[Fig. 4 — Illustration: Interpretation as part of a Bilboquet game (de Saint-Venant)]

IV. INTERPRETATIONS

"The dodecahedron and the icosahedron" are "good for almost nothing. Well: one could 'roll dice' with them. One would number the faces, let the body roll over the tabletop, and the number that appears on top when it comes to rest is—provided one does not cheat—determined by chance," C. Pöppe reports in *Spektrum der Wissenschaft*.[294] By contrast, the Gallo-Roman dodecahedron seems to contain a virtually unlimited number of possible uses—at least theoretically. If one believed all authors and their attempts at interpretation, one would, with a single dodecahedron, as it were, hold in one's hands a universal instrument, an all-encompassing symbol, a masterpiece, and an entire collection of games. But which theories withstand closer scrutiny?

All known (scientific) interpretations (until 1999),[295] in all their nuances, are to be presented in detail, explained, and examined critically. Quite deliberately, even completely

[294] C.Pöppe, Fast platonische Körper. Das wohltemperierte Dodekaeder, Spektrum der Wissenschaft. Papiermechanik 3 (1997) 3. (trans. Guggenberger)

[295] In recent years, more fanciful ideas have emerged, and earlier interpretations have been repeated. For a further development of my ideas, see Guggenberger/Leach (2025) and forthcoming publications.

abstruse ideas have not been excluded, since they form part of the history of research.

To bring the individual hypotheses—since a presentation in book form requires it—into a linear order proved to be a difficult undertaking. If the arc now spans from ornamental element across diverse articles of use, across symbols and magical devices, to toy and masterpiece, this is only a makeshift division and sequence. Many interpretations cannot be strictly assigned to one of the functional groups listed and would therefore actually have to be listed more than once. In order to avoid repetitions and cross-references as far as possible, this is pointed out in advance.

An ornamental function resonates in almost every explanatory model. The transitions between cult and play, between weapon and status symbol, between item of practical use and cult device—to indicate the most important connections—are fluid. In particular, the interpretations as more luxurious items are frequently coupled with a certain symbolic meaning of the object.

Wherever it seemed necessary or interesting, I have enriched individual theories with comparative material and developed one or another interpretation further.

IV.1 Ornamental Element

IV.1.1 Pendant (Jewellery)

On 2 November 1877, two Gallo-Roman dodecahedra were discussed at a session of the Royal Archaeological Institute (London). Sir John Maclean presented [Dodecahedron]Goodrich Castle (Guggenberger No.63), which seems to possess twelve openings of equal size; Mr. Franks presented [Dodecahedron]London 3 (Guggenberger No.67), which is distinguished by its particularly fine, fragile workmanship. It was proposed to interpret the objects as jewellery elements that were strung on a cord or the like.[296]

The majority, however, concluded that this was unlikely, not least because the dodecahedron would have been too unwieldy for that purpose, and differently sized openings would not have been required.[297] There is nothing further to add.

How one might imagine an actual pendant with elements in the form of dodecahedra is shown by the reconstruction of a necklace with the—admittedly much smaller and more delicate—gold dodecahedra from Gummadiduru.[298]

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[296] "[...] if they were merely for ornaments to be suspended" (Maclean 1878, 87).

[297] Maclean 1878, 87.

[298] cf. chapter VI.2.3 'Far Eastern Gold Dodecahedra'. — M.Kuraishi, Trial excavations at Alluru, Gummadiduru and Nagarjunikonda, in:

IV.1.2 Decorative Finial of a Cross

One of the most astonishing designations of the dodecahedron is that proposed by Félix Liénard (1884). In all seriousness—and, as he thought, with good reason—he considered [Dodecahedron]Châtillon-sous-les-Côtes (Guggenberger No.32) to be an ornamental element on a cross: "This object, which by its form and style appears to belong to the Merovingian period, is said—according to the opinion of highly competent archaeologists—to have served as an ornament at the end of one of the arms of an ancient cross."[299] An iron 'fitting piece,' found with the dodecahedron and not described in more detail, he interprets as a component of the pole on which he imagined the cross to have been fastened.[300]

According to this description, it would have had to be a small cross with a long shaft, such as is used for processions. A comment on this particular interpretation is, to be sure, superfluous. Liénard's approach is not entirely off the mark, however, insofar as he assumes a mounting of the dodecahedron on a staff or rod.

J.Marshall (ed.), Annual Report of the Archaeological Survey of India 1926/1927, 1930, 156.

[299] Liénard 1884, 66f. (trans. Guggenberger)

[300] Ibid., 67.

IV.1.3 Component of a Field Standard

When in 1863/1864 [Dodecahedron]Hof (Guggenberger No.81) came to the museum in Agram (Zagreb) by way of a donation, Sabljár—according to the statements of the finders, albeit with reservations—noted the intended purpose as the finial of a Turkish flag. The finders obviously took their inspiration from the incursion of the Turks into the east of Lower Austria in the year 1683, which Wilhelm Kubitschek describes as "no poor combination, drawing on a fanciful image of the terrors of the past."[301]

"Sabljár imagines the ('drilled through at the side' or 'split at one end') flagstaff as passing through two larger holes, with the tufts of horsetail being pulled through the smaller holes."[302]

Sabljár's ideas are naturally not to be pursued further on account of their anachronism and are, viewed in this light, to be regarded only as an amusing detail in the history of research; but do dodecahedra come into consideration as components of Roman field standards?

The insignia of the Roman military (*signum, vexillum*...) took manifold forms. Especially in the imperial period, their religious significance was also emphasised, and astral symbols (zodiacal signs) likewise played a role.[303] In this sense the

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[301] Kubitschek 1911, 238. (trans. Guggenberger)

[302] Ibid., 238 fn.4. (trans. Guggenberger)

[303] cf. Y.Le Bohec, Feldzeichen, DNP 4 (1998) 458-462; A.Neumann, Feldzeichen, Der kleine Pauly (1975) 530f.

dodecahedra, with their (possible) cosmic reference, would not fit at all badly into this context; their frequent presence at military sites could also be well correlated with this. In just such a function, however, pictorial representations would be expected; furthermore, the presence of a dodecahedron in a woman's grave leads to an explanatory dead end.

IV.1.4 Pommel of a Sword

The designation as a pommel of a sword is used by Conrad Leemans, director of the museum in Leiden, in a newspaper report from 1874, alongside 'pommel of a command staff.' This was done in accordance with the description of the object recorded in the museum's inventory list.[304] — Elsewhere, he also speaks of the 'pommel of a rapier hilt,' but already considers this interpretation rather unlikely.[305]

Here people were probably thinking of weapons of the sort of medieval two-handers, which can in fact possess hollow, multiply perforated pommels. To refute this theory—which Leemans himself soon abandons in favour of the explanation as a sceptre pommel—one need not go far in argument, since the find contexts and chronological position of the Gallo-Roman dodecahedra already exclude this interpretation.

[304] Leemans 1874, ohne Seitenangabe (after Leemans 1877, 189).

[305] Leemans 1877, 195.

IV.2 Weapon

IV.2.1 Club Head

The idea of connecting the Gallo-Roman dodecahedron with a striking weapon goes back to J. Dirks (1874?). Admittedly, he proceeds under the erroneous assumption that the dodecahedra are of Hungarian origin, and he relies on a 'morning star' described in E. Pratobevera's book *Die keltischen und römischen Antiken in Steiermark*.[306] He also, somewhat misleadingly, designates and interprets the dodecahedron as a 'morning star'; on the basis of the presumed fixed mounting on a shaft, however, one should in this context rather speak of a club head.[307]

"As club heads are designated objects made of imperishable material (stone, metal) of spherical or cylindrical basic form with a shaft hole, which were hafted onto a handle of organic material (wood)."[308] Some bronze club heads, which

[306] see Dirks (around 1874) after Leemans 1877, 189-192; cf. de Saint-Venant 1907, 21; cf. E.Pratobevera, Die keltischen und römischen Antiken in Steiermark (1856) 33. — On this type: cf. Boucher/Feugère/Perdu 1980, 33 Nr.222f.

[307] The morning star is not attached directly to the shaft but is connected to it by means of a chain: cf. Leemans 1877, 191.

[308] "They belong to a category of artefacts that is characteristic not only of the Bronze Age cultures of the Caucasus, but also of those of the North Pontic steppes and the Carpathian regions [...]." Moreover, in the Near East, they represent a long-lived and widespread form and were often deposited as votive offerings in temples or served as attributes of particular deities. "Apart from the fact that the mace must be counted among the oldest weapons in existence, it also possessed

appear in the Caucasus region from the Late Bronze Age onward, in fact—granting a great deal of goodwill—show remote similarities to the dodecahedra. So-called knobbed clubs also occur among them.[309] With that, the initial argument that the rounded execution of the vertex fittings speaks against this interpretation is refuted.[310]

A real use of the dodecahedra as a striking weapon is to be excluded for other reasons. The majority are unnecessarily light and too fragile for that. The walls would be inappropriately thin, and ten of the twelve openings would be not only useless but also destabilizing. One would expect a solid body in which only the opening for the shaft is left blank. And so, already 120 years ago, August von Cohausen judged that the "great delicacy of our specimen [[Dodecahedron]Wiesbaden, Guggenberger No.25] and the lack of a mounting socket [...] do not allow us to accept this idea."[311]

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outstanding significance as an insignium or symbol of authority (sceptre)." (I.Motzenbäcker, Sammlung Kossnierska. Der digorische Formenkreis der kaukasischen Bronzezeit, Museum für Vor- und Frühgeschichte. Bestandskataloge Band 3 (1996) 67. (trans. Guggenberger))

[309] cf. Ibid., 67-69.181f. 236.

[310] so de Saint-Venant 1907, 21f; Nouwen 1993, 61.

[311] Cohausen 1879, 393; cf. Conze (Westdt. Z.) 1892, 208 (trans. Guggenberger); de Saint-Venant 1907, 21f; Michel 1921, 133.

IV.2.2 Finial of a Ceremonial Club

At most, the interpretation as a component of a showy or ceremonial weapon remains—a possibility also hinted at by Dirks (1874?).[312]

To be sure, in this case one would expect that there had been (initially) some club heads in the shape of a pentagonal dodecahedron that actually came into use as weapons. There is no evidence for this. Such clubs were neither used by the Roman military in the imperial period, nor do they seem to have been in use as weapons in the Gallo-Roman context.[313] The appearance in women's graves also does not fit the image of the Gallo-Roman dodecahedron as a ceremonial weapon.[314]

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[312] after Leemans 1877, 189; cf. E.Pratobevera, Die keltischen und römischen Antiken in Steiermark (1856) 33; cf. Z.Ligers, Naissance de la royauté. De la masse d'armes au sceptre, Ethnologia Europaea 4, 1970, 24f.

[313] Although the Quednow collection includes, in addition to [Dodecahedron]Trier 1 (Guggenberger No.22), an artefact identified as a Roman Imperial-period mace head, both its interpretation and its dating are highly doubtful: cf. Faust 1995, 384 Nr.A133 (with comparative literature). — "The Roman arsenal contains," as Hannsjörg Ubl kindly informs me, "no maces and no ceremonial weapons" of this kind: H.Ubl (letter 2.2.1999 (trans. Guggenberger)); cf. Nouwen 1993, 61; de Saint-Venant 1907, 21; Conze (Westdt. Z.) 1892, 208.

[314] cf. Nouwen 1993, 61.

known from [Dodecahedron]Windisch (Guggenberger No.90),[393] in order then to place alongside these another object—in his opinion related, which is in the National Museum (of Antiquities) of Scotland.[394] He interprets all three objects or object groups as flower stands. Beyond this he adduces a curious Roman bronze device kept in Cologne[395] and recalls the large group of 'triplet and ring vessels' of differing date and provenance known under the term *kernoi*.[396] Finally, he points to devices in use today for

[393] see chapter VI.2.9 'Polyhedral "Cage Amulets"'

[394] It is a bronze object likewise produced by hollow casting and exhibiting the basic form of a slightly flattened sphere. The surface is furnished with eighteen spherical knobs arranged in such a way that—if one regards the knobs as the vertices of polygons—twenty faces result (twelve triangles, six quadrilaterals, and two hexagons). The triangular and quadrilateral faces are provided with an equal number of perforations, each of the same type. In addition, one of the hexagonal faces has a circular opening to which a swivelling loop with an open ring terminating in animal heads is attached. According to Barb, the ring could have served either to lift the stand out of a vase or to suspend the floral arrangement without a water vessel, "similar to ornamental baskets" (Barb 1957, 103 fig.2; 104, 106 (trans. Guggenberger)). I myself have seen a 'vase' in the form of a glass vessel with five openings at the top and a central suspension device; however, its underside was closed and therefore intended to hold water.

[395] This bronze implement in the Römisch-Germanisches Museum, Cologne (Wallraf-Richartz Sammlungen, inv. no. 308), is also interpreted as a candlestick, but Abramic and Barb describe it as a flower holder (intended to be inserted into a vase). According to Barb, the slits in the conical upper part allowed the flower stems to be passed through, while their angle of inclination could be arranged on aesthetic grounds by selecting the appropriate opening in the top plate for the end of the stem: Barb 1954-1957, 103 fig.4; 108.

[396] cf. e.g. R.Bosanquet, The so-called Kernoi, The Annual of the British School at Athens 3, 1896/1897, 57-61; Barb 1954-1957, 107.

arranging cut flowers, in particular calotte- to hemispherical objects of glass, ceramic, plastic, or metal that display a number of (mostly circular) holes for arranging the flowers.

He is of the opinion that the dodecahedra "satisfy the needs of lovers of cut flowers more ingeniously than any of the devices familiar to me."[397] The hollow space ensures that each individual flower stem or twig can be fixed in the desired inclination by inserting the stem also through an opening of the lower half of the dodecahedron. The dodecahedron "can be used for jugs, cups, and pots, where the little balls can rest within a narrowing neck or on the rim," and is "equally well suited for bowls and dishes, where the little balls ensure better stability on concave or convex domed inner bases." In this connection, he points to the nubs on the rim of the underside that are everywhere usual in glass flower stands.[398] As a final 'indication', Barb adduces [Dodecahedron]Feldberg (Guggenberger No.10). In his view, the 'wax traces' detected in the interior could stem from fastening 'recalcitrant' flower stems, since wax, owing to its insolubility in water, is particularly well suited to that purpose.[399]

In search of an explanation for the distribution area of the dodecahedra and their absence south of the Alps two thoughts occur to him, of which the first—"that the climate

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[397] Barb 1954-1957, 106. (trans. Guggenberger) — cf. the bibliographical references on the arranging of cut flowers and various quotations from the relevant literature: Ibid., 106 fn.12.

[398] Ibid., 106 with fn.13. (trans. Guggenberger)

[399] Ibid., 106 fn.12.

north of the Alps justified a greater appreciation and care for cut flowers than the rich vegetation of the south"—is difficult to comprehend, while the second can at least be put up for consideration. The distribution corresponds 'pretty much' to the occurrence of Gallo-Rhenish sigillata, from which the following consideration arises for him: "Were they perhaps the same firms that, together with the tableware made for a cultivated middle class, also brought onto the market or exported this device—intended primarily for use with such vessels—for the same circles of buyers?"[400] — Down to the present, no one has followed Barb in his interpretation.

That the Romans plaited twigs and flowers into garlands is well known; clay flowerpots are also attested.[401] But they do not seem to have known flower vases that were manufactured exclusively for this purpose[402]—which of course does not exclude the possibility that utilitarian vessels were occasionally used for it.

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[400] Ibid., 106. (trans. Guggenberger) — In this context, I would like to reproduce here verbatim Barb's tribute to the jubilarian Abramic—his article appeared as a contribution to the *Festschrift Abramic*: "It has become a pleasing custom that colleagues weave, for meritorious archaeologists, from their studies (in the ancient manner), wreaths or garlands, 'serta', 'corollae', 'laureae' or 'coronae'. Allow me, from the northwestern edge of the Roman Empire, to place—in spirit—upon the honoured celebrant's birthday table a Gallo-Roman bronze dodecahedron set in a sigillata bowl, adorned with the loveliest spring daffodils [...]." (Barb 1954-1957, 108. (trans. Guggenberger))

[401] so v.Petrikovits 1972, 127 fn.43.

[402] According to H. von Petrikovits, the flower vase as a distinct vessel type did not reach Europe until the 17th century, arriving from East Asia: Ibid., 127.

Apart from these general considerations—which show that the interpretation of the Gallo-Roman dodecahedra as a flower stand is, as Harald von Petrikovits puts it, "hardly substantiated"[403] and rather seems very far-fetched—the find circumstances, and above all the properties of the objects themselves, speak decidedly against it. The partly sharp rims of the openings could very easily damage or kink the flower stems. If the dodecahedron is placed on a flat plate, either the stems can be seen protruding unsightly from openings below, or—if the container is somewhat higher—only a portion of the stand is visible. Finally, it would be entirely incomprehensible why almost all dodecahedra are decorated if, as a flower stand, it is not visible inside a vase at all. Apart from this, dodecahedra have never—not even those from graves—been found inside or on any vessels. Accordingly, it would have to have been a stand for dried flowers; but then, if one wishes to drape the flowers into an attractive bouquet, the stems appear below. Alfons Barb's thesis is best to be filed away.

IV.3.6 Stand for a Rod

Wilhelm Kubitschek (1911) considers it possible that a rod-shaped object was inserted through two opposite openings of the dodecahedron "thereby providing it with better support or stability."[404] He does not, however, express himself more

[403] Ibid., 127. (trans. Guggenberger)

[404] Kubitschek 1911, 238. (trans. Guggenberger)

clearly, since indications for a more precise determination of purpose are lacking.[405]

Kubitschek's thesis becomes somewhat intelligible if one considers that [Dodecahedron]Hof (Guggenberger No.81), on the basis of which he formulates his considerations, is unusually heavy. In addition, this specimen in the 19th century actually served as a stand for Christmas trees (!), "as large as peasant families were accustomed to setting up in their low rooms."[406]

However, as the weight of the majority of the Gallo-Roman dodecahedra shows, this explanatory model is out of the question from the outset.

IV.3.7 Stand for Glass Containers

R. C. Bosanquet (1924), in his discussion of the attempts at interpretation to date, adduces the explanation as a stand for small, slender glass containers (*unguentaria*). From whom this interpretation originates is unfortunately not mentioned.[407]

The ointment vessels without base known from antiquity seem at first virtually to call for a stand; one is unavoidably reminded of test tubes. At a stroke, as in the interpretation as candleholder, two basic problems of the dodecahedron interpretation would be solved: the lack of a norm and the

[405] Ibid., 238f.

[406] Ibid., 238f. (trans. Guggenberger)

[407] Bosanquet 1924, 31; cf. also Wheeler 1930, 110.

constant diversity of the holes; for, after all, each little flask, being mouth-blown, has its individual dimensions, and the fact that opposite holes often have similar diameters would fit this interpretation well.

Stands for vessels are variously known from antiquity. A group of Late Antique small bronze objects in the form of pyramids with triangular and quadrangular bases from Egypt was demonstrably intended as stands for toilet flasks. "In order to stand upright, the small amphora with a pointed base slips into a pyramidal stand."[408] A related holder for vessels is used in Coptic chandeliers of similar date. The arms of the chandelier end in horizontal, perforated metal disks, in which the glass containers for oil and wick, which are pointed below like amphorae, are placed.[409]

It is also interesting that in modern laboratory supplies there are multi-calibre stands, such as the following holder advertised as a 'multi-purpose frame': "A novel patented frame system consisting of a holding bowl that accommodates four rotatable frame inserts. The universal frame inserts are square in cross-section and have different drillings on each of the four

[408] D.Bénazeth, in: Schätze aus dem Wüstensand. Kunst und Kultur der Christen am Nil. Katalog zur Ausstellung hg. vom Gustav-Lübcke-Museum der Stadt Hamm und dem Museum für Spätantike und Byzantinische Kunst, Staatliche Museen zu Berlin-Preußischer Kulturbesitz (1996) 214; cf.214f Nr.221. (trans. Guggenberger)

[409] cf. Ibid., 217 Nr.226.

sides [...]. Depending on which side the frame is placed on, the opposite side can be used."[410]

Against the interpretation of the dodecahedron as a holder for glass containers, however, speak its partly very small openings, the production holes, and the find circumstances; never—not even in [Dodecahedron]Gellep (Guggenberger No.11), which comes from a grave furnished to excess with glass vessels—were glass flasks or the like found in the interior, or even in the immediate vicinity. Furthermore, it must be pointed out that no other stands for Roman glass flasks are known either. Anne Hochuli-Gysel, whose expert opinion I requested, considers this thesis simply absurd: "Why should these little flasks [of the 1st-4th c. AD] need a stand? After all, they were capable of being closed; they could be set down leaning or hung up."[411]

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[410] NeoLab. Labor-Spezialprodukte (Katalog 1996/97) 200. (trans. Guggenberger)

[411] Kind information from Anne Hochuli-Gysel (letter 9.4.1999 (trans. Guggenberger)).

IV.4 Measuring Instrument

The interpretation of the dodecahedron as a measuring instrument already looks back on a long tradition and has stubbornly held out down to the present; most recently such a connection was supposed by M. Hartmann in 1983,[412] B. Pinsker in 1994,[413] and R. Dollinger in 1996.[414]

The many functions assigned to the Gallo-Roman dodecahedron as a measuring instrument were—like those as a stand—almost always prompted by the difference in hole sizes, but are, in the individual proposals, quite varied.

IV.4.1 Gauge (general)

Léopold Hugo was probably the first to consider and set down in writing an interpretation in this direction. In 1873, the gauging device seems to have been his favoured thesis, for he writes: "it is difficult not to regard them as metrological objects, as gauges [...]."[415]

Before the year 1892, Riegel, with reference to [Dodecahedron]Braunschweig (Guggenberger No.9), which shows a 'keyhole-like' enlargement of one opening, suggests seeing in it a multi-calibre gauge for cylindrical objects.[416] Independently of

[412] 'surveying purposes': Hartmann 1983, 23.

[413] Pinsker 1994, 247.

[414] Dollinger 1996, Nr.208.

[415] Hugo (C.R. 76) 1873, 420. (trans. Guggenberger)

[416] after Conze (Westdt. Z.) 1892, 208.

this, at the same time, Arthur Smith expresses something similar, invoking the locksmith of the British Museum, who "had declared the identification as a 'gauge key' to be beyond doubt."[417]

Alexander Conze (1892), who reports the two foregoing opinions of his colleagues, likewise favours the interpretation discussed in the Archaeological Society of Berlin alongside the dice theory; he speaks of a thickness-measurer for cylindrical bodies of different circumferences.[418] Alard du Bois-Reymond, an engineer whose opinion he sought on the matter, endorsed the theory and, as Conze relates, justified his agreement as follows: "Instruments of this sort are in use by manufacturers in all branches of manufacture and trade, in extraordinarily diverse forms; their use is an essential condition for all kinds of mass production; precisely because of the great variety of uses, however, the question as to the specific purpose for which a device of the kind indicated served cannot always be answered. There are therefore no decisive objections to the explanation advanced—namely, that it is not understood why, in the round openings on the same specimen, some, and not always the opposite ones, are the same size, and that the different sizes are not, for example, indicated by numbers."[419] Conze then recalls, in support of the gauge theory, the 'keyhole-like'

[417] so Ibid., 208. (trans. Guggenberger)

[418] Ibid., 208f.

[419] The engineer points to Hoyer's *Lehrbuch der vergleichenden mechanischen Technologie* 1 (Wiesbaden 1888) 60f, where various types of gauges are illustrated: so Conze (Westdt. Z.) 1892, 209; cf. Conze 1892 (AA 7) 25. (trans. Guggenberger)

enlargements of [Dodecahedron]Braunschweig as well as [Dodecahedron]Windisch (Guggenberger No.9 and No.90).[420]

Use as a gauge seems next to É. Dunant (1900)—alongside that as gaming dice—the most plausible,[421] and likewise to H. Vulliéty.[422] In W. Page (1908) this interpretation is cited as probable.[423] Amandus Weiss (1975) also names this function alongside other uses to be discussed below,[424] and Hannsjörg Ubl likewise suggested to me the possibility of an interpretation as a gauge.[425]

Although gauges, to my knowledge, are not known from ancient contexts and only since the Industrial Revolution have gained greater significance,[426] it nonetheless seems basically plausible that ancient craftsmen also used such, in part very simple, measuring devices. In principle, the Gallo-Roman dodecahedra are suitable as gauges, though not for generally valid standardisations, since each individual specimen, by virtue of its different hole sizes, as it were, represents its own system.[427] A function as a gauge for individual use thus remains.

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[420] Conze (Westdt. Z.) 1892, 209; cf. Conze 1892 (AA 7) 25. — cf. chapter II.7 'Traces of Use'

[421] Dunant 1900, 60.

[422] Vulliéty (around 1900), 60 fn.1.

[423] gauge-key for measuring metal rods: Page 1908, 192.

[424] Weiss 1975, 221.224.

[425] H.Ubl (letter 2.2.1999).

[426] cf. F.Feldhaus, Die Technik der Vorzeit, der geschichtlichen Zeit und der Naturvölker (1965) 614f.

[427] "Where would the 'control of standards' be in that case?" (Kolling (Homb. Z.) 1987, 4 (trans. Guggenberger)); cf. Erman 1894, 17.)

However, all purposes are implausible here that could equally well have been fulfilled— and in a decisively simpler way—by a simple metal plate with corresponding openings.[428] One would therefore have to assume that the pairs of holes were used together, for example as 'go' and 'no-go' sides. Unfortunately, this possibility too must be excluded, since the respective diameters of a pair of holes, taken as a whole, show deviations that are too great, so that use would be possible only in a few cases.

Should conical bodies then be standardised or measured? Here again, the strict restriction to the complicated dodecahedron form remains incomprehensible, for a simple cube with two openings per face—or even two parallel-mounted plates—would have served the same purpose. Moreover, irregular production holes are unusable as gauge holes. Hugo meets the problem by inserting a rod as a handle through these openings;[429] thereby, however, the gauge holes can only be used one at a time, so that one ends up again at the starting problem. Finally, the lack of order in the distribution of the holes or pairs of holes—which runs counter to all gauges known to me—is incomprehensible and makes the absence of any labelling all the more problematic.

For all these reasons, I find myself compelled to reject all interpretations as a gauge—however enticing the original idea was.

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[428] cf. e.g. de Saint-Venant 1907, 23-25.

[429] Hugo (C.R. 76) 1873, 420.

Some scholars went into greater detail with their interpretation of the Gallo-Roman dodecahedron as a gauge. Many of the arguments that speak against the following theses overlap with those just stated and therefore need not all be repeated.

IV.4.2 Gauge Device for Coin Blanks

Léopold Hugo (1873) for a time considered it quite conceivable that the differently sized holes of the dodecahedron, provided with a handle, might have served to standardise coin blanks or flans (*flans monétaires*). He bases this on observations he made on two specimens of type 1a, [Dodecahedron]Paris-Durand 1 and [Dodecahedron]Paris-Durand 2 (Guggenberger No.45, No.46).[430]

Alongside the missing standards of the holes, the most important arguments against Hugo's attempt at interpretation are the *in situ* contexts and find spots, and the lack of any indication of mints.[431]

[430] Ibid., 420.

[431] cf. Erman 1894, 17 fn.2.

IV.4.3 Gauge for Weapons Manufacture

Inspired by Hugo's interpretation of the dodecahedra as a calibre-measuring device, the 'commissaires' of the Academy of Sciences whom he consulted for his contribution hit upon the bold idea that the dodecahedra might have been used in the production and maintenance of firearms, either in fifteenth- or sixteenth-century Europe or else in China.[432]

Since some Gallo-Roman dodecahedra come from Roman military sites, H. Erman (1894) likewise asks at first whether these specimens might not have been used as measuring instruments in the manufacture of weapons—albeit of ancient date—only to qualify his statement immediately because of the lack of standardisation in the openings.[433]

The production of weapons for the Roman army was centralized only from the 4th century AD; before that, the army's need for weapons was covered by local *fabricae* in the forts or by civilian workshops settled in the vicinity.[434] That means, at the same time, that the form and appearance of the weapons were not subject to overly strict standards, and the differences in the openings from one dodecahedron to the next can hardly be adduced as an argument against this interpretation.[435] The

[432] Hugo (C.R. 76) 1873, 420 fn.2.

[433] Erman cites four dodecahedra in this context, [Dodecahedron]Feldberg, [Dodecahedron]Wiesbaden, [Dodecahedron]Carnuntum 1, [Dodecahedron]Windisch (Guggenberger No.10, No.25, No.78, No.90): Erman 1894, 17 with fn.1.

[434] B.Gralfs, Metallverarbeitende Werkstätten im Nordwesten des Imperium Romanum, Antiquitates 8 (1994) 47-49.

[435] but cf. de Saint-Venant 1907, 24.

objections remain essentially the same as those that already speak in principle against the interpretation as a gauge.

IV.4.4 Measuring Device for Finger Rings

A. J. Reinach (1908) thinks of its use as a calibre-measuring device related to that used by jewellers.[436] A. de Ridder (1915) likewise mentions the interpretation as a jeweller's gauge.[437]

Was the Gallo-Roman dodecahedron here to serve as an aid for determining a customer's finger circumference? In any case, Kolling lists the explanation as a "calibre for manufacturers of finger rings."[438]

This use is already excluded by the diameters of the holes observed on the dodecahedra.

IV.4.5 Instrument for Making Lurs

With the aid of the holes in the Gallo-Roman dodecahedron, mouthpieces for lurs were claimed to have been made. This can only be understood to mean that the dodecahedron supposedly served to standardise the mouthpieces of these curved brass wind instruments.

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[436] Reinach 1908, 147; mentioned as well: Boucher 1980, 91.

[437] "jewellers' gauges": de Ridder 1915, 33.

[438] Kolling (Homb. Z.) 1987, 4; cf. Greiner 1996, 15 with fn.36. (trans. Guggenberger)

As adventurous as this attempt at interpretation may appear, it finds a place in the literature in the context of a list of interpretations already voiced. The advocate of this thesis, advanced before 1987, remains unnamed.[439]

Since the lurs belong to the Nordic circle of the later Bronze Age (13th–7th centuries BC), this thesis—even as Kolling[440] emphasises—is entirely untenable on cultural and chronological grounds alone, though it is at least an enrichment for the collection of curious interpretations.

IV.4.6 Gauge for Surveying and Calibrating Water Pipes

Henri Michel (1921) subjects [Dodecahedron]Besançon (Guggenberger No.30) to precise measurements and comes to the conclusion that the openings and concentric circles can be brought into accord with Roman units of measurement. From this he infers that it is a measuring instrument of a Gallo-Roman official for the calibration of water pipes.[441]

In fact, water distribution in the Roman Empire was precisely regulated. The responsible official could determine a consumer's water usage on the basis of the diameter or the cross-section of the intake nozzle of the freshwater line. This standardised bronze orifice (*calix*) was usually set directly into the wall of a water basin, with the supply line connected to the

[439] Kolling (Homb. Z.) 1987, 4.

[440] cf. Ibid., 4.

[441] see Michel 1921, 135-138.

outlet side of the nozzle.[442] Michel now assumes that, in order to determine the aperture width, a conical wooden rod was inserted first into the nozzle and then into a hole of the Gallo-Roman dodecahedron.[443] The drill bits for the nozzle, too, could have been checked with the dodecahedron.[444] Furthermore, he imagines that, with the aid of a compass and on the basis of the concentric circles, the lead sheets from which water pipes were bent—and were in fact standardised according to the width of the sheet[445]—were measured.[446]

Against this one must first object that—not to mention the diameters—not all dodecahedra display concentric circles. Why, moreover, should the same hole size occur more than once on a single dodecahedron? And finally, precisely here standardised and labelled openings and circles would be indispensable.[447] There is no need to go further into detail to be able to exclude this interpretation.

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[442] cf. J.Landels, Die Technik in der antiken Welt (1989) 59-68; cf. also Nouwen 1993, 63.

[443] Michel points out that such an instrument was still in use in France in the 19th century: Michel 1921, 138.

[444] Michel 1921, 137f.

[445] cf. Tabelle bei J.Landels, Die Technik in der antiken Welt (1989) 52f.

[446] Michel 1921, 138.

[447] cf. Charrière 1965, 149; Nouwen 1993, 63.

IV.4.7 Drawplate for Hinges

As Hans G. Hartke informs me, Frank Willer recently suggested, on the occasion of the restoration of one of the Gallo-Roman dodecahedra from Bonn, the possibility of its use as a goldsmith's hinge-drawing device.[448]

The modern drawplate is "a plate of high-grade steel in which holes are arranged, their sizes diminishing evenly from one hole to the next."[449] When drawing hinges, the load on the tool may possibly be lower than in the manufacture of wire, but the rims of the openings in the dodecahedra are decidedly too thin for this use as well.

IV.4.8 Distance-Measuring Instrument

"The pentagonal dodecahedron of the Museum Carnuntum is one of the oldest geodetic instruments; it offers a surprising insight into the measuring methods of engineers on the Danube limes."[450] It is Friedrich Kurzweil (1957), himself an engineer, who, after thorough investigations of [Dodecahedron]Carnuntum 1 (Guggenberger No.78), arrives at this fascinating conclusion, which at first seems convincing. He observes on this Gallo-Roman dodecahedron that those pairs of holes whose

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[448] Kind communication from Hans Georg Hartke, conservator at the Rheinisches Landesmuseum Bonn: H.Hartke (letter 11.6.1997).

[449] E.Brepohl, Theorie und Praxis des Goldschmieds (1994) 181. (trans. Guggenberger)

[450] Kurzweil 1957, 25. (trans. Guggenberger)

diameters can be determined fairly exactly stand in quite special relations to one another; for three pairs of holes this is (approximately) the case.[451] If one forms, from the differences in diameter and the internal distance of opposite faces, the quotients, there result "decimal integer values of the reciprocal of these quotients": 1:10; 1:20; 1:40.[452]

A distance measurement can now be carried out as follows: "Let it be the task to set out, from a point A in the direction of B, a stretch of 40 cubits. The surveyor sends a helper with a measuring rod (M) one cubit long, which he holds horizontally at eye level, in the direction of B; the surveyor himself stands over A and looks through the dodecahedron in such a way that the ratio of 1:40 corresponds to the drillings in the line of sight, then brings the hollow body to that distance from the eye at which both apertures lying one behind the other appear the same size; [...] he now keeps this distance from the eye constant. [...] Then he guides the helper with the measuring rod so that it fits exactly within the field of view of the dodecahedron; the distance from the observer's eye to the helper is then precisely forty times one cubit."[453] In the same way, it is also possible, using this method, to measure an

[451] The largest pair of openings is exceptionally irregular. From this, Kurzweil infers a subsequent addition, without commenting on its purpose (Kurzweil 1957, 24).

[452] Ibid., 24. (trans. Guggenberger) — "The ratio formed by the difference in the hole diameters and the internal distance between the holes is, by a simple proportion, equal to the ratio of the length of a measuring rod as sighted across the hole edges to its distance from the observer's eye.": Mauel 1961, 14. (trans. Guggenberger)

[453] Kurzweil 1957, 24. (trans. Guggenberger)

unknown distance; in that case, however, one needs a staff with a scale rather than a simple measuring rod.

To facilitate measurement, Kurzweil proposes two auxiliary means: a pole on which the dodecahedron rests, i.e., a tripod, and a cord that can be stretched between the observer and the respective viewing holes in order to be able to maintain more easily the required distance between eye and measuring instrument.[454] Thus, with the Gallo-Roman dodecahedron, "distances could be measured or set out very quickly and without using long measuring tapes."[455]

Kurzweil's interpretation met with lively approval until very recent times. C. Swinnen (1961) fully adopts it in content;[456] K. Mauel (1961) checks Kurzweil's detailed calculations on [Dodecahedron]Bassenge and [Dodecahedron]Tongeren (Guggenberger No.2 and No.4). Although these dodecahedra do not yield such neat, integral magnification ratios, he sees the interpretation as a distance-measuring instrument confirmed. Otherwise, he throws into the discussion that in those cases where the pairs of holes require a distance of the observer's eye from the 'objective' that exceeds arm's length, the dodecahedron could just as well have been set down.[457] E. Swoboda (1958, 1964)

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[454] Ibid., 24. — Kurzweil draws attention to wall paintings in Egyptian royal tombs in which people are 'frequently' depicted holding staffs with bands of varying length and a 'spherical, knob-like object' at the upper end, though he is himself uncertain whether these figures represent land surveyors: Ibid., 25.

[455] Ibid., 24. (trans. Guggenberger)

[456] Swinnen 1961, 17.

[457] Mauel 1961, 14.

also follows Kurzweil's exposition in his description of Carnuntum: a "geodetic instrument of the military and civilian surveyors (*mensores*)."[458] R. G. Collingwood / I. Richmond (1969) concur.[459]

After his own measurements of [Dodecahedron]Tongeren (Guggenberger No.4), Pierre Méreaux-Tanguy (1975) comes to the same result. This method, he says, allows much more precise (!) and faster measuring than was ever possible with conventional aids such as measuring rods or measuring tapes. He expressly points out, furthermore, that for measurement it is not the hole sizes themselves but the size differences of opposite holes and their distance from one another that are decisive.[460] As merely curious, however, one must designate his explanation for the distribution area and frequency—he knows of 53 specimens; Méreaux-Tanguy speculates that the dodecahedra could have been produced in only a strongly 'limited edition' for a small elite circle of designers and surveyors who used a "geometry based on the pentagon."[461]

According to Amandus Weiss (1975), this measuring instrument was useful above all for distances that are difficult to measure (e.g., across rivers and ravines). As a counterpart to the dodecahedron, he envisages a measuring rod with an adjustable marker. To underpin his view, he undertakes further calculations on other Gallo-Roman dodecahedra and claims to

[458] Swoboda 1958, 87 (trans. Guggenberger); Swoboda 1964, 95.

[459] Collingwood/Richmond 1969, 316.

[460] Méreaux-Tanguy 1975, 29-31.

[461] Ibid., 30. (trans. Guggenberger)

recognize new magnification scales: 1:12, 1:24, and 1:36. "In many dodecahedra [...] it can be established that they exhibit continuous measures of half a *scrupulus* each. [...] As a rule, a closed measuring range is mostly encompassed, i.e., for example from ½ to ¾ of an inch," reports Weiss.[462] Marking, he says, was effected by the partially coloured (!) concentric circles and ring-and-dot motif.[464]

Beyond this he thinks he can recognize, in two bronze objects previously interpreted as candlesticks, tripods for dodecahedra; in his opinion they would have proved 'almost ideal' for the purpose. "The upper part of the stand can be tilted slightly to the left and right by means of a kind of ball joint. Through the slit present [...] a rod could be inserted that certainly bore markings enabling the rapid adjustment of the distance, required in each case, from the eye to the pentagonal dodecahedron."[465]

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[462] "With a magnification factor of 12 and the use of the 10-foot rod, the result is precisely 1 actus at 120 feet [...]. The pentagon-dodecahedron from Aventicum [= [Dodecahedron]Avenches, Guggenberger No.86], for example, exhibits, among other values, the magnifications 12 and 24. Thus, the street intervals of 2 and 3 actus in that city could have been staked out quite effectively.": Weiss 1975, 223. (trans. Guggenberger)

[463] He calculates a *scrupulus* as measuring 1.03 mm. [Dodecahedron]Elst (Guggenberger No.75), for example, represents the continuation of the *scrupulus* series of [Dodecahedron]Hartwerd (Guggenberger No.76): Weiss 1975, 221.

[464] Weiss 1975, 221.

[465] Ibid., 222. (trans. Guggenberger) — Weiss alludes to two 'exactly identical' bronze objects which he claims to have seen in the Museum Carnuntinum (there described as candlesticks from the legion)

Even within the last years, further authors have joined the thesis introduced by Kurzweil. For E. Vorbeck (1982) it is "an indispensable instrument for the *agrimensores*,"[466] and A. Mutz (1983) speaks of a 'surprisingly versatile' and 'sophisticated' measuring and sighting device.[467] Reinhard Dollinger (1996) states, in an auction catalogue, the intended purpose of [Dodecahedron]Wien (Dorotheum, Guggenberger No.94) quite as a matter of course as an "instrument used by the military and civilian surveyors (*mensores*) for surveying roads and plots."[468]

The theory of the distance-measuring instrument is to be rejected. Already the occurrence in a woman's grave—to which Nouwen, among other things, points as an argument[469]—is a first indication against the interpretation. One would also expect that this device would have come into use in other parts of the Empire. Precisely in military land surveying the Gallo-Roman dodecahedron should actually have spread rapidly. Despite the numerous finds from military areas this did not happen. Furthermore, one would expect depictions—for example, on tombstones—of so essential and representative an instrument for the land surveyor.

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[466] Vorbeck 1982, 22. (trans. Guggenberger)

[467] Mutz 1983, 6.

[468] Dollinger 1996, Nr.208. (trans. Guggenberger)

[469] Nouwen 1993, 72.

Dodecahedra have always been found without accessories; the two bronze objects cited by Weiss can scarcely be considered as stands for that reason alone. Mounting on a wooden pole that has not survived is, again, unthinkable, because on the one hand the dodecahedron would have to be firmly fixed, and on the other hand the rod could be inserted through only one hole so as not to obscure the line of sight—above all because in that way the 'objective' cannot be tilted vertically.

If the problems that arise in connection with a tripod still constitute a relatively weak argument against use as a distance-measurer, the lack of marking of the individual openings must be named as a more cogent objection. With the naked eye, the pairs of holes can hardly be distinguished; and, after all, ancient measuring instruments were marked and labelled.[470]

Finally, this attempt at interpretation must be filed away on account of the openings themselves. The measurements known from further Gallo-Roman dodecahedra in no way confirm the observations made on some few specimens. New magnification scales turn up constantly and the observer's eye would, in the case of some pairs of holes, have to assume an extremely great distance from the 'objective' in order to be able to bring the circles into alignment, such that the surveyor not only could no longer hold the dodecahedron in his hand, but would truly have to be endowed with an eagle's eye.[471] In this

[470] cf. Thompson 1970, 95; Allason-Jones/Miket 1984, 218; Nouwen 1992, 40; Nouwen 1993, 72.

case in particular, usable results are impossible, but they are also difficult to obtain in general, since aids comparable to the rear-and-fore-sight principle are lacking to bring the openings into alignment. Furthermore— even if one does not take the pairs of production holes into account—it is (today) possible for hardly any opening to determine the diameter completely exactly, so that the person measuring the given hole retains a leeway to set the measures so that the desired round ratios are more readily achieved. In [Dodecahedron]Carnuntum 1 (Guggenberger No.78), for example, that, according to Kurzweil's measurement, would already require a distance of 3.2 m for one pair of holes, the measurements given by Greiner would make these two holes identical in size and therefore make distance measurement impossible.[472]

The apparently momentous numerical ratios are thus obviously a coincidence—influenced by 'skilled measuring.'

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[471] cf. Greiner 1996, 16. — Barb had already voiced initial misgivings, since the measurements of Hof, which he employed for a comparative calculation, yielded entirely different proportional values (Barb 1954-1957, 109). Pirling refers to experiments carried out by "archaeologists of the Saalburg Museum near Bad Homburg with a 'pentagon-dodecahedron' found there [= [Dodecahedron]Feldberg, Guggenberger No.10], which, however, did not produce the desired results (Pirling 1984, (trans. Guggenberger)). — cf. also Thompson 1970, 94f; Kolling 1984, 250; Allason-Jones/Miket 1984, 218; Nouwen 1992, 40; Nouwen 1993, 73.

[472] cf. the measurement tables appended to this study. — Thompson 1970, 95; Nouwen 1993, 72. — [Dodecahedron]Goodrich Castle (Guggenberger No.63), with its uniformly sized openings (if true), would of course have to be disregarded entirely.

Yet the ancient surveyors did know an instrument with which distances could be determined without pacing out the line to be measured with measuring rods or the like: the *dioptra*.[473] This device, simple in principle but in some forms extremely versatile, has over the 'Kurzweil device' the essential advantage that it can also establish the distance or height of completely inaccessible points and the distance between two inaccessible points.[474] In principle, the *dioptra* corresponds to the *theodolite* still in use today, only in that the optics could be decisively improved here thanks to the magnifying lens that was added. Until the invention of the *distomat*, distances were thus determined by means of angles and auxiliary lines.

IV.4.9 Astronomical Surveying Instrument

Closely related to the thesis of the terrestrial measuring device is the interpretation of the Gallo-Roman dodecahedron as an astronomical surveying instrument. Considerations in this direction are likewise put forward by Friedrich Kurzweil (1957), but he arrives at the following result:

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[473] "[...] strictly speaking, the sighting tube; in a broader sense, also an instrument equipped with one opening or with several corresponding openings, designed for sighting." (F.Hultsch, Dioptra, RE V 1 (1903) 1073. (trans. Guggenberger))

[474] cf. G.Couquer/F.Favory, Les Arpenteurs romains. Théorie et pratique (1992) 75 f; J.-P.Adam, Groma et chorobate. Exercices de topographie antique, MEFRA 94, 1982, l004f; F.Hultsch, Dioptra, RE V 1 (1903) 1073-1076.

"Use [...] for astronomical purposes seems to be excluded, because precise aiming at distances is possible only with sufficient illumination, which is lacking at night."[475]

That Kurzweil takes this objection to be an exclusionary argument is strange, for bringing the two openings into alignment and aiming at a nocturnal target is the least of the problems.[476] How else could the night sky ever have been surveyed with the aid of an astronomical *dioptra*?[477]

More telling than Kurzweil's 'exclusionary reason' are those arguments that already make the interpretation as a 'terrestrial' distance-measuring instrument impossible.

IV.4.10 Standard Measure for Lengths

For [Dodecahedron]Carnuntum 1 (Guggenberger No.78) Friedrich Kurzweil (1957),[478] alongside the function as a distance-measurer, claims to have recognized an additional possible use of the Gallo-Roman dodecahedron that is not based on the relations of hole sizes but on the distance of the knobs from one another.

If the dodecahedron is held in the measuring position he describes, the 20 vertices of the body, and with them the knobs

[475] Kurzweil 1957, 25. (trans. Guggenberger)

[476] By means of a tube mounted on the dodecahedron, which would also serve as a spacer, the act of sighting could have been facilitated.

[477] cf. F.Hultsch, Dioptra, RE V 1 (1903) 1078.

[478] Kurzweil 1957, 25.

attached there, form four vertical planes parallel to one another. Each face thus comprises five knobs. The fact that the distance of the two middle planes from one another is 12 mm—which would correspond to the difference between the Attic and the Roman foot—he does not regard as a coincidence, but as intended from the outset.

"The knobs would thus have served "to enable one, at any point in the terrain, without having to carry rulers or measuring tapes, to produce any multiples of Attic or Roman units of measurement."[479]

This interpretation far surpasses that of the distance-measuring instrument in boldness. Apart from the fact that the dimensioning of the Gallo-Roman dodecahedron in this case would have to be based on a highly complicated mathematical calculation,[480] one can hardly imagine a more cumbersome and imprecise substitute for a ruler.

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[479] Kurzweil 1957, 25. (trans. Guggenberger) — "The difference could serve, in fact, as a basic unit for making adjustments to Greek or Roman measure according to the part of the empire, the surveyor might happen to be working in!" (Thompson 1970, 94.)

[480] see Kurzweil 1957, 25.

IV.4.11 Angle Measurer

Amandus Weiss (1975)[481] links to his main thesis of a calibre-measuring instrument and a distance-measuring instrument the conjecture that the Gallo-Roman dodecahedron could also have been used to determine fixed angles, as a direction indicator.

For this, the dodecahedron was to be placed on a tripod through a pair of holes such that one face lay horizontally on top, and then a sighting rod was to be laid against the knobs. Any desired direction—at intervals of 10 grade (gon)—was thus to be determinable: "On numerous Roman city plans," says Weiss, "it can be demonstrated that the various orientations—e.g., of streets, temple axes, forums, theatres, city walls, etc.—can be measured with the 400 gon division and fit into a 10 gon, or mostly 20 gon, division."[482]

The dodecahedra are not suitable for this purpose. Precise angles cannot be measured partly because of the very large knobs, which are only approximately evenly shaped and moreover not very precisely attached. Beyond that, the pentagons themselves sometimes deviate relatively greatly from the regular form.

For laying out the *limites*, the orthogonal grid of land division, the Roman *agrimensores* primarily used the *groma*,

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[481] Weiss 1975, 223f.

[482] Weiss 1975, 223f. (trans. Guggenberger)

which was entirely adequate[483] for this purpose and simple to handle.

Apart from the far more complicated but also more versatile—because tiltable—*dioptra*, other sighting instruments also appear to have been in use to determine fixed angles.[484]

IV.4.12 Standard Weight

Amandus Weiss (1975)[485] also tries to establish a connection to ancient systems of weight. Some Gallo-Roman dodecahedra, namely [Dodecahedron]Elst and [Dodecahedron]Hartwerd (Guggenberger No.75 and No.76), he says, also fulfilled the function of a standard weight. According to his information, these two pieces weigh 370 and 185 grams, and thus the Attic pound is fixed in them.

Assigning the function of a weight to the dodecahedron is reminiscent of small solid metal polyhedra which Ferdinand Lindemann already lists as weights, as well as of Beat Rütti's considerations tending toward a corresponding interpretation of a rhombicuboctahedron of glass in Oberwinterthur.[486]

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[483] With the aid of the *groma*, only right angles can be measured.

[484] cf. A.Günther, Römisches Landmesserinstrument aus Koblenz, Germania 15, 1931, 271f. (I am grateful to Bernhard A. Greiner for the bibliographical reference.)

[485] Weiss 1975, 221f.

[486] see chapter VI.2.6 'Small, Unpierced Polyhedra without Inscriptions or Decoration'

As far as the dodecahedron is concerned, one can vividly imagine how laborious it would have been to balance the weight precisely with the aid of the knobs. Beyond that, the two weight figures given by Weiss remain dubious. The values published by Robert Nouwen, at 326 and 140 grams, deviate extremely from these. It seems quite plausible that here an 'original' weight was simply reconstructed 'exactly.' Apart from that, the weight statistics of the Gallo-Roman dodecahedra, despite various damages to individual pieces, sufficiently prove that there can be no talk of a standard.

IV.4.13 Universal Planning Instrument

In the sense of universally deployable measuring instruments, Amandus Weiss (1975)[487] imagines that the Gallo-Roman dodecahedra were used both as a gauging measure and as distance and angle measurers and, additionally, in individual cases as a standard weight.

Uniting these very different uses in a single device, Weiss says, would have been a 'significant invention.' In this respect, he is right.

In contrast to other theses, in the universal planning instrument the absolutely necessary exactness of all measures (opening sizes, edge lengths, angles, weight) is an extreme aggravating factor. That would indeed be a good argument for

[487] Weiss 1975, 224.

the special shape of the measuring instrument and would help to explain why a device so elaborate to manufacture was produced many times; but the interpretation can already be refuted on the basis of the individual functions.

IV.5 Calendar

IV.5.1 Agricultural 'Sun Calendar'[488]

G. M. C. Wagemans (1996, 1997)[489] proposes a function that again moves in the direction of measuring instruments. He believes he can demonstrate that the Gallo-Roman dodecahedron was used as a solar measuring device with which one could measure the position of the sun in spring and autumn and thus determine a fixed date. The device, he says, was employed in agriculture in order to increase harvest yields.

Primarily, it served to determine the time for sowing winter grain. Wagemans sees his view confirmed by the distribution area of the dodecahedra, for precisely because of the harsher winters in central and northern Europe the timely sowing is of decisive importance there. In his view, other

[488] A vague resemblance between the basic form of the dodecahedron and 'polyhedral' sundials ("resembling one of the old polyhedron [or many-sided] sundials") is already noted in the 'extracts from the museum catalogue' (Museum in Carmarthen?) communicated by H. Kingsford and reproduced by Evans (1923): Evans 1923, 57.

[489] Wagemans 1997, 159-172; cf. Wagemans 1996, 199-207.

agriculturally relevant dates in spring could also have been calculated.[490]

The determination of the date is to be imagined as follows: the dodecahedron is placed outdoors on a horizontal support. On sunny days, at noon—i.e., at the time of the highest position of the sun—it is checked whether, and through how many pairs of holes of the dodecahedron, light passes. For this purpose, they are, in turn, aligned toward the sun. The first determinable date in autumn is the day on which, for the first time, a ray of sunlight finds its way through one of the pairs of holes; the last is that day on which the sun is already so low that, for the first time, light passes through all the pairs of holes. In spring the situation is exactly the reverse, owing to the increasing angle of the sun's rays to the earth.

In accordance with the six different pairs of holes, in theory six measurements could be carried out in each case. Wagemans, however, excludes the largest pair of holes (the production holes), whereby the measuring period would theoretically extend to at least five consecutive days in each case.[491] For most Gallo-Roman dodecahedra, however, he calculates significantly longer periods. In some specimens, the first and last measuring point would lie more than a month apart. The measuring ranges of all dodecahedra considered by Wagemans fall—relative to the latitude of the findspot—within the period between March 4 and May 1 and between August 12

[490] Wagemans 1997, 162.

[491] Wagemans 1997, 166.

and October 9. As the basis for these calculations, he used the hole diameters given by Nouwen.[492]

When one of the angles of incidence recorded on the dodecahedron is reached by the sun, the date can be determined on the basis of a table that contains, for the corresponding latitude, the maximum solar angle on the relevant days of the year.[493]

At [Dodecahedron]Elst and [Dodecahedron]Hartwerd (Guggenberger No.75 and No.76) Wagemans undertook experimental control measurements. Because of the imperfect form of the dodecahedra—not all five knobs of the base face are simultaneously in contact with the support—there resulted, as could hardly be otherwise expected, in part considerable deviations from the 'ideal' calculations. Moreover, in practice significantly more than six or five measuring results per dodecahedron are possible.[494] Nevertheless, in the end he assumes—relatively arbitrarily—that only ten measuring positions were intended per dodecahedron.[495] According to the theory, that seems most plausible to him, the knobs may have

[492] Wagemans himself, however, concedes the following: "The calculation assumes a perfectly regular body in which the small spheres are attached in such a way that the dodecahedron stands horizontally. In practice, this will probably not be the case [...]." (Ibid., 160. (trans. Guggenberger))

[493] Wagemans 1997, 160.

[494] cf. Ibid., 165-167.

[495] see Ibid., 169.

served, when calibrating the device, to make corrections (by filing down the little feet).[496]

Wagemans reckons that it was only a matter of determining a single day within the measurable period, namely the last. The preceding measuring days were relevant only because one could never be sure whether the sun would shine on the decisive day. Thus, further possibilities were taken into account to determine the date indirectly. In doing so, he assumes that the measuring days were (intentionally) evenly distributed over the measuring period.[497]

The fact that the calculable dates of the individual dodecahedra in part differ greatly from one another Wagemans explains by different climatic conditions and agricultural soils. For each region, the time of sowing was, he says, determined separately by persons of higher status at central places such as temples, military camps, and *villae rusticae*.[498]

The icosahedron from Arloff is used to underpin his hypothesis, for he supposes an analogous use, only that here the measurement was carried out with the aid of the twelve

[496] Ibid., 168.

[497] Wagemans 1997, 161.169.

[498] For this reason, Wagemans also considers it unlikely that a specific feast day was meant to be calculated with the aid of the dodecahedron. In his view, the measuring periods of the individual specimens differ far too greatly from one another for him to posit a single date of religious significance: Ibid., 163.

knobs—whose measurements, however, are not known to him.[499]

The method of date determination proposed by Wagemans seems—also considered in the ancient context—extraordinarily cumbersome; moreover, the calendar function is restricted to a few days of the year. What purpose would a narrowly seasonal sun calendar serve in a society in which the Julian calendar—differing hardly at all from the solar year—must already have been known—calendars being posted publicly in many places—and water clocks and sundials (*horologium solarium*) with pointer (*gnomon*) had long been set up in publicly accessible places and used in the military sphere,[500] and in which plug-in calendars for domestic use and— in higher circles— increasingly from the 3rd century AD[501] 'pocket sundials,' in part conceived as travel clocks with settings for different latitudes, were used?

Wagemans speculates on the simplicity, lack of education, and traditional orientation of the rural population. The economically best time for sowing, he says, was made known to the peasants by the great landowner in the context of traditional religious ceremonies, detached from the unfamiliar, unpopular, and confusing Julian calendar.[502] That this attempt at

[499] Ibid., 164; Wagemans 1996, 205f.

[500] cf. K.-W.Weeber, Alltag im alten Rom (1998) 376f. — It should be emphasised that numerous dodecahedra have been discovered at military installations, where they were evidently also employed.

[501] cf. Ibid., 377.

[502] Wagemans 1997, 163.

explanation cannot convince is something even Wagemans himself is aware of: "It should be clear that, in order to provide a well-founded and unambiguous explanation of why this form of date determination was used alongside the Julian calendar, further work from various academic disciplines is still required."[503]

Why was not simply a traditional Celtic calendar comparable to the calendar of Coligny[504]—probably used by Druidic circles—adopted and the 'right time' proclaimed with its help? Why should one choose precisely the most cumbersome and most error-prone method for this purpose? Poorly worked or slightly off-centre openings, an unsteady footing on account of the knobs, and an imprecise geometric basic form constitute— as Wagemans himself admits[505]—considerable

[503] Ibid., 163. (trans. Guggenberger)

[504] The bronze calendar of Coligny (c. late 2nd century A.D.) is to be understood primarily as a monument of traditional Celtic culture with religious relevance. It records a lunar cycle of five times twelve months, which was aligned with the course of the solar year through the insertion of two intercalary months; as a result, however, it exceeds a span of five years in our modern reckoning by a considerable margin. "In comparison with the Julian calendar, which had already been in force in Roman civil life for more than 200 years at that time, the Gallic calendar of Coligny is decidedly archaic. Its use can be explained only if we think of 'national-Celtic' producers and users, and for this the most likely candidates are, of course, circles of druids. They are the ones to whom one could most readily attribute the speculative element inherent in a calendar." (H.Birkhan, Kelten. Versuch einer Gesamtdarstellung ihrer Kultur (1997) 789f (trans. Guggenberger); cf. 786-790; cf. Charrière 1965, 152.)

[505] cf. Wagemans 1997, 160.165.

sources of error. If it was only a matter of announcing the sowing date, it would have sufficed for the landowner first to note the date on his accurate calendar. This form of use of the Gallo-Roman dodecahedron is simply impossible.

Was the actual process of date determination therefore carried out within a religious framework before the assembled populace in order to make the position of the sun, and thus the important date, clearly visible to them?[506] In that case one would surely, first, have built much larger (clearly visible) measuring instruments and, second, functioning instruments of a mysterious shape that spared one the embarrassment of a public mismeasurement. What is more, what happened when the sky was overcast? The 'sowing festival' might, owing to the weather, have dragged on for over a month in vain... The thesis of a measuring instrument with a predominantly cultic character is thus to be discarded.

IV.5.2 Symbolic Calendar with Reference to Lugdunum

see IV.6.1

[506] Wagemans 1996, 206.

IV.6 Symbol

In recent years, a clear tendency toward symbolist explanatory models can be observed. Robert Nouwen and Bernhard A. Greiner, who have dealt with the Gallo-Roman dodecahedra in great depth, also think along these lines. Nouwen (1993) comes to the conclusion that the meaning of the dodecahedron is most likely to be found in the symbolic sphere, in the field of tension between philosophy, religion, and magic.[507] Greiner (1996) is inclined rather to a symbolic role, since the purely practical interpretations hitherto proposed in the literature seem to him, on the basis of thorough consideration of the properties of the Gallo-Roman dodecahedron, improbable to impossible: "An astronomical-astrological function is possible, as is that of an insignium or a sceptre."[508]

Let us now consider in detail the specifically expressed symbolist interpretive approaches:

[507] Nouwen 1993, 75; cf. Nouwen 1992, 45; Nouwen 1994, 102.

[508] Greiner 1996, 18. (trans. Guggenberger)

IV.6.1 Symbolic Calendar with Reference to Lugdunum

With reference to the alleged depiction of a dodecahedron on an *as* struck in Lugdunum,[509] Amable Audin (1959, 1962, 1965)[510] suspects a special connection with Lyon. By emphasizing the relation to the annual cycle (see below) established by Deonna, Audin interprets the dodecahedron as a symbolic calendar and sees in it in turn a reference to the Genius of the city.

This local Gallo-Roman deity is seen in the tradition of the Celtic Lug, the presumed name-giver of Lugdunum, to whom, among other things, a function as sun god and thus influence on the course of the year is ascribed.[511] — On the reverse of an aureus of Mark Antony from 43 BC, the right foot of the Genius, furnished with a radiate crown, rests on a globe.[512] There are indeed dodecahedra in Lyon; but, without the comparison with the coins, the 'special' relation to this city falls away.

As for the interpretation as purely symbolic cult calendar in general, it can be stated that, for lack of compelling arguments, it remains implausible and— even if in the end it evades verification—must be rejected. Moreover, this role is

[509] see chapter I.3 'Sources of Dodecahedron Research'; cf. Steyert 1895, 133.

[510] Audin 1959, 106f; Audin 1962, 156f; Audin 1965, 74-77; cf. Boucher 1980, 91.

[511] Audin 1965, 7 4-7 6; cf. H.Birkhan, Kelten. Versuch einer Gesamtdarstellung ihrer Kultur (1997) 600f. 722f

[512] Thévenot 1959, 95.

taken on by calendars that are at once generally useful and functional, for example, plug-in calendars.[513]

IV.6.2 Symbol for Iron

The interpretive efforts of Ferdinand Lindemann (1897)[514] do not fall short of Audin's in their strangeness: "Iron had [...] at the time of its first becoming known a very high value; nothing was more natural than that the curiously regularly formed mineral that contained this highly prized metal should be accorded a kind of special reverence, or that a special symbolic meaning should be attached to it."[515] By the mineral Lindemann means pyrite in its rare crystallization in the form of the pentagonal dodecahedron (*pyritohedron*).[516] This reverence, he says, spread from the Piedmont Alps or Elba, the regions of occurrence of these extraordinary crystals, as far as Gaul, where it found its special expression in the form of the Gallo-Roman dodecahedra. Lindemann's thesis was adopted without reservation by Eva Sachs (1917),[517] and Moritz Cantor[518] likewise argues in this direction.

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[513] "Peg calendars were used not only in profane, everyday contexts but also for religious or magical purposes. [...] The cult of the planetary and weekday gods spread particularly from the later 2nd century onward." (Martin-Kilcher 1988, 35 (trans. Guggenberger)); cf. K.W. Weeber, Alltag im alten Rom (1998) 198.)

[514] Lindemann 1897, 725f.

[515] Ibid., 726. (trans. Guggenberger)

[516] see chapter V.2 'The Discovery of the Dodecahedron and its Role in Ancient Intellectual Life'

[517] Sachs 1917, 84.

The Gallo-Roman dodecahedron made of bronze or *brass* as a symbol for the metal *iron*? One is simply left speechless.

IV.6.3 Association with the Element Fire

Benno Artmann (1993, 1999), for whom the key to understanding the Gallo-Roman dodecahedron lies primarily in its geometric form, cites indications that the meaning and function of the artefact may possibly stand in connection with the element fire.

The mathematician recalls that Hippasos, the 'publisher' of the geometric dodecahedron, according to Aristotle, regarded fire as the most primordial of all elements;[519] at the same time—like Lindemann, though drawing different conclusions—he points to the fundamental geometric similarity of the dodecahedra with the *pyritohedra*. If one strikes them with a stone, pyrite crystals—as the name already suggests (*pyr* = fire)—emit sparks. So-called pyrite nodules were therefore, in the Stone and Bronze Ages, a component of fire starters.[520]

[518] Cantor 1900/1907, 176.

[519] Artmann 1993, 53; Artmann 1999, 302.304; cf. Aristoteles, Metaphysika, A 3,984a.

[520] Artmann 1993, 52; Artmann 1999, 302.304. Zur Nutzung des Pyrits: see N.Nieszery, Bandkeramische Feuerzeuge, AKorrBl 22.3, 1992, 359-376.

The linking of the dodecahedron with the element fire is in itself an interesting idea, not least because it can be connected both with candlestick theories and with astral symbolism (light in the interior, strength of the sun, etc.), as Artmann also thinks,[521] who moreover—on account of the Geneva silver dodecahedron dice—can imagine "some connections to the zodiac."[522] The incompatibility with the Platonic doctrine of the elements, however, proves highly problematic: there fire is symbolized by the tetrahedron, whereas the dodecahedron is defined as the emblem of the cosmos.[523]

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[521] Artmann has in mind a light source within the object that would accentuate the differently sized circular openings, but he considers this particular interpretation unlikely—also owing to the absence of soot traces (B.Artmann, letter 30.10.1998; cf. Artmann 1993, 52; cf. also Coulon 1910, 254).

[522] Artmann 1999, 304; cf. 305.

[523] cf. Hill 1994, 292.

IV.6.4 *Image de l'Univers*

As early as Raimond Coulon (1910), a cosmic meaning was considered, which, however, the dodecahedron supposedly acquired only much later, in its secondary use.[524] Salomon Reinach (1911), in his review of Coulon's treatise, rejects Coulon's Bronze Age dating and a mystical secondary use in Gallo-Roman times, to be sure, but considers a causal connection with Platonic-Pythagorean thought, on account of the very special shaping, to be plausible.[525]

Waldemar Deonna (1917, 1954) takes up this approach. Already in 1917, he suspects a cosmic-religious significance of the Gallo-Roman dodecahedra,[526] but it is only 37 years later, shortly after the appearance of Saint-Michel's essay (1951),[527] likewise strongly oriented in this direction, that he sets out his theses in full.[528] He recalls in detail the role of the pentagonal dodecahedron among the Pythagoreans and Platonists as embodiment of the universe and assumes that the Gallo-Roman dodecahedra were in all probability meant to represent this cosmic polyhedron: "The Pythagorean and Platonic conceptions of the universe, indeed, seem to provide the rationale for the existence of the knobbed dodecahedra."[529]

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[524] see chapter IV.7.2 'Cult Object or Amulet with Druidic Connection'; Coulon 1910, 253-258.

[525] Reinach 1911, 464 fn.1.

[526] Deonna 1917, 144-146.

[527] see Saint-Michel 1951, 101.

[528] Deonna 1954.

[529] Ibid., 33. (trans. Guggenberger)

In the special features of the Gallo-Roman dodecahedron Deonna sees confirmation of his interpretive approach. Because it is hollow and pierced, he refers to the text fragment ascribed to the Pythagorean Philolaus, where the dodecahedron is possibly described as the 'barge' (*holkas*) of the sphere—a term that makes him think of a hollow form, a vessel.[530] He also recalls the old philosophical image of the *cosmic cave*.[531]

Deonna ascribes symbolic value throughout to the details of the Gallo-Roman dodecahedron, which cite the circle and the sphere: openings, concentric circles, ring-and-dot motifs, and knobs.[532] He emphasises that the sphere symbolizes the perfect state (completely uniform, no beginning and no end), the 'All,' the divine nature; that, according to Pythagoras, the sphere is the most beautiful geometric body, and the circle its counterpart in two-dimensional space.[533]

In order to bring out the 'cosmic meaning' of the knobs, Deonna musters a multitude of archaeological comparisons, among them pentagrams with dots at the tips as found on Gallic coins,[534] together with other motifs interpretable as celestial signs such as circles and wheels. He can imagine that both

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[530] Philolaos, Peri physeos, after Stobaios, Extracts 1, prem. 3. (cf. C.Wachsmuth, Ioannis Stobaei Antologii. Eclogae physicae et ethicae I (1884) 18.); cf. Deonna 1954, 37f.

[531] cf. Deonna 1954, 38.

[532] cf. Ibid., 39.

[533] Ibid., 33; cf. Albinus, Didaskalikos, XIII H167-168.

[534] cf. Deonna 1954, 47 fig.6; cf. Balk 1995 (after A.Kolling, letter 6.2.1999).

figures—the dodecahedron and the 'ball pentagram'—mean the same thing when he points out that the pentagram, also called *pentalpha*, was in antiquity the badge of recognition of the Pythagoreans and a symbol of the universe, and still today has a mystical-magical character.[535] In addition, he points to circular symbols with balls and circles at the rim,[536] as well as to crescent or lunula depictions with balls at the ends, which in his opinion symbolize heavenly bodies.[537]

In his view, the largest pair of holes could also reflect the Tropics of Cancer (summer) and Capricorn (winter), the two poles of the Milky Way, the gates of heaven through which the souls wander.[538]

Further confirmation Deonna finds in the predominantly Pythagorean numerology,[539] which has also left its mark on Roman monuments.[540] The body is based on the 'cosmic' number 5. The twelve-faced figure composed of regular pentagons is at the same time the fifth Platonic solid, the 'fifth element'. Four times five is 20, which corresponds to the number of vertices of the Gallo-Roman dodecahedron furnished with knobs.[541] Six times five is 30, the number of the edges of the dodecahedron—where 4 and 6 are in turn special numbers. 30

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[535] Deonna 1954, 44-48.

[536] Ibid., 48-51.

[537] Ibid., 52-55.

[538] so Ibid., 40 fn.10 (with bibliographical references).

[539] cf. Ibid., 39-44.

[540] Deonna cites the underground basilica at the Porta Maggiore and gravestones as examples: see Ibid., 63f.

[541] cf. Ibid., 43.

is for Deonna again a 'cosmic number' (days of the month, etc.[542]). This numerology in the dodecahedron would sometimes be reinforced by 5 or 10 ring-and-dot motifs around each opening. 12 pentagons form the dodecahedron, which itself possesses 12 circular openings.[543] 12 times 30 again yields 360, which roughly corresponds to the days of the year. Deonna emphasises that already in Plutarch the pentagonal dodecahedron—on account of the coinciding numbers—is a symbol both of the year and of the zodiac.[544]

Finally, Deonna also finds confirmation in classical myths. He points to a passage in the *Dionysiaca* of Nonnus where Hymenaeus, in the game of *kottabos*, offers a 'world globe' as the stake:

"He had put up as a prize for the victor something clever made by his haughty mother Urania, who knew all the courses of the stars, a revolving globe shot with light like the form of Argus [...]."[545]

The hollow, openwork ball with which Zeus played as a child, and which Aphrodite promises to Eros if he kindles Medea's love for Jason—described by Apollonius of Rhodes (3rd

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[542] see Ibid., 40 fn.9.

[543] cf. Ibid., esp. 40f.

[544] see chapter V.2 'The Discovery of the Dodecahedron and its Role in Ancient Intellectual Life'; Deonna 1954, 41; cf. Artmann 1999, 304f. — Charrière points out that these numbers are also contained in the icosahedron: Charrière 1965, 152.

[545] Nonnus, Dionysiaca, XXXIII 67-70 (W.H.D.Rouse, Nonnos. Dionysiaca II (1940) 471. (altered Guggenberger); cf. Deonna 1954, 39.

c. BC) in the *Argonautica* in a disputed passage—also reminds him of the dodecahedron:[546] "[...] a well-rounded ball, a plaything such that not even you yourself could receive a more beautiful one from the hand of Hephaestus: it is made of golden rings, and around each are doubly wound curved connecting pieces, but the seams are hidden, for over all there runs a dark-blue winding pattern. And if you throw it with your hands, it draws a star-like trail through the air."[547]

In summary, Deonna's basic thesis is as follows: permeated with numerological and astral symbolism, the Pythagorean doctrine met with lively interest in the Gallic region and was fruitfully combined with similar indigenous traditions.[548] Since a large portion of the dodecahedra comes

[546] Deonna 1954, 38f.

[547] Apollonius von Rhodes, Argonautica, III 135-141 (trans. M.Guggenberger). — This is an exceedingly complex passage. Numerous alternative translation proposals—differing from my own—have been advanced, offering contradictory descriptions of the ball: see R.Hunter (ed.), Apollonius of Rhodes. Argonautica. Book III (1989) 113; G.Mooney (ed.), The Argonautica of Apollonius Rhodius (1964) 231; F.Vian (ed.), Apollonios de Rhodes. Argonautique. Chant III (1961) 40f; M.Gillies (ed.), Apollonius Rhodius. The Argonautica. Book III (1973) 18f; É.Delage/F.Vian, Apollonios de Rhodes. Argonautiques. Tome 2. Chant III (1980) 115f. — What seems to me the most plausible—because the most practicable—is that the rings of the ball were held together by wires wrapped twice around the points of contact between each pair of rings. This method of construction resembles that of the gold dodecahedra from Oc-Eo, although the ball was probably composed of twenty parts rather than merely twelve, since otherwise it could scarcely have been described as 'well rounded', unless one were to translate 'even(ly)' in the sense of uniformly shaped.

[548] cf. Deonna 1954, 65f.

from Gaul, Gallo-Romans, under the influence of Roman Pythagoreanism, took up the dodecahedron and its cosmic meaning into their conceptual world, because this could easily be reconciled with their own philosophical (Druidic) tradition. Only at this point were the details characteristic of the Gallo-Roman dodecahedron—circular openings, concentric circular decoration, ring-and-dot motifs, and knobs, which in particular had a great tradition in Gaul—added and thus gave the artefact its final stamp.[549]

Building on this meaning as an *image de l'univers*, Deonna—although, on the basis of the find contexts, he assumes that, beyond that it also had a practical function within the framework of a fortune-telling game—does not exclude a purely cultic function of the dodecahedron.[550]

Émile Thévenot (1955)[551] takes up these ideas; Louis Malleret (1961)[552] as well as Jean Chevalier and Alain Gheerbrant (1982)[553] follow Deonna in their interpretation.

It is not the linking of the Gallo-Roman dodecahedron with the Platonic-Pythagorean dodecahedron as emblem of the universe as such[554] that is problematic; rather, it is the individual explanations that Deonna provides for some details of the

[549] s. Ibid., 67f.

[550] Ibid., 69.

[551] Thévenot 1955, 292-294.

[552] Malleret 1961, 347-350.

[553] Chevalier/Gheerbrant 1982, 362.

[554] see chapter II.15 'The Regular Pentagonal Dodecahedron as Basic Form'

dodecahedron that are quite speculative. In numerical speculations—as well as in the literary comparisons—Deonna goes very far. The interpretation of the knobs as planets or stars is problematic, since the knobs in most cases—quite different from what one would expect—are not spherical.[555] The ring-and-dot motif and the concentric circles may also be explained as purely ornamental.[556] But the differently sized openings—which distract somewhat from the geometric form of the dodecahedron—should have possessed some symbolic and/or functional significance. Here Deonna is to be agreed with when he considers astral symbolism quite possible. As of now, more detailed conjectures remain speculative.[557]

IV.6.5 Insignium as the Finial of a Sceptre

C. Leemans (1877) holds the view that the dodecahedron most likely formed a component of a staff-shaped badge of rank. As an example, he cites a commander's staff—apparently with a ceremonial mace in mind, presumably following Dirks' interpretation.[558] W. Pleyte (1880) speaks of a general's staff; in an especially large pair of holes of [Dodecahedron]Hartwerd (Guggenberger No.76) he sees the indication of a mounting.[559] But A.

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[555] cf. chapter II.12 'Knobs'

[556] see chapter II.11 'Surface Design of the Pentagonal Faces'

[557] see chapter II.13 'Round Openings'

[558] Leemans 1877, 188-195.

[559] commander's staff (*veldheerstaf*): Pleyte 1880, 59.

Conze (1892) considered such an interpretation 'hardly advisable.'[560]

Only over a hundred years later does Alfons Kolling (1984, 1987) again put forward cautious reflections in this direction. In the irregular, 'frayed,' seemingly not worked for display contours of the largest pair of holes[561] he sees confirmation that a shaft was passed through the dodecahedron, and he imagines a wooden staff.[562] Convinced at the same time of a Celtic-cultic symbolic content of the Gallo-Roman dodecahedron, Kolling also suspects a connection with Druidic rituals.[563] In any case, for Kolling it is "unimaginable that one could have bought a dodecahedral dice in a household goods store."[564]

M. Henig and K. Leahy (1989) gave new nourishment to this theory by publishing two hollow, openwork, Roman (?) 'sceptre finials' of bronze. The formal connection between these and the Gallo-Roman dodecahedra proves, on closer inspection, however, to be too vague to yield decisive conclusions about the use of the dodecahedron; at least, though, these finds—assuming ancient origin—document that

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[560] Conze (Westdt. Z.) 1892, 208; cf. Michel 1921, 133.

[561] production holes: see chapters II.13 'Round Openings' and II.6 'Manufacture'

[562] Kolling 1993, 124; Kolling (Homb. Z.) 1987, 4.

[563] Kolling 1984, 251.

[564] Kolling (Homb. Z.) 1987, 6. (trans. Guggenberger)

openwork bronze objects with knobs could occasionally serve as finials.[565]

In 1993, Kolling reinforces his thesis: an "insignium [of the Druid], for example, as a knob on a sceptre."[566] And Ingeborg Huld-Zetsche (1996) agrees with Kolling's arguments. A "connection with Celtic religion," and specifically a use as "sceptre finial of Druids or their successors," seems to her quite conceivable.[567] Robert Nouwen (1993)[568] and Bernhard A. Greiner (1996),[569] both of whom attribute a certain degree of symbolic meaning to the Gallo-Roman dodecahedron, likewise show an inclination toward mounting the dodecahedron on a staff and toward a function as an insignium.

The distribution area and the find contexts of the Gallo-Roman dodecahedra basically speak rather against state

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[565] see chapter VI.2.8 'Polyhedral, Openwork Sceptre Finials"; Henig/Leahy 1989, 321-323.

[566] Kolling 1993, 125. (trans. Guggenberger) — As Alfons Kolling informed me, he continues to adhere to this thesis and considers it confirmed by the bronze fittings published by Henig and Leahy: A.Kolling (letter 6.2.1999).

[567] Huld-Zetsche 1996, 289 (trans. Guggenberger); I.Huld-Zetsche (letter 23.11.1998).

[568] Nouwen 1993, 74f.

[569] "An astronomical-astrological function is possible, as is that of an insignium or sceptre." (Greiner 1996, 18. (trans. Guggenberger)) "I believe that the dodecahedron was mounted on a staff, using the two opposite largest openings, which are generally not surrounded by any ornamentation." (B. Greiner, e-mail of 25.7.1998 (trans. Guggenberger)). In this case, however—since not all openings would remain visible—Greiner rules out an astronomical–astrological use (Greiner 1996, 16).

dignitaries, whereas a connection with the indigenous Druidism does not seem absurd.[570] The Druids did, in fact—apart from their garment described by Pliny and the legendary sickle for cutting the mistletoe—undoubtedly have additional badges of rank or cultic requisites at their disposal. "One may think," says Birkhan, "primarily of ceremonial staffs and lances, cultic clubs, and sceptres."[571]

What seems problematic here, however, is the limitation both in time and space of the occurrence of the Gallo-Roman dodecahedra to Celtic territories under Roman rule. Could these be insignia of Romanized Druids?

I think one should not fix the possible circle of users of the dodecahedron too much on an elite stratum, precisely because of its relatively frequent occurrence, but should think rather of persons (indirectly) influenced by ancient philosophy who, in the broader sense, could also stand in Druidic tradition.

As for the basic possibility of a function as a finial on a staff, it should be noted that there is indeed much to be said in favour of it: first, the pair of production holes[572] found on most Gallo-Roman dodecahedra, where damage is repeatedly

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[570] cf. chapter IV.7.2 'Cult Object or Amulet with Druidic Connection'

[571] Indeed, there are finds of sceptres dating from pre-Roman times: H.Birkhan, Kelten. Versuch einer Gesamtdarstellung ihrer Kultur (1997) 905. (trans. Guggenberger)

[572] see chapters II.13 'Round Openings' and II.6 'Manufacture'

observable;[573] and second, the find situation of [Dodecahedron]Gellep (Guggenberger No.11).[574]

IV.7 Religious, Esoteric, or Magic Device

IV.7.1 Device for Frequency Selection

"With a pentagonal dodecahedron one can achieve frequency selection.[575] In Roman times this object was made of bronze, [...] Depending on the size of the hole (i.e., its circumference), the hollow body emits a wavelength. When placed within interference zones, this resonator emits specific frequencies."[576] This rather remarkable quotation was found, without indication of an author, on the internet.

The extent to which there was already in antiquity any engagement with the phenomena now grouped under the term *radiesthesia* is unknown to me.

[573] see chapter II.7 'Traces of Use'

[574] see Guggenberger 2024, catalogue.

[575] By this is meant the 'frequency-accurate' procedure in dowsing.

[576] From a reply by rg@fakt.com to an inquiry on this matter: www.fakt.com/rg/anfrage.htm. (last access 1999, trans. Guggenberger)

IV.7.2 Cult Object or Amulet with Druidic Connection

Was it a toy or indeed a cult object? H. Erman (1894) is uncertain and leaves the question open.[577] De Saint-Venant (1907), who favours the practical function of the Gallo-Roman dodecahedron as a component of a bilboquet game, likewise by no means excludes an interpretation as a purely cultic object. In that case, however, he argues, it would be pointless to rack one's brains any further over the form and use of the dodecahedron, for then no explanation could be found.[578] — "Strange deduction!" as Deonna observes, for after all the dodecahedron must also, in this context, have had an inherent meaning.[579]

Coulon (1910),[580] who interprets the dodecahedra as Bronze Age masterworks (see below), holds—if only as a *hypothèse hypothétique*—that a secondary attribution of mystical meaning is at least possible. Later, in Roman times, the dodecahedra were kept by Druids who believed they recognized various cosmic meanings in them. Individual dodecahedra may in fact have been produced only for this new intended purpose. While the dodecahedron was merely an alien object for the broad mass of the Gauls, the Druid or initiate may perhaps have recognized in it an image of the cosmos, the universe. Finally, Coulon argues that the dodecahedron

[577] Erman 1894, 17.

[578] de Saint-Venant 1907, 29.

[579] Deonna 1954, 31. (trans. Guggenberger)

[580] Coulon 1910, 253-258.

possesses a dual character, being at once a symbol of order and of chaos.

In fact, despite its construction from regular pentagons, its visible sides—unlike those of a sphere—appear in part rather unbalanced, an impression heightened by the holes.[581]

Furthermore, Coulon argues that the dodecahedron might stand for other pairs of opposites such as good and evil, right and wrong. The pentagons symbolized the months of the year, and the differently sized openings symbolized the varying strength of the sun. The twenty knobs, too, would have offered numerological starting points for the Druids.[582]

But Coulon soars to truly bold conjectures: the knobs together with the entire dodecahedron might possibly stand for the fruits and branches of the mistletoe, which displays a 'striking' (?) structural similarity to the lattice system that underlies the dodecahedron.[583]

Perhaps it was also, since it is not too large and not too heavy, worn around the neck on a cord as an amulet,[584] or used as an apotropaic sign, for example one that was supposed to protect a hoard of coins.[585] In any case, Coulon argues that the dodecahedron was subsequently invested in Gaul with a

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[581] cf. chapter II.14 'Reflections on the Aesthetics or Fascination of the Gallo-Roman Dodecahedron'

[582] Coulon 1910, 253f.

[583] Ibid., 256f.

[584] Coulon 1910, 257.

[585] Ibid., 258.

mystical-symbolic meaning. In some of his considerations he thus comes—albeit from a different starting point—close to Deonna's views already expounded at length.

Léonard Saint-Michel (1951) likewise does not believe that the Gallo-Roman dodecahedra were created for a practical purpose; for him all the measurements differ too markedly from one another.[586] The complex geometric basic form constitutes, in his eyes, the decisive commonality, an indication of a philosophical background.

Since the dodecahedra were found predominantly in traditionally Celtic regions of the Roman Empire and disappear with late antiquity, he regards them as a 'pagan Gallo-Roman' phenomenon. He points to the great significance of numerology among the Celts,[587] but also presupposes knowledge of Pythagorean thought, and thus of the meaning of the dodecahedron as a symbol of the universe,[588] and assumes there is a kernel of truth in the legendary reports of ancient writers about a lively intellectual exchange between Pythagoreans and Druids.[589] He considers a connection with

[586] Saint-Michel 1951, 97f.

[587] s. Ibid., 109.

[588] Ibid., 100-103.111.

[589] Contacts between Druids and Pythagoreans may be assumed, although these perhaps took place on a larger scale only in the Roman Imperial period. Late antique authors, however, report a much earlier encounter: "And the Celtic Druids investigated to the very highest point the Pythagorean philosophy, after Zamolxis, by birth a Thracian, a servant of Pythagoras, became to them the originator of this discipline. Now after the death of Pythagoras, Zamolxis, repairing thither, became to them the originator of this philosophy. The Celts esteem these as prophets and seers, on account of their foretelling to them certain (events), from calculations and numbers by the Pythagorean art; on the methods of which very art also we shall not keep silence, since also from these some have presumed to introduce heresies; but the Druids resort to magical rites likewise." (Hippolytos, Philosophoumena XXII (trans. J. H. MacMahon (ccel.org/ccel/hippolytus/refutation/anf05.iii.ii.xxiv.html)); cf. Saint-Michel 1951, 102f; Reinach 1911, 464 fn.1; cf. Deonna 1954, 65-67.89; Thévenot 1955, 292; Kolling 1984, 251; H.Birkhan, Kelten. Versuch einer Gesamtdarstellung ihrer Kultur (1997) 914.)

Druidic practices likely. In this connection, Saint-Michel coins for the Gallo-Roman dodecahedron the designation *microcosme de poche* (pocket microcosm).[590]

He explains the lack of written references to the meaning of the Gallo-Roman dodecahedra by the fact that the doctrines of the Druids are scarcely known in general, because they were transmitted only orally and in secret, and because the ancient writers do not report very extensively and precisely on Druidism.[591] He does not exclude, however, a connection between the dodecahedra and the so-called 'serpent's egg' (*ovum anguinum*) described by Pliny, which Françoise Le Roux characterizes as "one of the fundamental symbols of 'Druidism,' a powerful talisman":[592] "I have indeed seen such an egg the size of a moderate-sized round apple, remarkable for its

[590] Saint-Michel 1951, 101.

[591] Ibid., 103. 110f.

[592] F.Le Roux, L'ovum anguinum et l'oursin fossile, in: Hommages a Marcel Renard 2, Collection Latomus 102 (1969) 422. (trans. Guggenberger)

cartilaginous shell, with numerous cup hollows resembling those of the arms of an octopus," says Pliny.[593]

This *ovum anguinum* has recently been linked to the egg-laying of the whelk (*Buccinum undulatum*).[594] More plausible, however, still seems to be to see in it a fossil sea urchin. Sea urchins did indeed come to light in prehistoric graves—and in artificial mounds without other finds.[595]

Saint-Michel deems it possible that at first sea urchins were taken as 'serpent's eggs,' or symbolized them, and that at

[593] Pliny, Naturalis historia XXIX.52-54 (trans. Guggenberger).

[594] The whelk (*Buccinum undatum*) occurs frequently in the Atlantic and the North Sea, whereas it is not native to the Mediterranean: so H.Birkhan, Kelten. Versuch einer Gesamtdarstellung ihrer Kultur (1997) 905; cf. on this theory: Pigott 1993, 117f with fig.80 (after H.Birkhan 1997, 905 fn.2).

[595] G.Chauvet, Ovum anguinum, RA 36, 1900, 281-285; cf. F.Le Roux, L'ovum anguinum et l'oursin fossile, in: Hommages à Marcel Renard 2, Collection Latomus 102 (1969) specially 422; K.Sallmann, Plinius der Ältere 1938-1970, Lustrum 18, 1975 (1977) 236.238f; C.-J. Guyonvarc'h/F.Le Roux, Die Druiden. Mythos, Magie und Wirklichkeit der Kelten (1996) 408-411 (with numerous bibliographical references); R.König, C.Plinius Secundus d. Ä. Naturkunde. Lateinisch—Deutsch. Bücher XXIX/XXX (1991) 222f; J.Chevalier/A.Gheerbrant, Dictionnaire des symboles (édition revue et corrigée 1982: 1996) 719f; cf. Saint-Michel 1951, 109.

a later time the Gallo-Roman dodecahedra took their place and fully assumed their meaning. The knobs could, in his opinion, in a highly stylized form suggest the heads of the snakes that produce the egg. He concedes, however, that the much simpler explanation as protection of the body from damage, or a 'mathematical' explanation (?), is also conceivable. Through the association with the snakes, in any case, a chthonic significance of the dodecahedron would be implied.[596]

Regardless of whether his *serpent's egg* theory is correct or not, Saint-Michel in any case assumes that the dodecahedron had a cultic-magical meaning and possibly stood in connection with mantic practices. Find contexts, such as those in military forts, he explains by saying that the dodecahedron, in the course of time, suffered a loss of significance which could have led, for example, to a Gallic soldier playing with the dodecahedron to pass the time. He attributes most damage to dodecahedra to such misuse.[597] And he explicitly points out that many games of entertainment derive from magical or divinatory actions.[598]

That it is a "testimony of a native cult" is assumed by H. Bögli (1970) with reference to [Dodecahedron]Avenches (Guggenberger No.86), but he offers no explanation for his surmise.[599]

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[596] Saint-Michel 1951, 109f.114; cf. Chevalier/Gheerbrant 1982, 362.

[597] Saint-Michel 1951, 111.

[598] Ibid., 108f.

[599] Bögli 1970, fig. text (without No.). (trans. Guggenberger)

Alfons Kolling (1984, 1987, 1993) again thinks primarily of a Druidic-cultic use of the Gallo-Roman dodecahedron. His argumentation largely corresponds to that of Saint-Michel. The deviations in the measurements between individual specimens, the complicated workmanship, and the unusual shaping lead him to conclude that the dodecahedron served no "trivial or technical purpose."[600] On the basis of the spatial and temporal distribution, he assumes that the dodecahedron "was neither earlier—nor later nor even among the Neopythagoreans and Neoplatonists of Roman times—the object of any utilitarian designation," but rather had a function in the cult of the 'late' Celts.[601]

That [Dodecahedron]Schwarzenacker (Guggenberger No.21) was found in the immediate vicinity of offering shafts and sacrifices of a Celtic-Roman sanctuary he evaluates as an indication of the correctness of his thesis. To underscore the possible 'magical' connection, Kolling adduces comparisons such as the small polyhedral, openwork bronze pendants furnished with knobs,[602] which may have served as amulets, and dice such as the silver dodecahedron from Geneva.[603] Kolling places the Gallo-Roman dodecahedron within "the broader field of Druidic rituals"[604] and can imagine its use as a Druidic insignium, for example as the knob of a sceptre.[605]

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[600] Kolling (Homb. Z.) 1987, 5. (trans. Guggenberger)

[601] Ibid., 4. (trans. Guggenberger)

[602] see chapter VI.2.9 'Polyhedral Cage Amulets'

[603] Kolling (Homb. Z.) 1987, 5.

[604] Kolling 1984, 251. (trans. Guggenberger)

I should like to set aside arguments such as similarities with the mistletoe, or comparisons like the connection with the so-called *serpent's eggs*, in order to clear the view to the essential point—the presumed Druidic connection of the Gallo-Roman dodecahedron. The linking of the dodecahedron and Druidism at first appears anachronistic, yet Druidism was by no means 'eradicated' under Roman rule; even in the advanced imperial period it does not seem to have sunk into insignificance.

"'Druidesses' prophesy to Alexander Severus (222–235), Aurelian (270–275), and Diocletian (284–305). One gains the impression," as Helmut Birkhan opines in his book *Kelten. Versuch einer Gesamtdarstellung ihrer Kultur*, "that a certain belief in the Druids, in the sense of late antique superstition, was practically fashionable in the third century!"[606]

Apart from this, scholars still boasted of their Druidic descent in the 4th century AD. "From this one can see that, after the suppression of the autochthonous Celtic cults and the decline of their teaching activity as priests associated with the rise of state schools, the Druids found a new field of activity in the Gallo-Roman mixed religion—perhaps also in medical practice at the healing springs with their cultic continuity—and

[605] In this context, Kolling also notes that the shoes of the Druids were said to bear a pentagram, referring in this regard to Johannes Aventinus (Bavarian Chronicle): Kolling 1993, 125. — cf. Kolling (Homb. Z.) 1987, 6.

[606] H.Birkhan, Kelten. Versuch einer Gesamtdarstellung ihrer Kultur (1997) 907f. (trans. Guggenberger)

that they, as is still noticeable in the 4th century, constituted an important part of the Gallic *intelligentsia*.[607]

A Gallo-Roman dodecahedron in the hand of a person of Druidic descent, or of a person (also) shaped by Druidic thought, should therefore by no means occasion surprise, once one seeks the principal essential trait of the dodecahedra in the sphere of symbolism. Since in doing so, there is by no means any need to shy away from a Platonic–Pythagorean connection, this argumentation again leads us close to the thesis of the emblem of the cosmos.

IV.7.3 Unspecified Divination Device

Already in the notes to a notice by Hugo (1873) it is not excluded—without any closer justification—that divinations were carried out with the aid of the dodecahedron.[608] According to A. Wankenne (1965), we are dealing with an 'instrument for divination.' Pythagorean thought underlies the dodecahedron. He refrains from considerations concerning the practical use of the divining device.[609]

D. Simon-Hiernard (1990) accords the Gallo-Roman dodecahedron a cosmic, magical-mantic character, which is

[607] Ibid., 908 (trans. Guggenberger); cf. Saint-Michel 1951, 105f.

[608] Hugo (C.R. 76) 1873, 420 fn.2.

[609] Wankenne 1965, 173.

underlined by its presence in graves as a "prophylactic and esoteric symbol."[610]

IV.7.4 Divination Dice

Following his own reflections on the symbolism of the Gallo-Roman dodecahedron (*image de l'univers*) and taking into account the formal kinship with dice, Waldemar Deonna (1954) develops the theory of the dodecahedron as a component of a popular practice for predicting the future.[611] As essential indications for this use he adduces that the dodecahedra mostly come from profane, rather public areas and are found not so rarely. The grave finds, too, speak in favour of the interpretation as dice. Deonna points out that dice in graves can be interpreted as a symbol of the uncertainty of human fate.[612]

Games were often shaped by numerology, and the numbers 12 and 5 repeatedly have a special significance.[613] The Romans and Greeks alike engaged in dice games not only for pastime. In mantic procedures, too, various kinds of dice—besides knucklebones, various polyhedra, apparently including dodecahedra—were employed.[614] *Astragalomanteia* and

[610] Simon-Hiernard 1990, 77. (trans. Guggenberger)

[611] see Deonna 1954, 69-88.

[612] cf. Ibid., 73f; cf. also Duval 1957, 364.

[613] Deonna mentions, as examples, 'petta pentegramma', 'pente grammai', 'pente litha' and 'duodecim scripta': Deonna 1954, 78.

kybomanteia (dice oracles) are attested for antiquity just as astrological number oracles are. Either the inquirer himself cast the knucklebones or polyhedra, or a specialist, for example an astromancer.

How one is to imagine such an oracle is described by Pausanias. In his description of the Oracle of Hercules Buraicus he explains: "The person who inquires of the god prays before the image, and after praying he takes four dice and throws them on the table. There are plenty of dice lying beside the image. Each die has a certain figure marked on it, and the meaning of each figure is explained on the tablet."[615]

And a Byzantine treatise provides, according to W. Gundel's description, the instructions for an astro-logical dice oracle: "[...] the lots are thrown one after another from the dice cup [...]. What follows is a method by which, on the basis of these dice, one is to calculate the subsequent lots and insert them into the nativity. Hermes has designated the lot of the Moon-goddess as the foundation of fate, and that of the Sun-god as the lot of the daimon. In exactly the same manner a particular lot is assigned to each of the other planets. [...] The final dice is Horoskopos; this signifies the foundation of the entire cosmos [...]."[616] According to Pseudo-Callisthenes, the

[614] cf. chapters VI.2.5 'Other Polyhedral Dice with Numbers or Letters' and VI.2.2 'The Silver Pentagonal Dodecahedron Dice from Geneva'. — Deonna 74f; cf. Ineichen 1996, 63-65; Heinevetter 1912.

[615] Pausanias, Description of Greece VII.25.10 (trans. J.G.Frazer, Pausanias's Description of Greece (1898) 368; cf. Ineichen 1996, 63-68.

astromancer employs an artfully crafted tablet made of precious materials (ivory, ebony, gold, and silver), on which, among other elements, the sun and the moon as well as the twelve zodiacal signs are depicted. In order to calculate the nativity (the 'horoscope'), the astromancer 'places' the seven planets—fashioned from various gemstones—and the Horoskopos made of copper into the tableau, or else casts them onto the board. More commonly, however, astro-mantic dice oracles are performed using five or seven lots, that is, without the Horoskopos dice.[617]

Deonna thinks he has indications of a form of astrological fortune-telling game for which a game board divided into 12 fields was used. A mosaic, preserved only in fragmentary form, from the baths of Tebessa, subdivided into sections each of which originally showed a different animal and whose centre has a ship with the inscription *Fortuna redux*, represents in his opinion such a 'game board.'[618] He assumes that in the context of such games dodecahedron dice as well as lists with prefabricated answers were used.

Indeed, a collection of oracular sayings of imperial date (*Sortes Sangallenses*) has been preserved, which is divided into sections of 12 sayings each, and thus suggests the use of a

[616] Catal. cod. astr. I 167, 13ff (F.Boll/C.Bezold/W.Gundel, Sternglaube und Sterndeutung. Die Geschichte und das Wesen der Astrologie (1926) 195 (trans. Guggenberger)).

[617] see Ibid., 195-197.

[618] so Deonna 1954, 77 (with reference to other similar mosaics); cf. S.Gsell, Musée de Tébessa, Musées et collections archéologiques de l'Algérie et de la Tunisie 2 (1902) 67-70; tab.9,1.

twelve-sider for the drawing of lots.[619] For the related, likewise ancient, and most simply practised Astrampsychos Oracle, played with the aid of a dice, the rules have been transmitted.[620]

That fortune-telling games or astrological practices with dodecahedra almost inevitably correspond to the 12 signs of the zodiac is obvious. For antiquity the silver dodecahedron dice from Geneva shows this function, bearing the names of the zodiacal signs on its faces.[621]

As the best comparandum for his reconstructed oracle game—consisting of a dodecahedron dice, a game board, and a list—Deonna adduces a medieval–early modern dice game which, in his view, stands entirely in the tradition of ancient fortune-telling games. It was described in 1556 by François Gruget in a book with the explanatory title *Le Plaisant Jeu du Dodechedron de Fortune, non moins récréatif que subtil et ingénieux entre tous les jeux et passe-temps de fortune, autrefois composé par Jan de Meun pour le roi Charles V* [...].[622] It has hitherto remained largely unknown that André Steyert (1895) had already recognized in this popular fortune-telling

[619] Deonna 1954, 78; cf. Heinevetter 1912, 52; see A.Dold, Die Orakelsprüche im St.Galler Palimpsestcodex 908. Die sogenannten 'Sortes Sangallenses', Sitzungsberichte der Österreichischen Akademie der Wissenschaften. Philosophisch-historische Klasse 225, Abh.4 (1948).

[620] Heinevetter 1912, 52. — The Greek Magical Papyri refer, for example, to another form of dice oracle; a Homeric verse obtained by casting the dice is then interpreted: so Heinevetter 1912, 56.

[621] see chapter VI.2.2 'The Silver Pentagonal Dodecahedron Dice from Geneva'

[622] cf. Deonna 1954, 89.

game a survival of the dodecahedra. He therefore interprets the depiction he supposes of a dodecahedron on a Lyon coin as an emblem of fate.[623]

The *Plaisant Jeu du Dodechedron de Fortune* is a dice game, going back to older models, for predicting the future—functionally comparable to card-reading (Tarot, etc.)—which found great favour in Europe in the 16th and 17th centuries and was therefore repeatedly reworked, edited, and translated. From it one drew 'information' about future wealth, marriage, health, etc. With the aid of a twelve-sided dice marked with the numbers 1 to 12, one was finally to find, for a given question, in a list the answer allotted by fate. The first edition of the game comprised 144 questions (12 times 12) and just as many answers.[624]

Jean de Meun (13th c.), the inventor of the game according to Gruget, was a scholar who knew Plato at least indirectly through Calcidius. The latter mentions the 'cosmic' dodecahedron and also wrote alchemical works.

According to Deonna, the dice game could also be based on the *books of fate of Alfhadel*, which contain 144 questions with 12 answers each regarding the signs of the zodiac.[625] The connection to antiquity would thus be established

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[623] Steyert 1895, 133. — cf. chapter I.3 'Sources of Dodecahedron Research'.

[624] see Deonna 1954, 80-87 (with game rules and original quotations); cf. P.Lacroix, Curiosités des sciences occultes (1862) 268-270; Charrière 1965, 151.

[625] so Deonna 1954, 81f.

by a roundabout route. Since Gruget himself emphasises that the dodecahedron is ideally suited to such games not only for purely practical considerations, thanks to its twelve-faced form, but also through its ancient 'cosmic' meaning, Deonna sees himself confirmed in his interpretation.

In antiquity as in the Renaissance—when scholars again took up the subject of the polyhedra on a philosophical-scientific plane—intellectual-historical ideas flowed in.[626] Del Rio, in his *Disquisitionum magicarum libri sex*, in which he sharply condemns all forms of fortune-telling games, cites two games practised with dodecahedron dice. One of these is designated the *Ludum Pastorum* and corresponds to the one mentioned above; the other could possibly have been conducted with a dodecahedron provided with zodiacal signs.[627]

That the Gallo-Roman dodecahedron displays no numbering or labeling of the faces does not trouble Deonna, for he envisages a use that departs from the classic function of a dice. The dodecahedron could have been thrown onto a game board, and by its position marked one of the fields drawn upon it. The meaning of the throw would then have been taken from a list by consulting the corresponding sign.[628]

In this connection, it should be noted that the so-called *Tabula Bianchini* has already been interpreted as an

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[626] Ibid., 87.

[627] *Ludus qui describitur in doodekaedroo*: cf. Nouwen 1993, 68; Deonna 1954, 80.

[628] Deonna 1954, 77f.88.

'astromantic dice board.' On the basis of literary indications W. Gundel imagines the functioning as follows: "[...] the dice board represents the sphere of the fixed stars, the dice represents the planets, and the throw itself represents the schema whose meaning the astromancer must decipher with the aid of his texts [...]."[629]

Deonna's theory was received positively in the following years. Françoise Le Roux (1955), in a review, considers his hypotheses quite conceivable, for one must assume that the dodecahedron possessed a function or meaning that is no longer familiar to us. Le Roux reproaches the scholars before Deonna for having sought practical purposes—such as the interpretation as a candlestick—that could long since have been clearly assigned to other objects.[630] Fernand Benoit (1957)[631] interprets the occurrence of dodecahedra in find complexes that can be assigned to public areas as an indication that the object formed part of a popular fortune-telling game. P.-M. Duval (1957) and E. Virieux (1961)[632] likewise tend to Deonna's approach. To the latter this mystical use appears in any case more appropriate than a practical, profane purpose,

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[629] F.Boll/C.Bezold/W.Gundel, Sternglaube und Sterndeutung. Die Geschichte und das Wesen der Astrologie (1926) 200. cf. 191-200. (trans. Guggenberger)

[630] Le Roux 1955, 303.

[631] Benoit 1957, 107.

[632] Virieux 1961, 22.

and the former even concludes: "The issue of the dodecahedra [...] can, for the most part, be considered resolved."[633]

Walter Burkert (1962) also thinks along these lines: "[...] they presumably served as a dice oracle, but whether the underlying intent was playful or serious, mythical or cultic, is hardly possible to determine."[634] He is more reserved about a derivation from Pythagorean-Platonic thought, for like "numbers, the simplest geometric figures have their 'archetypal' symbolic character [...] These curious dodecahedra may be rooted in similar areas."[635]

For J. Chevalier and A. Gheerbrant (1982) the Gallo-Roman dodecahedra served "without doubt" as divination dice.[636] Stéphanie Boucher (1976) interprets more cautiously: "There has been talk of games of chance, perhaps of divinatory games."[637] Since the dodecahedra are thoroughly robust, yet their knobs are sometimes damaged or broken off; and since they are larger and heavier and more elaborately made than other dice, she assumes a dice-like use that must have exceeded the significance of a simple gambling utensil. She argues that the dodecahedron was probably most likely thrown onto the ground, and conclusions drawn from the position, for the 12 faces of the dodecahedron are equivalent to 12 possibilities. In any case the number 12, says Boucher, is the

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[633] Duval 1957, 365. (trans. Guggenberger)

[634] Burkert 1962, 436. (trans. Guggenberger)

[635] Ibid., 449; cf. 436 fn.87. (trans. Guggenberger)

[636] Chevalier/Gheerbrant 1982, 362. (trans. Guggenberger)

[637] Boucher 1976, 213. (trans. Guggenberger)

key to understanding the dodecahedron, for otherwise one would also have used other polyhedra.[638]

Stefanie Martin-Kilcher (1988) recalls the newly discovered silver dodecahedron dice of Geneva and concludes that the dodecahedra are 'probably' divination devices. In contrast to the dice from Geneva, however, the Gallo-Roman dodecahedra "with their differently sized perforations and pegs would have required more complex handling."[639]

Apart from the fact that Deonna offers no explanation as to how one was supposed to throw or roll the Gallo-Roman dodecahedron onto a field of the game board without—obviously for all—violating the principle of chance, all the authors adduced thus far fail to provide a concrete explanation for the use of the openings.[640] Hans Stohler (1966/1970), who adheres more strongly than Deonna to the interpretation of the dodecahedron as a dice in the conventional sense, assumes that the twelve holes—just as had already been conjectured nearly a hundred years earlier with regard to a use as game dice[641]—were closed.[642] As for concrete use, he gives free rein to his imagination. First the astrologer placed the dodecahedron in

[638] Ibid., 212-214; Boucher/Feugère/Perdu 1980, 91.

[639] Martin-Kilcher 1988, 34. (trans. Guggenberger)

[640] Only in a footnote does Deonna recall the marked rod that, in de Saint-Venant's bilboquet game, helps determine the width of the opening: Deonna 1954, 88 fn.5.

[641] Maclean 1878, 87f; Cohausen 1879, 394.

[642] An option that Deonna considers unlikely. That the width of the opening and its significance were determined by means of a conical object seems to him even more plausible: Deonna 1954, 88 fn.2.5.

a leather pouch, spoke a magic formula over it, and invoked Hermes for information, then let the dice roll onto the table.

"In this way, the place in the heavens was determined from which the astrologer could fix the twelve celestial 'houses' [more precisely: the 12 places/loci], of which the first was significant for the entire course of the life of the person born, the second for possessions and profit, while the third celestial house concerned siblings, the fourth the parents, the fifth the children, the sixth the health of the person born. The seventh celestial house gave information about marriage, the eighth about death, the ninth about religion and travel, the tenth about honours, arts, character and conduct of life, the eleventh about benefactions and friends, then the twelfth about enemies and captivity." In order also to take into account the influence of the planets, "he put the numbers of the celestial houses into the openings of the dodecahedron and invoked, in turn, the individual planetary gods to indicate to him in which celestial house they stood at the birth of the person in question. In this way," says Stohler, "the astrologer was enabled to carry out and complete the interpretation of the celestial figure according to countless ancient prescriptions."[643]

We learn of another unusual dice method through J. Kenis's reconstruction of the fortune-telling procedure, illustrated by Nouwen (1992). The Gallo-Roman dodecahedron,

[643] Stohler 1966-1970, 401; cf. on the methods of ancient astrology: F.Boll/C.Bezold/W.Gundel, Sternglaube und Sterndeutung. Die Geschichte und das Wesen der Astrologie (1926) 58-67.153-157. (trans. Guggenberger)

marked with zodiacal signs incised in wax, is wrapped with a band and then, by holding one end of the band, let fall so as to set it in rotation.

Stephan Balk (1995)[644] proposes interpreting the Gallo-Roman dodecahedron as a component of the 'Drude dice,' which "was used in the mystical-religious sphere, probably for making predictions about fate."[645] According to him, the dodecahedron serves as a frame for twelve rotatable wooden disks bearing symbols. These disks have recessed, circular sockets of differing diameters[646] on their backs, with the aid of which the disks can be inserted into the openings of the 'frame.' The 'symbol faces,' bearing the names of the signs of the zodiac and the five Platonic solids in differing arrangements, are held in position with the help of threads that are stretched—using the knobs in the form of pentagrams or 'Drude's feet'—across the faces, in such a way that they remain rotatable. Concentric circles would have served as 'guide rails' for the disks.

The mantic action is carried out by a Druid who, in a trance state, turns the individual sides of the 'druidic dice' and then draws his conclusions from the positions of the symbols relative to one another.

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[644] Balk 1995, 1-12.

[645] Ibid., 7. (trans. Guggenberger)

[646] Balk's speculation goes decidedly too far: the coins found inside [Dodecahedron]Saint Parize-le-Châtel (Guggenberger No.53) could in reality have been such bases and thus the remnants of such closure discs: Balk 1995, 3.

If one imagines the holes of the Gallo-Roman dodecahedron to be closed, one indeed solves the problem of the missing markings and gains a divination instrument that could under some circumstances be employed individually. Very problematic, however, remains the fact that one thereby departs strongly from the material givens of the dodecahedra. The most cogent objection that must be made against such interpretive attempts is that the variability of the hole diameters thereby receives no, or only an insufficient, justification. For Balk's argument that in this way each 'symbol face,' and thus each sign of the zodiac, should have been assigned a particular,[647] fixed face of the dodecahedron is not convincing already for the reason that these disks, once mounted, no longer needed to be removed.

A completely different, significantly simpler explanation of the holes—one that would at the same time practically justify their variable diameters—can be obtained if one reconstructs a divination dice in connection with a fortune-telling technique allegedly practised in Africa, mentioned by Léonard Saint-Michel (1951) in a marginal note. Here an object provided with several openings is tossed or rolled; then one inserts that finger which fits best into the hole "allotted by fate." The prediction depends on which finger it is.[648]

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[647] Balk 1995, 10.

[648] Saint-Michel derives his information from an anonymous traveller in Africa. Unfortunately, I have no confirmation of the existence of this divinatory game: Saint-Michel 1951, 113 fn.3. (trans. Guggenberger)

Whether or not Saint-Michel's information corresponds to reality, I regard a comparable practical use within the interpretive complex of the Gallo-Roman dodecahedron as a divination device as still the most conceivable. Above all, however, irregular production holes of the dodecahedra seem to speak against it.

IV.7.5 Divination Pendulum

Although Deonna (1954) primarily wishes to recognize a divination dice in the dodecahedron—since, as de Saint-Venant already claimed to have observed, traces of use suggested that the dodecahedron was thrown[649]—he apparently does not exclude the possibility that the dodecahedron was also employed as a kind of pendulum. Fastened to a cord and hung up or held in suspension by hand—for example, above a game board—the swing of the pendulum could in his opinion determine a sign, a letter, or a number. In this case, too, he presupposes oracular lists that provided answers.[650]

This interpretive attempt refers to a passage already mentioned by Franz Heinevetter in Ammianus Marcellinus (ca. 330–395 AD). In the course of a report on a show trial instigated by the emperor Valens against seers who had asked fate about the succession to the throne, a special form of alphabet oracle is described: A bowl made of various metals, on whose rim the

[649] Deonna 1954, 70; cf. de Saint-Venant 1907, 31.

[650] Deonna 1954, 88.

24 Greek letters were engraved at regular intervals, was placed on a little table woven from laurel branches. A ring hanging on a thin thread, set in oscillation by the questioners, then disclosed syllables and words by striking individual letters.[651]

Granted, in theory one could fasten a cord to one of the knobs of a dodecahedron or pass such a cord through holes; nevertheless, despite the comparandum, the explanation as a pendulum is entirely pulled out of thin air.

IV.7.6 Conjurer's Device

A. Caspari (1882) recognizes in [Dodecahedron]Avenches (Guggenberger No.86)—depending on how he holds and turns the artefact—a multitude of faces and grimaces. For him, the openings represent various pairs of eyes, noses, and open mouths. By inserting fingers into holes and letting the fingertips emerge again at other holes one could create yet more fantastic figures. These observations lead him to conclude that a magician or conjurer was the user[652]; an interpretation that he also adopts for a second curious object, an ivory mask with a

[651] Ammianus Marcellinus, Res gestae, XXIX 1,29-32; cf. Heinevetter 1912, 56; Deonna 1954, 88 fn.8.

[652] *prestidigitateur*: Caspari 1882, 326. — "This curious and unique piece [...] appears to have belonged to one of those conjurors who were very numerous at that time." (RA 34, 1882, 312. (trans. Guggenberger))

mechanism of unclear function, which was found 'at the same time.'[653]

Admittedly, this requires much imagination. Only very few in the audience would likely have been able to keep pace with the performer in terms of powers of imagination.

Incidentally, L. Saint-Michel (1951) also mentions, in a subordinate clause, the 'similarity' of the Gallo-Roman dodecahedron to a face. Depending on the size of the eyes and the mouth, the face, he speculates, could have had a special (divinatory) meaning.[654] As unlikely as this use may seem, it cannot—in contrast to Caspari's interpretation—be entirely ruled out; for here the method is supposed to remain mysterious to the non-'initiated,' the 'client.'

G. Charrière (1965) does not exclude the possibility that the Gallo-Roman dodecahedron could have served a juggler as a 'loaded' dice for fraudulent machinations; we shall return to this in the context of the interpretation as game dice.[655]

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[653] Caspari 1882, 326; cf. RA 34, 1882, 312; Blümner 1882, 326-328.

[654] Saint-Michel 1951, 113f fn.3.

[655] Charrière 1965, 155f.

IV.8 Game Device

IV.8.1 Unspecified Game Apparatus

The interpretation of the Gallo-Roman dodecahedron as a toy or component of a game is one of the earliest, if not the very first, for Daniel Bruckner (1763)[656] already thinks along these lines. Carl Friedrich Quednow (1820)[657] assumed that it "probably" served as part of a game, and Ferdinand Keller (1861)[658] likewise simply regards the dodecahedron as a toy. A. Vaissier (1893)[659] and H. Ponroy (1902)[660] share these opinions.

That this interpretation was voiced so early is by no means a coincidence, for the explanation as a game, or as a component of one, initially does in fact lie close at hand. On the one hand, the 'dice-like' form suggests it; on the other hand, in a game—as in a cultic object—virtually any shape of apparatus is conceivable.

Many authors shrink from venturing closer conjectures, because for an object as peculiar as the Gallo-Roman dodecahedron, in theory any number of the most diverse and most contradictory game rules could be devised. Most types of games, however, would take far too little account of the specific

[656] Bruckner 1763, 2944.

[657] Quednow 1820, 174.

[658] Keller 1861, 12 (trans. Guggenberger); cf. as well as the note appended to a contribution by: Hugo (C.R. 76) 1873, 420 fn.2; cf. furthermore Rochholz 1879, 38.

[659] Vaissier 1893.

[660] Ponroy 1902.

properties of the dodecahedron and therefore fail to justify it sufficiently. But if one does not go into the rules at all, one is making things too easy.

IV.8.2 Game Dice

The idea that the Gallo-Roman dodecahedron was a game dice is, at first glance, a very obvious one; no wonder, then, that it was voiced early. "In support of this conjecture, the different sizes of the holes and their systematic distribution," asserts J. Amiet (1870),[661] and H. Blümner (1882) concedes: "For me, the relation to a dice game or a similar game is still the most likely."[662]

At a meeting of the Royal Archaeological Institute (London) on November 2, 1877, the conjecture was voiced that the dodecahedra could have been intended as dice for games of chance. Possibly the holes were originally furnished with ivory disks on which (numerical) signs were incised to distinguish the twelve sides. Since, however, no means for attaching these plates to the dodecahedron are present, the interior of the 'dice' could also have been filled with wax. Marks could easily be incised, and in that case the knobs would serve a practical purpose by protecting the soft, delicate wax surface.[663]

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[661] Amiet 1870, 197. (trans. Guggenberger)

[662] Blümner 1882, 327. (trans. Guggenberger)

[663] Maclean 1878, 87f; cf. A Guide to the Antiquities of Roman Britain (1922) 43 (after Allason-Jones/Miket 1984, 218).

V. Cohausen (1879), too, assumes that the openings were filled or glued up with more perishable material in order to apply different markings, and he relies on a solid-cast pentagonal dodecahedron furnished with tally points in the form of ring-and-dot motifs,[664] and does not doubt in the least "that this little riddle, too, will ultimately be solved in our sense."[665]

In the impossibility of being able to prove a practical use, L. Martin (1890) sees an indication in the direction of game dice.[666] And the gentlemen Hübner and v. Luschan likewise expressed, in the discussion on the occasion of the presentation of [Dodecahedron]Braunschweig (Guggenberger No.9) by Conze at the Archaeological Society of Berlin, the conjecture that it could be dice.[667] Louis Le Clert (1898)[668] also thinks—at least in the broader sense—of a game dice, and for Émile Dunant (1900)[669] this thesis—alongside that of a gauge—still seems the 'most plausible.'

G. Charrière (1965) asserts that, by virtue of its 20 vertices, a dodecahedron rolls best of all the regular polyhedra and that by rounding the vertices one can further improve its rolling properties. This, however, also amplifies an imbalance of the rolling body through unequal weight distribution—in the

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[664] see chapter VI.2.7.2 'The Pentagonal Dodecahedron Dice of Bronze in Bonn'

[665] Cohausen 1879, 394. (trans. Guggenberger)

[666] Martin 1890, 21 (after Nouwen 1993, 61f).

[667] after Conze 1891, 183.

[668] "[...] a kind of dice or instrument used for some game of chance." (Le Clert 1898, 186 (trans. Guggenberger); cf. 185.)

[669] Dunant 1900, 60.

case of the Gallo-Roman dodecahedron on account of the holes—something that may have been intended. Charrière reconstructs a dice game which, outwardly, has the character of pure chance, but in which a skilled player could, by deft handling, achieve calculated throws improving his chances. Accordingly, it was either a game of chance or a game of skill (with a random component). In the former case he assumes an ignoble game in which a professional player—a conjurer—relieved passers-by of their savings (see above), but he considers the latter more likely.[670] The aim of the game was to throw the largest or the smallest hole; that is, to exploit the imbalance of the body optimally or—to defy it—throw the less probable holes.[671] M. Petrovszky (1994) follows the interpretation as a game dice as this still seems to him the most probable explanation. Specific rules, however, are not discussed.[672]

From antiquity, an innumerable number of dice have survived. They consist of the most diverse materials, from the cheapest to the most precious: wood, bone, ivory, lead, bronze, silver, gold, amber, terracotta, faience, glass frit, stone, crystal, etc. Not a few of them fail to exhibit one of the shapes of dice familiar to us, but instead possess other polyhedral forms. Among these are many icosahedra, some tetrahedra, irregular polyhedra of varying numbers of faces, but also twelve-sided dice—bearing in mind that the semiregular form of the rhombic

[670] Charrière 1965, 155f.

[671] see experiments: Ibid., 157.

[672] Petrovszky 1994, 78.

dodecahedron was also in use.[673] In terms of size, most ancient game dice are far smaller than the Gallo-Roman dodecahedra, yet there are—as I have already emphasised[674]—examples whose dimensions are comparable to our objects. Dice are usually made solid. But this yields no essential conclusions for the use of the Gallo-Roman dodecahedra either,[675] for a hollow Ptolemaic bronze icosahedron (ca. 200 BC) with Greek numerals is also known.[676]

Two peculiarities, to be sure, genuinely distinguish Gallo-Roman dodecahedra from all known ancient game dice. They are furnished with knobs at the vertices and possess holes in place of the usual face markings.

It should be borne in mind that the faces weigh different amounts owing to the differently sized circular cutouts. The body's centre of gravity therefore does not coincide with the geometric centre of the dodecahedron, with the result that—

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[673] see chapter VI.2.5 'Other Polyhedral Dice with Numbers or Letters' — There were, however, also special forms, such as dice in rod and top form or even in the shape of a human figure, to mention only the extremes: cf. M.Fittà, Spiele und Spielzeug in der Antike. Unterhaltung und Vergnügen im Altertum (1998) 110-122; Deonna 1954, 74-76; Heinevetter 1912, 48-52.57f; P.Perdrizet, Le jeu alexandrin de l'icosaèdre, Bulletin de Institut français de l'Arcéoologie orientale 30, 1931, 1-16 (according to Ineichen 1996, 167); Cervi-Brunier 1985, 155.

[674] cf. chapter II.8 'Size'

[675] Conze considers the hollow form unsuitable for dice: Conze (Westdt. Z.) 1892, 208.

[676] Deonna 1954, 75; cf. P.Perdrizet, Le jeu alexandrin de l'icosaèdre, Bulletin de Institut français de l'Archéologie orientale 30, 1931, 1-16 (according to Ineichen 1996, 167); Charrière 1965, 150.

statistically—not every one of the twelve faces comes to lie uppermost with equal frequency after a throw.[677] Admittedly, one could accept this influence on probability, or even—as Charrière surmises—have aimed at it. Numerous simple dice, despite the effect on the properties of the specimen, were sawn out of tubular bone, so that two faces had to be closed off with a bone peg. That in one case or another a dice was thus also loaded is conceivable.[678]

There are also extremely irregular six-sided dice, and ones on which a particular numeral occurs on more than one face[679]—both of which in at least some cases must have been intended. A bone dice from Bad Wimpfen unites these exceptional cases in itself.[680] In any event, with figurative dice (in the shape of a human figure),[681] and with knucklebones

[677] See the mathematical calculations in: Charrière 1965, 154f; cf. Greiner 1996, 17.

[678] Ineichen does not, to be sure, know of an example for this, but he reports astragali with ground side faces and cites Aristotle, who (albeit in an experimental context) speaks of knucklebones weighted with lead: Ineichen 1996, 38.

[679] cf. openings of equal size on a dodecahedron. — "In Boge on Jutland, dice have been discovered that bear the same number on two different sides." (M.Fittà, Spiele und Spielzeug in der Antike. Unterhaltung und Vergnügen im Altertum (1998) 113. (trans. Guggenberger))

[680] E.Schallmayer, Die Verbreitung von Knochen in römischer Zeit, in: M.Kokabi/B.Schlenker/J.Wahl (ed.), 'Knochenarbeit'. Artefakte aus tierischen Rohstoffen im Wandel der Zeit, Saalburg-Schriften 4 (1996) 73 fig.2. — Ineichen illustrates a quite irregular dice: Ineichen 1996, 52 fig.11.

[681] cf. M.Fittà, Spiele und Spielzeug in der Antike. Unterhaltung und Vergnügen im Altertum (1998) 113.

(*astragali*), for example, it is in the spirit of the game that not all sides can be thrown with equal probability.

The knobs of the Gallo-Roman dodecahedron certainly do not speak in favour of the dice theory,[682] but they do not rule it out; for despite the knobs at the edges the dodecahedron can be rolled, although its rolling behaviour depends not inconsiderably on the nature of the surface.[683]

Remaining as the most forceful argument against an interpretation as a dice (in the usual sense) is the unresolved question of the marking of the faces; for the differently sized circular openings of the dodecahedron, as A. Conze puts it, are "hardly suited to provide, for use in play, equally recognizable distinguishing marks, such as the recessed points divided up in different numbers on proper dice—the *tremata*—quite as is still the case today."[684] True, with *astragali* the sides were labelled

[682] cf. Kolling 1984, 250; Bosanquet 1924, 31.

[683] Dice experiments using a replica of the Tongeren specimen, acquired at the museum in Tongeren, confirmed this. Charrière even holds the view that the dodecahedron rolls well precisely because of its knobs. In his opinion, they served the same purpose as the rounded vertices of an ordinary dice. As an example, Charrière cites dodecahedral dice (with rounded vertices) that were used in France in the 1960s in the context of horse betting (Charrière 1965, 153 fn.1; 154; cf. chapter II.12 'Knobs'). — Greiner arrives at the opposite conclusion: "Dice experiments with the specimen from Windisch (No.90), however, have shown that the knobs are highly obstructive when the object is thrown and, at the same time, are at risk of being damaged." (Greiner 1996, 17. (trans. Guggenberger))

[684] Conze (Westdt. Z.) 1892, 208. (trans. Guggenberger) — Franz Heinevetter, too—who in his work Würfel- und Buchstabenorakel in

only in exceptional cases, since with a little practice they can be distinguished as they are; but the 12 sides of the Gallo-Roman dodecahedron can, by optical means, be distinguished from one another only with extreme difficulty, if at all. The ornamentation of the faces with concentric circles, ring-and-dot motifs, and the like does not help much.[685] One would in fact have to measure and 'decode' the value—say by inserting a conical peg (cf. the bilboquet theory). [Dodecahedron]Goodrich Castle (Guggenberger No.63), with holes all of the same size, in any case would have had to have been marked in some other way.

The idea of a wax filling is in itself ingenious, for it solves the problem of marking, can explain why no disks (of ivory) to close the openings have been preserved, and at the same time assigns an important practical function to the knobs. It would then have to have been a dice game that required the faces to be provided again and again with different signs. Here, however, one begins to argue in circles; for if there were other markings, what then is the point of the openings being of different sizes—with the single exception named?[686]

Griechenland und Kleinasien deals extensively with a wide range of ancient dice and follows Conze—is convinced that the dodecahedra do not represent any kind of dice: Heinevetter 1912, 58.

[685] cf. Conze (Westdt. Z.) 1892, 208; de Saint-Venant 1907, 26; Erman 1894, 17; Deonna 1954, 27.

[686] cf. de Saint-Venant 1907, 27.

IV.8.3 Dice Cup or 'Marble Container'

Daniel Bruckner (1763) asks his readers about the Gallo-Roman dodecahedron: "Was it a dice basket?"[687]

Since high stakes were not infrequently involved in gaming, great importance was also attached in antiquity to preventing manipulations by individual players. Dice cups or funnels[688] were therefore used, but the so-called dice tower funnels (*turricula*), attested in both literary and pictorial sources as well as by a few finds, was also cherished as a particularly reliable aid for rolling the dice. Martial reports on the security of this system by having one of these masterworks speak as follows: "If the hand of the cheat, who arranges the dice to suit himself, first throws them through me onto the board, the wish alone remains."[689] An artfully worked specimen of copper alloy, with inscription and ring-and-dot motifs, was found in a Roman villa near Bonn.[690] It may have been an apparatus of this kind that Bruckner had in mind, as he assumed a comparable function for the Gallo-Roman dodecahedron.

Closely related to the interpretation just presented is the one favoured by A. Comarmond (1857), alongside the bilboquet

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[687] Bruckner 1763, 2944. (trans. Guggenberger)

[688] Ineichen 1996, 45.60.

[689] Martial, Epigramme, XIV 16 (after M.Fittà, Spiele und Spielzeug in der Antike. Unterhaltung und Vergnügen im Altertum (1998) 116. (trans. Guggenberger))

[690] cf. M.Fittà, Spiele und Spielzeug in der Antike. Unterhaltung und Vergnügen im Altertum (1998) 116f; H.Horn, Die Römer in Nordrhein-Westfalen (1987) tab.15.

theory:[691] The hollow dodecahedron is filled with (marble) balls of differing sizes, which 'perhaps' bear numbers, and then thrown like a French boule. Through the motion, some of the balls fall out of the dodecahedron; their number (or type?) or their total point value indicates the value of the throw. Since here the technique of the performer would be important, he does not see in this a pure game of chance.[692]

Léopold Hugo likewise considered, briefly, in a small handwritten note from 1873, a related idea: to fill the dodecahedron with numbered objects or with dice that then fall out of the bronze container by chance.[693] And in 1906—independently of the others—Baudin proposes a related solution. He fills the dodecahedron with balls of differing sizes corresponding to the sizes of the 12 holes; then he rolls the dodecahedron, and depending on which balls fall out, plus or minus points are counted.[694] A further variant is finally introduced by A. Blanchet (1906). Not only the number of balls that fell out, but also the hole from which they fell, was decisive for the result.[695]

There are compelling arguments against this group of interpretations. Whether the Gallo-Roman dodecahedron is filled with differently sized objects of whatever shape, with a

[691] see chapter IV.8.4 'Component of a Bilboquet Set'

[692] Comarmond 1855-1857, 396f.

[693] Hugo (handschriftliche Notiz, 1873, Archiv der Akademie der Wissenschaft, Paris) after de Saint-Venant 1907, 27f.

[694] Baudin (handwritten communication to de Saint-Venant, 1906) after de Saint-Venant 1907, 28.

[695] Ibid., 28.

single object, or with objects all of the same size, an object must also be able to fall through the smallest opening if one does not wish to degrade certain holes to mere ornament. Filling the hollow body already poses a problem; upon being thrown, especially the smallest objects—which can slip through almost all the openings—would usually fall out, particularly when the range of opening diameters is wide.[696]

If the dodecahedron is used as a dice aid in the sense of a cup, basket, or dice tower, similar problems arise. A small dice that fits through all the holes could fall out again already when being thrown in; a larger dice, by contrast, might find no way out even after repeated rolling of the dodecahedron. (Or has the player, then, thrown a 'zero'?)

Moreover—unless one wishes, somewhat abstrusely, to think of the coins inside [Dodecahedron]Saint Parize-le-Châtel (Guggenberger No.53)—no corresponding objects have been found together with dodecahedra. Especially dice or marble balls should have been preserved in at least one or another grave. In keeping with the container, one would expect that some of them would have been objects of better, less perishable material.

Furthermore, it must be borne in mind that several objects used as filling hamper the 'dice basket' in rolling. To minimize this negative influence, the Gallo-Roman dodecahedra would have to be heavier, or the filling material—unlike coins, for example— extremely light. The device would probably have to be tossed, and so it could actually only be a

[696] cf. Ibid., 28.

game played outdoors, for it requires a good deal of space. That the dodecahedron was used as dice on an ordinary game board or table can in any case be excluded.

Finally, the variant in which one is to remember through which holes objects have fallen is impracticable; in many cases one will no longer be able to ascertain this. If anything, in such a game the question would have to be where and how the individual objects that have fallen out come to lie; but everything that is known so far about the Gallo-Roman dodecahedra speaks against any interpretation as a 'dice basket.'

IV.8.4 Component of a Bilboquet Set

Already A. Comarmond (1857),[697] who is fairly certain that the dodecahedron is a piece of game equipment, a component of a game whose rules have long been forgotten, reconstructs a game that bears a strong resemblance to bilboquet, a dexterity game that is attested in Europe already in the late Middle Ages but was above all exceedingly popular in sixteenth- and seventeenth-century France and enjoyed the greatest favour even at the royal court. At that time it came onto the market in two variants.

In the original, eponymous version,[698] a ball with a hole had to be caught on a pointed spike, also called a 'lance tip;' in

[697] Comarmond 1855-1857, 396.

[698] from French 'bille' (ball, sphere) and 'bocquet' (lance tip)

the other a ball had to be caught with a small cup. The two parts are each connected to one another by a cord. — In the most varied adaptations, bilboquet is played worldwide today.[699]

Comarmond ventures, concerning the course of the game, the supposition that one first aims to catch the tossed dodecahedron by one of the openings with a pointed object. Once that has succeeded, the value or meaning of the throw or the catch depends on the respective hole. He sees in this a combination of a dexterity game and a chance game. With that he has already anticipated de Saint-Venant's views in essence.

J. Amiet (1870) likewise, with reservations, describes the Gallo-Roman dodecahedron as a "toy to be tossed, which was caught in the air with a pointed stick."[700] L. Martin (1890) concurs,[701] and according to v. Fellenberg-Bonstetten, as Conze reports, they "were intended to be caught on a stick, such a game being still customary in French-speaking Switzerland."[702] F. Eggenschwiler (1898)[703] and C. Jullian (1908)[704] in turn confirm these suppositions.

Julien de Saint-Venant (1907), for whom the connection with a throwing game still seems the most likely,[705] made these

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[699] A pierced ball, a ring, or similar object is caught with a pointed implement or—what is considerably simpler—a ball is caught in a cup.

[700] Amiet 1870, 197. (trans. Guggenberger)

[701] after Nouwen 1993, 61.

[702] Conze 1891, 183. (trans. Guggenberger)

[703] Eggenschwiler 1898, 34 fn.1.

[704] Jullian 1908, 93 (after Deonna 1954, 27 with fn.3).

[705] de Saint-Venant 1907, 31.

rather general statements more concrete. Speaking in favour of a game à la bilboquet, in his view, are first the size as well as the weight and the knobs. In his opinion they were meant to protect both the object itself and the person from damage or injury.[706]

He adds a hardwood stick, since such a one is durable and yet would not batter the dodecahedron. Unlike bilboquet, however, his conical staff is provided with markings as well as adjacent numbers.[707] If the catch succeeds, a smaller hole counts for more points than a larger one on account of the increased degree of difficulty. De Saint-Venant considers this game primarily well suited for two persons, one taking on the role of thrower, the other that of catcher.[708]

It further seems plausible to him that the thrower likewise used a (simple) stick in order to thread the dodecahedron with its two opposite, especially large openings, then toss it upward and possibly set it in rotation[709] in the process.[710] It would therefore be a combination of dexterity and chance game, which also explains both the differently sized openings and their lack of markings.

As Alfons Barb notes, "it would be no fun, under certain circumstances, to get half a kilogram of bronze, with sharply protruding vertex knobs, on the head."[711] The occasionally high

[706] Ibid., 31.

[707] For the calculation of the numerical values: see Ibid., 30 fn.1.

[708] De Saint-Venant here refers to the old *jeu des grâces* and also to the diabolo game: see Ibid., 30f.

[709] Here, too, the comparison with the diabolo game applies: Ibid., 30f.

[710] Ibid., 31 fn.1.

weight of Gallo-Roman dodecahedra is not to be adduced as a reason that excludes the interpretation. Small bilboquet versions of barely 3 cm in diameter are known, but the largest have a weight of over 1.5 kg.[712] Rather, the angular form and the knobs speak against it, which, incidentally, are themselves also at risk.

Are we dealing, then, with a sport practised outdoors on a meadow[713] by players (legionaries?[714]) equipped with helmets? The bone object found together with [Dodecahedron]Gellep (Guggenberger No.11) could—theoretically—be used as a spur to new arguments in the direction of the bilboquet theory. But why, of all people, should a well-to-do lady have indulged in this sport? Why, moreover, are the edges of the holes in part kept nonsensically thin and delicate? Thus, was the dodecahedron in fact not thrown high, and was it, as is customary with bilboquet, attached (by one of the knobs) to a cord?

As a rule, such devices are made of wood or bone and have no vertices. A (wooden) ball perforated twelve times would be far better suited for this purpose as well as incomparably easier to manufacture. Thus, one would, despite the interpretation as a toy, once again have to interpret the form

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[711] Barb 1954-1957, 103. (trans. Guggenberger)

[712] W.Endrei, Spiele und Unterhaltung im alten Europa (1988) 155; cf. J.Botermans/T.Burrett/P. van Delft/C. van Splunteren, Il libro dei giochi. Origini, storia e regole dei giochi di tutto il mondo (1989) 233.

[713] That would be gentler on the dodecahedron upon impact.

[714] What argues against Bosanquet's view here is the restricted area of distribution: Bosanquet 1924, 31.

strictly symbolically.[715] Remarkable in this connection is a traditional North American variant of the bilboquet game. In the *Ajaqaq* of the Canadian Inuit, a multiply perforated object—for example, a rabbit skull or a carved bear—must be caught with a stick. The holes can also vary in diameter.[716] The manner in which the thrown object becomes impaled is decisive for the 'result.' The game has a ritual character, for it was intended to hasten the return of the sunlight.[717]

Despite this interesting, newly won comparandum, I would like to keep my distance from the theory. Apart from the fact that the pairs of production holes of Gallo-Roman dodecahedra of type 1a do not seem to have been worked for appearance, many hole edges as well as faces are demonstrably completely intact showing not the slightest traces of damage or wear.[718] Individual specimens that were in use for a longer time should display on the surface characteristic scratches and/or dents that can derive from this and no other

[715] After all, no exceptions to the dodecahedron form are attested.

[716] In a Japanese variant of the bilboquet, three cups of different sizes are used to catch a ball: J.Botermans/T.Burrett/P. van Delft/C. van Splunteren, *Il libro dei giochi. Origini, storia e regole dei giochi di tutto il mondo* (1989) 233.

[717] Indigenous peoples of North America, by contrast, sometimes played for high stakes: Ibid., 232f; cf. Deonna 1954, 70 fn.1 (with literature on the magical use of bilboquet games).

[718] cf. chapter II.7 'Traces of Use'

use.[719] Walther Barthel was right when he already stated in 1909 that this interpretation "will hardly find many friends."[720]

IV.8.5 Game akin to Ring-Toss

De Saint-Venant (1907) also mentions the possibility of another, similar game, as it were the 'fun-fair variant' of the pastime described above.

The aim of the game could have been to place the Gallo-Roman dodecahedron, by throwing, rolling, or sliding, onto one of several small conical sticks fixed vertically in the ground. For comparison, he recalls that game in which one must throw metal rings over knife handles.[721]

In this case, it is true, the risk of injury is reduced; the other objections already named remain valid. Moreover, this interpretation seems simply too absurd to be taken seriously.

[719] The traces of use observed by de Saint-Venant, described by him in such general terms, could derive from any kind of handling (including improper handling): de Saint-Venant 1907, 31.

[720] Barthel 1909, 94 (trans. Guggenberger); cf. also Deonna 1954, 27.

[721] de Saint-Venant 1907, 31.

IV.8.6 'Peg Game'

In the course of the discussion at the presentation of [Dodecahedron]Saint Parize-le-Châtel (Guggenberger No.53) at the Sorbonne on 21 April 1906, Émile Espérandieu voiced an interpretive suggestion that later met with hardly any attention.[722] He reconstructs a game for several persons for which, besides a Gallo-Roman dodecahedron, one also needs (wooden) sticks whose thickness is matched to the different diameters of the holes of the device. After each player has chosen a stick or drawn one, the dodecahedron is tossed, and the participant whose stick fits most exactly into the hole lying uppermost wins the round. He wins the stake or a certain sum, or that number of points indicated by circles. But most of all, says Espérandieu, the openings without ornament were worth the most.

The differently sized openings find an explanation, and the supposedly African fortune-telling practice mentioned independently by Saint-Michel, already described above, shows similarities with this kind of game. [Dodecahedron]Goodrich Castle (Guggenberger No.63)—or rather the information available on this piece (holes all of the same size)—would, to be sure, have to be ignored—as in many other interpretive attempts as well.

[722] see Ibid., 29 fn.1; cf. Espérandieu 1906 (after de Saint-Venant 1907, 29 fn.1).

IV.8.7 Puzzle Game Analogous to *A Voyage Round the World*

The puzzle game *A Voyage Round the World*, also known as *The Traveller's Dodecahedron*, was devised by the Irish mathematician Sir William Rowan Hamilton.[723] It is based on the existence—demonstrated by him in 1856—of systems of non-commutative algebra,[724] in particular on the so-called icosian calculus, which can be illustrated in the form of paths along the edges of a regular pentagonal dodecahedron.

In the game *Traveller's Dodecahedron* each of the 20 vertices of the regular solid represents a global city. The series of cities begins—corresponding to the 20 consonants of the alphabet—with Brussels, Canton, and Delhi and ends with Zanzibar. The basic idea of the game is to find an itinerary that makes it possible to visit all places exactly once and, at the end, to *return* again to the starting point, thus undertaking a complete journey around the world—which, expressed in mathematical terms, corresponds to a Hamilton circuit.[725] For this purpose the vertices, which are provided with nails or pins, are wrapped one after another with a string and thus connected to one another.

[723] cf. N.Biggs/E.Lloyd/R.Wilson, *Graph Theory 1736-1936* (1986) 35.

[724] An algebra in which multiplication is not required to satisfy the rule xy = yx.

[725] A Hamilton circuit is one that passes through each point exactly once and does not, in general, cover all the edges.

Many other (more demanding) tasks with differing rules and restrictions, which can be set by a second player, are possible; these were, however, chiefly practised with the two-dimensional variant of the game, the *Icosian Game*. Here the pentagonal dodecahedron is replaced by a game board with a mesh of lines and points that shares the necessary properties with the polyhedron, that is, it is isomorphic to the graph of the pentagonal dodecahedron.[726]

L. Allason-Jones and R. Miket (1984) can imagine that a related game was practised with the ancient Gallo-Roman dodecahedron.[727]

To practice such a puzzle game one does not need Hamiltonian insights. A comparable game can also be devised empirically. The knobs of most dodecahedra would undoubtedly be excellently suited for winding a string around.[728] For the openings, however, a justification would first have to be found. Should the thread (in one game variant) also be passed through the interior of the dodecahedron? The differing sizes of the holes nevertheless remains unexplained. This interpretation is—unfortunately—one of the most improbable.

[726] cf. examples: N.Biggs/E.Lloyd/R.Wilson, *Graph Theory 1736-1936* (1986) 32-34.

[727] Allason-Jones/Miket 1984, 218.

[728] [Dodecahedron]London 2 (Guggenberger No.66) with three small knobs at each vertex is not particularly well suited to this, but it does work.

IV.8.8 Children's Toy

Use as a children's toy is listed by K. Mauel (1961) as an interpretive attempt, without the corresponding source being given. Nor is any further explanation offered.[729]

Perhaps what was meant here was a peg toy[730] or a rattle—explanatory models that are repeatedly voiced spontaneously. Be that as it may, the interpretation as a mere children's toy becomes implausible already when one calls to mind the numerous finds from forts and is, finally, to be excluded by the occurrence of Gallo-Roman dodecahedra in adult graves.

IV.9 Object without Any Actual Function

IV.9.1 Masterpiece

Raimond Coulon (1910) broke entirely new ground with his interpretive approach. In search of an explanation for the dodecahedron phenomenon beyond both practical apparatus and cultic inventory, he developed the theory of the masterpiece.[731]

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[729] Mauel 1961, 14; cf. Pirling 1986, 114.

[730] Several people to whom I described the dodecahedra were reminded of the large hollow plastic spheres that have twelve flattened faces with openings of various shapes, into which a correspondingly shaped block is to be inserted.

[731] see Coulon 1910, 238-250.

By analogy with the customs of medieval guilds, he supposes that the dodecahedra were manufactured by Bronze Age craftsmen—bronze casters—within the framework of a kind of master's examination in order to demonstrate their skill. Accordingly, certain craftsmen's rights and titles would have been tied to the production of a dodecahedron.

To support his thesis, Coulon points out that in France even around the mid-19th century the fabrication, on the lathe, of structures similar to the dodecahedron was practised and considered a proof of professional ability. The *corporation des plombiers zingueurs* (guild of plumbers and zinc workers) likewise, at this time, produced dodecahedron-like structures (*dodécaèdre pyramidé*) of zinc.[732]

Salomon Reinach (1911) saw in numerous museums ivory dodecahedra of differing provenance. A (practical) use, as he emphasises, was never indicated. Taking into account the great technical skill that the manufacture of a dodecahedron presupposes, he does not exclude an explanation of the dodecahedra along the lines of Coulon's interpretation, although he recognizes in the dodecahedra the works of Roman craftsmen.[733] Pierre Méreaux-Tanguy (1975) is of a similar opinion. He highlights the manufacture of a Gallo-Roman dodecahedron as an extraordinary achievement. They were

[732] so Ibid., 247-249.

[733] Reinach 1911, 463f; cf. Reinach 1905, 352.

therefore, "perhaps for good reason," also interpreted as masterpieces.[734]

Even if one rejects this hypothesis, one thing remains undisputed. Although the manufacture of a large bronze is certainly more demanding,[735] the creation of a dodecahedron required, besides an understanding of the geometry of the solid, a high degree of craftsmanship and skill, from the production of a model to the casting and finally to the cold work.[736]

Some modern-period dodecahedra were indeed created for the sake of making them and were valued on account of their especially fascinating and aesthetic form as well as their preciousness. By means of refined workmanship, art turners produced, among other things, hollow dodecahedra with 12 openings and a twelve-pointed star inside or nested twelve-facers made from a single piece.[737] The material used was primarily bone or boxwood.

[734] Méreaux-Tanguy 1975, 28; cf. 30. (trans. Guggenberger)

[735] Gerhard Sperl is of the opinion that this "does not constitute an especially demanding task for the bronze caster" (G.Sperl, letter 25.3.1998 (trans. Guggenberger)).

[736] see chapter II.6 'Manufacture'

[737] e.g. in Dieppe: so Coulon 1910, 246f. — Cohausen had already drawn attention to the formal affinity between the dodecahedron and early modern ivory turnings, although in interpreting the dodecahedron he pursued entirely different lines: Cohausen 1879, 393; cf. Saint-Michel 1951, 113 fn.3. — Deonna also claims to have heard of various 'dodecahedra' from Japan and Africa that had no specific functional purpose: Deonna 1954, 28 fn.4; cf. also Méreaux-Tanguy 1975, 29.

These masterpieces and comparably elaborate turner's works date mainly from the 16th to the 18th century[738] and at times form part of a larger whole. Concerning the lid knob of a lidded cup of rhinoceros horn, Elisabeth Scheicher notes the following: "The real 'Kunststuckh' is the five-part lid finial, in which mastery of the material is demonstrated to perfection. On the dish, above that, a spiral appears, in whose axis a needle tapering to hair-thinness toward the top becomes visible. The core piece, however, is the openwork polyhedron, within which two smaller polyhedra are visible, and within these, a spiked sphere. The crowning of the finial is formed by an openwork pyramid."[739]

With regard to the meaningfulness of manufacturing polyhedra on the lathe at the turn from the 19th to the 20th

[738] C.Martin, *Der Drechsler. Ein Handbuch für Werkstatt und Schule* (1905, Nachdruck 1990) 261; H.Knoppe, *Meistertechniken der Drechselkunst* (1926, Nachdruck 1986) 76.

[739] E.Scheicher, Kunstkammer, in: A.Auer/O.Gamber/E.Scheicher/K.Wegerer, *Kunsthistorisches Museum. Sammlungen Schloss Ambras. Die Kunstkammer*, Führer durch das Kunsthistorische Museum 24 (1977) 38 (trans. Guggenberger); cf. E.v.Philippovich, *Kuriositäten—Antiquitäten* (1966) 462. — In the Kunstkammer of Schloss Ambras in Innsbruck there is also a hollow turned ivory sphere (diameter 50 mm; southern Germany, second half of the 16th century, inv.no.PA824) containing eight further, progressively smaller nested spheres.

century, C. A. Martin remarked in his manual *Der Drechsler*:[740] "Even if according to today's notions such works must be termed 'breadless art,' it can by no means be denied that the maker of such works must possess a multitude of manual skills in order to complete these 'little feats of art.' If such things are made in otherwise work-free time, they also fulfil their practical use, especially for younger turners, namely the training of manual turning skill."[741]

Even the turning of a tetrahedron already counted as quite difficult. "In a set of instructions, it says that by increasing the number of faces and edges from three to five, the difficulty with regard to the exactness of manufacture increases enormously."[742] By hollowing it out and making it from a single piece, the demands on craftsmanship become even greater. The apprentice is "induced by the clarity of the forms to the greatest exactness."[743] The result becomes measurable at the edge. The manufacture of geometric solids is therefore a fixed component of training in many trades, from woodworking to the metalworking craft. What E. Brepohl emphasises concerning training as a goldsmith thus has more general validity.

It stands to reason that similar exercises were also practised in antiquity. As today, a distinction was made then

[740] C.Martin, *Der Drechsler. Ein Handbuch für Werkstatt und Schule* (1905, Nachdruck 1990).

[741] Ibid., 261. (trans. Guggenberger)

[742] Kolling 1993, 125. (trans. Guggenberger)

[743] E.Brepohl, *Theorie und Praxis des Goldschmieds* (1994) 266. (trans. Guggenberger)

between masters (*magistri*) and apprentices (*discipuli*). Vocational training, which was not regulated by the state, could last several years. Journeyman's or master's examinations are, however, not mentioned in the ancient sources.[744] That the budding craftsman had to demonstrate his technical knowledge and manual skill, and that the master of his craft was proud of his abilities and wanted to show them outwardly, goes without saying. Funerary inscriptions that praise the craftsmanship of the deceased, and grave reliefs with scenes of craft, provide eloquent testimony of this self-confidence. Besides the characteristic tools, finished products are proudly presented here as well.[745]

But if the dodecahedron actually had such an important role for the Gallo-Roman craftsman, would one not then expect precisely the depiction of this object? After all, from the multitude of finds it would follow that this kind of 'master's examination,' or proof of craftsmanship, was quite common. It likewise strikes one as odd that other (Platonic) solids were not manufactured in the same manner. The icosahedron from Arloff still represents a one-off. Above all, however, one runs into argumentative difficulties when attempting to justify the differently sized openings. In that case, aesthetic considerations (?) would have had to be decisive.

[744] H.Schulz-Falkenthal, Zur Lehrlingsausbildung in der römischen Antike, *Klio* 54, 1972, esp. 205-210; K.-W.Weeber, *Alltag im alten Rom* (1998) 49f.

[745] cf. K.-W.Weeber, *Alltag im alten Rom* (1998) 168f; G.Zimmer, *Römische Berufsdarstellungen*, Archäologische Forschungen 12 (1982).

Consequently, if one pursues the thesis of the masterpiece consistently, the meaning of the Gallo-Roman dodecahedron shifts from the proof of craftsmanship to the finished product as an ornament, with which we pass seamlessly to the last interpretive attempt and immediately return to the thesis placed at the beginning concerning a piece of jewellery.

IV.9.2 Knick-knack

"Was it a toy, a distance-measuring device, something magical, or a 'just-because object' for which there was no meaningful possible use?" asks Bruno Kröll (1995).[746] Could we actually be dealing, as Hannsjörg Ubl (1997) terms it in his list of the spectrum of voiced theses, with a handsomely shaped knick-knack?[747]

The restriction to the dodecahedron form remains, as with the masterpiece theory, incomprehensible. Explaining the ongoing variation of the hole diameters as a generally accepted aesthetic device at once seems—not only highly unsatisfactory and nothing more than an 'emergency solution' until the ultimate clarification of the intended purpose—but also cannot be substantiated by any evidence. And a decorative function of

[746] Kröll 1995, 13. (trans. Guggenberger)

[747] Ubl 1997, 163.

whatever kind for the irregular pairs of production holes is definitively to be excluded.[748]

[Figure]

Fig. 5 Illustration from Peter Apian's *Instrument Buch* (1533)

[748] see chapters II.13 'Round Openings' and II.14 'Reflections on the Aesthetics or Fascination of the Gallo-Roman Dodecahedron'

V. THE MEANING OF THE PENTAGONAL DODECAHEDRON FROM ANTIQUITY TO THE PRESENT

V.1 Chapter Introduction

Within the Greco-Roman world, the pentagonal dodecahedron in its regular and pure form occupied an outstanding and special position among geometric solids, founded originally on philosophical considerations, which continued to influence intellectual life in Late Antiquity—from mathematics to astronomy, astrology, and alchemy, and on to simple mantic-magical practices. Ancient knowledge in the West about the pentagonal dodecahedron and the other regular solids, which had been lost during the Middle Ages, was taken up again and disseminated in Europe by scholars of the Renaissance. In the aftermath, down to the present day, not only scholars but also engineers, artists, and artisans have engaged with the dodecahedron.[749]

[749] cf. Kolling (Homb. Z.) 1987, 2f.