Gerald Artner

The coin as the measure of many things - a size comparison

On November 20, 2024, Gerald Artner a presentation on "The coin as the measure of many things - a size comparison" in the Austrian Mint's hall. Dr. Artner presented his collection of over a thousand images of coins in scientific journals and the statistical analysis of the associated data set. The subsequent discussion brought numerous insights, but also raised new questions. The presentation and discussion are summarized in this article.

Widespread distribution in scientific journals

During the discussion, it quickly emerged that the surprising thing is actually how many coins are used as size comparisons in scientific journals. In many journals, the proportion of articles using coins for size comparison is in the single-digit percentage range. One can assume that, in principle, researchers access to precise measuring equipment, but the use of coins seems strange at first.

The use in peer-reviewed scientific papers shows a certain consensus between authors, reviewers, editors and publishers. There seems to be a consensus that coins in photographs are a good way to illustrate the size of objects in a simple way. Coins are never part of a pile of objects in the background of the photos. Objects and coins are deliberately arranged in scenes. Fig. **1** shows typical examples.
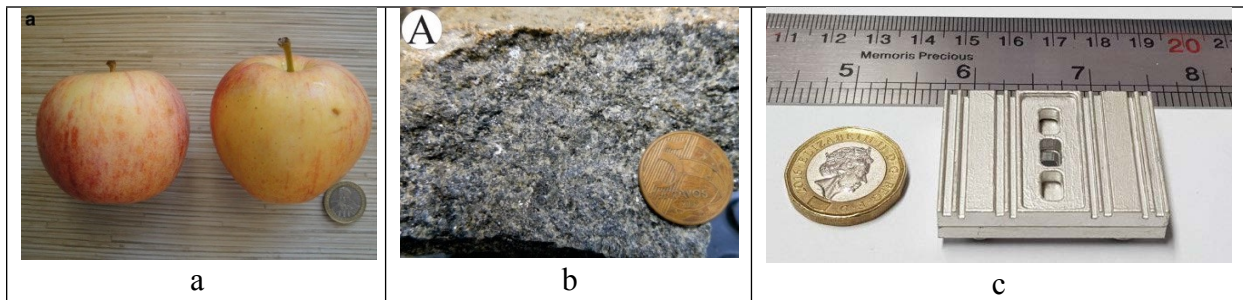

| a | b | c |

Fig. 1 a) Blanke/Yuri 2020, CC-BY 4.0, b) de Paiva et al. 2021, CC-BY and c) Alkaraki et al. 2020, CC-BY 4.0

Objects of known size

The data analyzed shows that coins are not to be understood here as a category of cash. Similar objects in the numismatic sense are not used as a size comparison. The data set does not include ATM cards, shares, jewelry, medals, bullion, checks or bank statements. A banknote is used as a size comparison in Cereijido *et al.* 2019 and is shown in Fig. **2.**
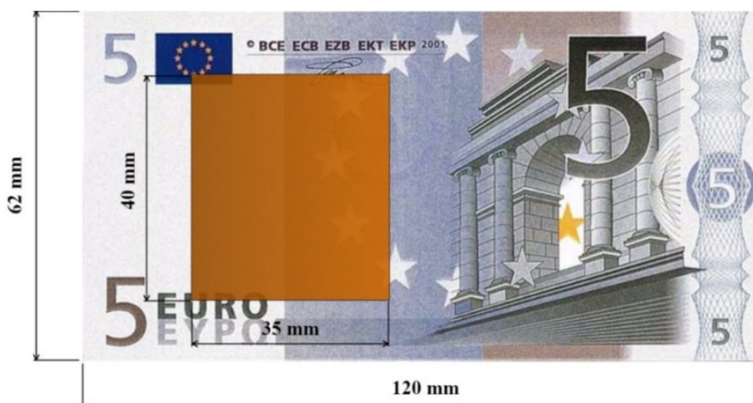

Fig. 2 Cereijido et al. 2019 uses a five euro banknote as a size comparison. The caption reads "Dimensions of the conductive plates compared to a 5€ banknote." CC-BY 4.0

Coins here are rather parts of a group of "objects of known size". During the research, a wide variety of objects were found when comparing sizes: Ballpoint pens, matchboxes, paper clips, stamps camera covers, hammers, hands, iPhones, grains of rice. A selection is shown in Fig. **3**. None of these items is as popular as coins. In the discussion it was brought up how intuitively the size of objects is shown by the numismatic comparison. At first glance, it is clear how large the object shown is. Scientists should be well aware that coins are not objective measuring instruments for comparing size. The coin should simply and clearly convey the approximate size of the object shown; detailed size information is provided in the text of the article or technical drawings. Qualitative analysis of some articles could provide further insights here.
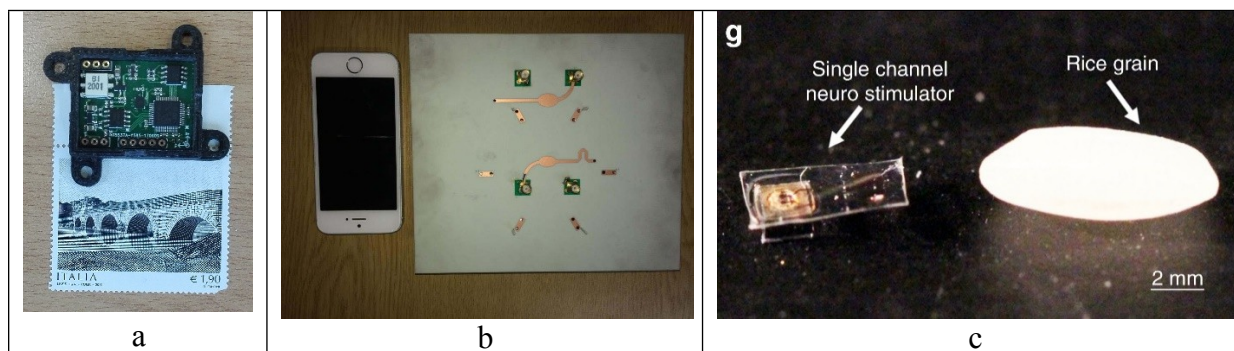

Fig. 3 Selection of "objects of known size" from scientific articles. a) Stamp, Testoni et al. 2019, CC-BY 4.0, b) Mobile phone, Su et al. 2019, CC-BY 3.0, and c) Grain of rice, Khan et al. 2019, CC-BY 4.0

One finding in Artner 2024 is that no historical coins are used as a size comparison. The discussion showed that this would probably not work at all. Coins work so well as size comparisons because their size is known to everyone. The size of historical coins such as ducats or sestertii, on the other hand, is unknown to the numismatic layman. It has also been argued that the sizes of historical coins are less precisely defined than the case today. The fact that coins selected for size comparisons should be generally known is probably also the reason why no collector coins or investment coins were found in Artner 2020 and Artner 2024.

In Artner 2020, it was still assumed that the emerging use of coins could be the beginnings of a rudimentary measuring system, but this is not supported by the statistical analysis in Artner 2024. A linguistic analysis shows that the words *size, scale, diameter, comparison* are frequently used, and that currencies and coins are also described. There is no intention on the part of the authors to measure with coins; it is clearly a comparison of size. This seems obvious in the discussion. Coins are suitable for visually illustrating the approximate size of *coin-sized* objects. Other methods are better suited for precise measurements and size specifications.

In Gupta *et al.* 2019, coins are stacked and their summed height illustrates the thickness of a dielectric resonator. Yang *et al.* 2019 use coins to measure the maximum possible pressure on a membrane, stating "A hybrid membrane suspended on a tube edge is mechanically strong enough to support five coins (~16.0 g) without rupture (Fig. 3D)." The coins have a defined surface area and mass and therefore exert a weight force per surface area and thus a pressure on the membrane via gravity. By stacking coins, the authors increase the pressure on the membrane until it ruptures. Counterintuitively, only one example in the dataset uses coins as a measure of monetary value. Song/Millman 2017 use a US penny as a size comparison and write in the text: "On a cost-per-weight basis, the material cost of manufacturing one device is approximately 0.01 USD, enabling economic production of many devices." The penny shown is the same size and cost as the object shown.

Intention of the authors

At first glance, it does not seem surprising which coins are used. Almost exclusively circulation coins of their own currency are used. There seems to be a trend towards coins with a face value of one for all currencies except the US dollar. Discussions on US dollar coins provide a numismatically plausible explanation. One-dollar coins are notoriously unpopular and half-dollar coins are also rare. Susanne Sauer notes that the preferred use of *quarters* and *pennies* may well reflect the situation in the wallets of US Americans. Authors simply seem to take coins that they carry with them.

But on the contrary, it is surprising how clear some statistics are. 94% of euro coins show the common side. For Markus Greif, this shows a consensus among authors who consciously decide how to show euro coins. Preferring the common side of euro coins to the national sides could be a statement by scientific authors to emphasize the common over the divisive. However, this is initially an assumption and should be investigated further, perhaps with a survey. The email address of the corresponding author is usually given in the article.

It is also surprising how many coins do not fit into the scheme at all, e.g. foreign coins. That authors from Taiwan use USD as foreign coins seems plausible, but the widespread choice of Hong Kong dollar coins among authors from India seems puzzling. The authors seem to simply reach into their wallets when they take the photo, but on the other hand, the authors seem to consciously consider which coins they use. Perhaps photos with foreign coins are also taken during research stays abroad.

In the discussion, it was raised whether interesting outliers in the data set should be analyzed in more detail or whether their authors should also be included. Two articles were found in which photos of coins used as size comparisons for sketches instead of photos. Two other articles use coins in over thirty photos each. Still two other articles use coins over sixty years old. Coins are stacked, as electrodes for RFID readers, miniature robots are balanced on the edge of coins.

Finally, coin images generated with generative, artificial intelligence were discussed, see MÖNG contribution Artner 2022. AI-generated coins can be creatively adapted to specific scenarios, but the recognition value as a coin is lost because fictitious coins do not offer the viewer any associations with the sizes of real coins.

Conclusio

By comparing sizes, coins are taking on new tasks beyond payment transactions. The coin gains new significance as an everyday object of known size. For numismatists, these observations offer new approaches to understanding the cultural and practical role of coins in modern science. In contrast to the familiar historical context of numismatics, we must first explore what insights be gained from the choice and representation of these coins. Coins as a solution when real proportions difficult to represent in digital images? A look into the wallets of researchers? Can the intentions and interactions of researchers be deduced from this? Coins as digital anthropology like Horst/Miller 2012? Numismatic measurement technology? In any case, size comparisons are already a curious trend with coin amusements.

Fig. 4 Group photo of the participants

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