

Digital Microscope Helps Detect Counterfeit Currency

Collecting “Funny Money”

Nobody wants counterfeit money in their wallet. Even counterfeiters want to get rid of their own creations as quickly as possible. However, experts work intensively to identify counterfeit money on behalf of the law. Martin Weber of the National Analysis Center of the German Bundesbank (Federal Bank) in Mainz is such an expert on forged banknotes. Although anyone can spot most counterfeit euro notes just by looking at them, microscopes are needed to detect the signature of the counterfeiters and convict them. The Bundesbank now uses a new Leica DVM5000 Digital Microscope, as well as stereomicroscopes, to examine counterfeits with even greater precision and enhance the effectiveness of training.

Mr. Weber, what role do you and your colleagues play in the National Analysis Center of the Deutsche Bundesbank?

As a National Analysis Center, our legal mandate is to be concerned with forged banknotes and coins. We also handle damaged money and repay the person who submitted it, provided the reimbursement criteria are met. My team specializes in banknote forgeries. In addition, on behalf of the police, we monitor everything that is treated as legal tender: payment cards, securities, traveler's checks, and currency in gold and silver coins.

Our core task is not, as you might suppose, to determine whether banknotes are real or fake. Our trained eyes can tell this at first glance. We examine whether a counterfeit matches one we already know of and the technique it has been manufactured with. A counterfeiter leaves behind a unique individual “trademark,” always using the same technique and mostly concentrating on certain security features he considers important or believes to have mastered particularly well.

He will usually then make easily recognizable mistakes in other places. In this way, we can normally clearly assign forgeries to a perpetrator, who is initially unknown. If the perp is caught, our expert's reports not only allow us to prove in court that the criminal originated the fakes and how it was done, we can also indicate the time frame and extent to which he did it.

We get most of the counterfeit money from the police. Occasionally, banks submit suspicious cash directly. After we have examined the forgeries, we give our reports and results to the police, who pass them on to the public prosecutor. The judge of the court hearing may request our presence in court to explain the reports.



Photo: © Deutsche Bundesbank

How do you examine the counterfeits?

We concentrate almost exclusively on visual examination, using stereomicroscopes of up to 100x magnification with various light sources and filters. We also need to know as much about forging as the forgers themselves. All the five experts in our group have a degree in printing engineering. When we view a counterfeit under the microscope in incident, transmitted or UV light, we can tell exactly how it was produced.

Fig. 1: Martin Weber, expert in counterfeit banknotes at the National Analysis Center of the German Bundesbank, can spot a fake at first glance.

Photo: © Deutsche Bundesbank



Fig. 2: Analyzing a banknote with the Leica DVM5000: with the instrument's high magnification levels, versatile zoom optics, and large depth of field, experts can discover how counterfeit money was produced and match a forgery to a known "trademark."

How do you benefit from the digital microscope?

The new digital microscope is a much-needed addition. In terms of magnification, we are brushing up against our limits with the stereomicroscopes. Now, with higher magnification levels and better depth of field, we can examine paper structures, inks, and pigments, for instance effect pigments and diffraction structures in holograms, with greater accuracy. Another reason we need high magnification levels is that the counterfeiters' inkjet printers deliver ever-finer resolution.

The flexibility of the digital microscope is also a great advantage for us. For example, the tilting stand enables us to record the effect of movement on the security features. The versatile zoom optics allow us to verify in much finer detail whether counterfeits were produced with printers or paper confiscated from suspects by the police.

The digital technology is also great for documenting our work. We record every single result in digital images, which may be used as conclusive visual material to support written evidence in court or for discussions among colleagues. Pictures of forgery details are also useful in our well-functioning European

network for tracking down perpetrators. Relatively few forgeries are committed in Germany. They are mostly the work of internationally organized groups.

You also hold training courses for the police, businesses and banks. What do you teach and what advantages does the digital microscope provide?

Training sessions represent an increasing proportion of our work. One of our responsibilities is to show staff of the criminal investigation police and state investigation bureaus how forgers work. The second target group are checkout staff in shops or bank cashiers who are trained on the job by the nearest branch of the Bundesbank. We show them a sample set of forgeries to demonstrate the problems that forgers have with the security features.

However, we are often surprised at how little some course participants know about the security features of the euro banknotes. These features are designed to make forgeries easy to identify without technical equipment. But without the knowledge of how a genuine banknote should look and the security features on a genuine note, the person receiving the currency will not be able to distinguish a genuine banknote from a forgery.

We are organizing more and more seminars on an international level to share experience with experts from other central banks. Our Technical Central Bank Cooperation department also helps to set up and develop money analysis centers in other countries. We have installed a large flat screen in our laboratory for in-house training that we can directly connect to the digital microscope. All the participants are thus able to watch a live demonstration of what we examine under the microscope and the methods we use. So the new technology helps us make lectures and training courses more lively and effective.

Have forgeries become more common over the last few years?

The Federal Bank registered 60,000 counterfeit euro notes in the year 2010, which was 14 per cent more

Photos: © Deutsche Bundesbank



than the year before. Damage resulting from forgery increased from 3.1 to 3.4 million euros. The highest increase can be recorded for the counterfeit 50 euro notes. The number of counterfeits of other denominations, however, is declining. Statistically, there are seven forgeries in Germany per year for every 10,000 members of the population, which puts us well below the European average. The figure also indicates the low risk of coming into contact with counterfeit money. Even though this means people don't pay much attention to the security features, it doesn't worry us that much in view of the low risk for private individuals and the success of the police in solving forgery crimes. Our main aim is to reach as many people as possible with our ongoing awareness-raising work and copious information material on the Internet which is available to everyone free of charge.

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Fig. 3: Foil element of the 500 euro note, image acquired with the digital microscope's swing stand at a 45° angle.

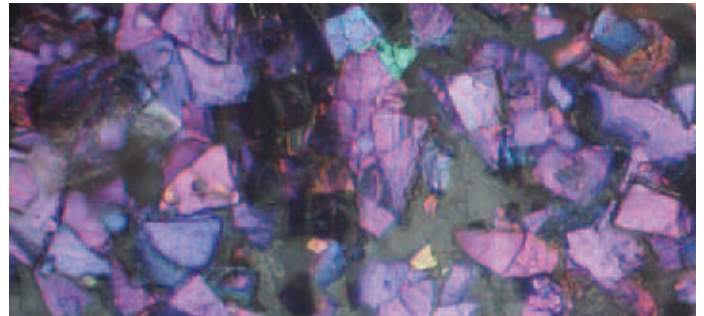


Fig. 4: Special OVI pigment only found on genuine notes of 50 – 500 euro denominations. This photograph was taken at a magnification of 1000x.

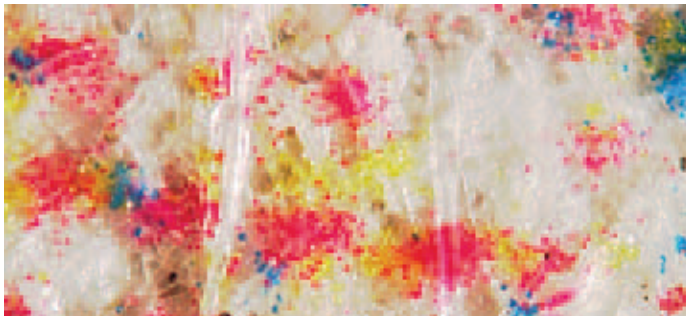


Fig. 5: Toner particles and paper fibers of a forgery.



Fig. 6: 3D image capture of the intaglio printing on a genuine 500 euro bill. A section was made through the profile.

Photos: © Deutsche Bundesbank



Money Museum of the Deutsche Bundesbank

Interesting facts on the history of money and how it is produced and used are presented in the Money Museum in the Frankfurt headquarters of the Deutsche Bundesbank

www.geldmuseum.de

Security features

The Bundesbank provides clear information on the security features of euro banknotes on its website. Brochures and CD-ROMs can also be ordered.

www.bundesbank.de