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The Impact of Substrate Choice on Banknote Design
— *Special Section*

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The Impact of Substrate Choice on Banknote Design

Karin Mörck-Hamilton, Crane Currency

How would you describe your role in the banknote design process?
KMH: The Banknote Designer's responsibility is to make sure that end product, the banknote, meets all different requirements regarding security, ease of public use, is 'seen' by sensors, and is producible, cost effective, durable and, yes, attractive. My role is to map out all these requirements, many times based on a given specification, and to integrate them into a banknote structure/architecture and ensure the end product meets all expectations.

I have said it before: A Banknote is a product and product design is a process to develop solutions in a manner where both functional and aesthetic demands are included.

For this you need to work with a team of different skills and competences. But as the Banknote Designer, you have to take the lead.

How do you evaluate different substrate types for a new series of banknotes?
KMH: In most cases the Central Bank has already specified substrate(s) before the design work starts.

In some cases I have been part of pre-decision phase as a consultant like for the new Swedish and Norwegian series. In the Swedish project different substrates were evaluated from different perspectives such as the variety and integration of preferred security features, cost, tradition/recognition by the public, ink staining etc. Ultimately, in the case of the Riksbank the customer made the decision to use a durable paper substrate.

Central Banks such as Reserve Bank of Australia and also Reserve Bank of New Zealand have a long tradition of polymer substrate as the supplier originated in Australia.

Other Central Banks take a new step and decide to go for a completely new substrate or sometimes mix different substrates in a banknote series. Decision to mix substrates is in most cases based on durability/longevity concerns rather than security. Depending on the country and environment the decision is very individual. Paper and polymer substrates wear differently and also substrate is the carrier of security features which have to be as durable as the substrate to make sense.

When mixing substrates in a series, it is of course challenging from the designer's point of view. You want to create a banknote series that speaks same language despite the difference in substrates.

So called layered/sandwich substrates are to me a bit confusing. I cannot get rid of the feeling that it looks like a handcrafted simulation exercise. But if they persist, I will probably get used to it.

In your opinion, how does substrate choice have an impact on banknote design?
KMH: Substrate choice has of course an impact on the design as banknote design is about integration of security features into the substrate or applied on the substrate.

Substrates such as polymer or sandwich/layered substrates will have an impact on security feature choice. Even choice of a certain paper substrate might have an impact on the design such as intaglio depth.

So substrate is important part of the banknote and therefore the designer will always take this into account when creating the banknote structure/design.

How did substrate choice have an impact on your own design process?
KMH: Substrate choice does not really change the basic design process. We follow a standard process which allows us to work with different designs/structures. This basic design process helps when substrates, features and requirements are slightly different between projects. Design itself will be different depending on substrate but having one basic process helps when you have to do research about new features and work with new suppliers/stakeholders. In the end, the architecture is similar for all banknotes, it is just the materials and its adaption that is different.

How did substrate choice enhance your final banknote designs?
KMH: The choice of substrate itself does not enhance the banknote design – a skilled banknote designer enhances the final design by adapting to the characteristics of the substrate and making it an integrated part of the banknote.

Did substrate choice have any adverse impacts on your final design and if so, how?
KMH: I would not say negative impact, but when working as a designer, with a completely new substrate, there might of course occur "surprises". For example, when working with polymer the first time, I did not know that this substrate is very transparent in the areas where it is expected to be opaque. So a motif printed in a dark colour on reverse would be visible on the front. Being a banknote designer you are already very much aware of the importance of different feature positions in relation to each other, front and back. For printing and also machine readability purposes. If not being aware of the polymer substrate transparency, you might end up in a situation where a strange dark shape from reverse is visible on the front portrait. This is why proofing on the actual specified substrate is so important. You learn by trial and error, but the errors should happen in proofing, not in production.

Would you say that the choice of substrate opened a significant amount of new design possibilities for your series of banknotes?
KMH: So far, No. It is the combination of substrate, security feature and print that can open up new design possibilities.

Can you give some clear examples of the above?
KMH: Well, we are today engaged in some interesting combinations that are too soon to talk about, but I won't rule out another interview some months down the road.

What was the most interesting thing for you about working with a new/different substrate?
KMH: The most interesting thing is that you learn something new. This applies on everything new such as new security features. You have to take your time and try to understand as much as possible about this new material/product. Understand how this can be integrated into the overall banknote design. And also figure out how a counterfeiter should attack it as a stand-alone material. How can I make it secure by design?

How did you validate the impact that a new substrate would have on human banknote users once issued?
KMH: A completely new substrate such as switching to polymer from paper substrate might be a challenge. The public is used to a certain feeling when touching and handling paper banknotes and with a completely new substrate, the public must be trained and it will take a while to get used to it. With a new substrate comes new security features and these have also to be informed about. Most efficient is to introduce features that are bold and obvious. These the public will notice and learn, and hopefully not look at to the exclusion of all other features – it's a balance. So substrate is the carrier of features and when integrated well into substrate, these are what the public will remember, not the substrate itself.

How did you validate the impact that a new substrate would have on automated devices in your cash cycle?
KMH: Introducing a New Banknotes Series always requires communication/team work with the BEM's (Banknote Equipment Manufacturers), not only because of an eventual new substrate, but to make sure that machine readable features are positioned and designed correct front and back in the overall banknote design. Important to have these discussions early in design process and also to check test/measure samples and proofs in different MR equipment. It is an important part in the Banknote Design process – not only to make sure the design can be read easily by sensors but also to make sure the BEM's get the needed information to be able to program the equipment so that it can identify the banknotes.

How do you see banknote substrates evolving in the future?
KMH: Well, substrate will not be less complicated that's for sure. More features will be part of the substrate already before printing has started to add on more features.

This may cause initial challenges in production. But substrate is an important part of the final banknote product and when designed well, everybody in the production chain should be aware of the quality demands and why every step in the production process is important.

Everyone must know the end product and how it will be used.