF2 is doing only a slightly better. This is most likely a result from the used methodology. Participants had no idea how to judge this feature, since they don't know it and weren't instructed. However, one could argue that this is the same case in normal life. The emerald number, the OVI on the euro 5 of the Europa Series, has also low figures for both confidence and authenticity sensibility. Participants indicated that the genuine OVI looked too shiny and glimmering. In their perception this can't be genuine. They made the distinction between genuine and counterfeit better with the OVI on the euro 50 (ES1). Although participants identified intaglio first series as genuine, they also rated about 50 counterfeits as genuine. This is caused by the fact that respondents often don't know they're supposed to touch this feature.

CONCLUSIONS

The study is mainly focused on the perception of the man in the street and not that much on the underlying technique of the features. It discriminates between different public features.

The general public has a poor knowledge of security features. People at large don't feel the need to know more, since they trust their banknotes and therefore hardly check them. The chance of encountering a counterfeit is low, and money coming from a retailer as change or from an ATM is trusted. There is a clear difference in the level of confidence between various features. One of the main findings is that features that provided the impression of 'difficult to be counterfeited' contribute to the confidence. The foil feature of the Europa Series is rated highest confidence score.

The study confirmed that participants have very limited knowledge of public security features. The watermark is best known, although people don't know what it looks like. Participants hardly used the 'look-feel-tilt' method. In case of 'look' the watermark was not always held to the light. And in case of feel, many respondents don't know that they are supposed to touch specific areas. As for the ability to actually authenticate features, large differences were found. Also here the foil feature of the Europa Series performed best, followed by the foil as applied on the ES1. Participants indicated that the genuine emerald number on the Europa Series can't be real, as it is too shiny and glimmering.

The applied method contributes to the evaluation of the performance of public security features. Future features should add to the public's confidence. As features should also assist the public during an authenticity check and as people in general have limited knowledge of the features, they should be self-explanatory, a finding also reported by Masuda et al. (2015). The way to go are realistic images, easy names, fitting the theme and an unambiguous task and judgement. The 'intuitive method' used by DNB can predict to what degree security features are self-explaining.

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