

Continuity and change: on a computer-aided classification of Late Neolithic and Early Bronze Age pottery from the Netherlands

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Abstract

This article discusses the preliminary results of an ongoing project on the typological classification of Late Neolithic and Early Bronze Age pottery from the Netherlands. The overall goal of the present study is to contribute to the improvement of the current pottery typologies. The SECANTO computer program was used to group the pottery in shape groups, based on their profiles, and the resulting groupings were compared with the current pottery typologies.

Key words: *typologies, Late Neolithic and Early Bronze Age pottery, Single Grave Culture, Bell Beaker Culture, Barbed (Wire) Beaker Culture*

1 Introduction

This article discusses the preliminary results of an ongoing project on the typological classification of Late Neolithic and Early Bronze Age pottery from the Netherlands. To be more specific, vessels of the Single Grave Culture (in the following abbreviated as SGC), the Bell Beaker Culture (further BBC) and the Barbed Wire (Beaker) Culture (BWC) are being analyzed. The first two cultures lasted from *c.* 2800-2400 BC and *c.* 2400-1900 BC resp.¹ and are regarded as marking the end of the Dutch Neolithic. The BWC (*c.* 1900-1600 BC) is seen as representing the onset of the Bronze Age in the Netherlands.²

With respect to the emergence and development of the Late Neolithic and Early Bronze pottery, different views are held. At the moment there are basically two theories: the unilinear model and the two-track model. These shall be discussed in detail, but before doing so it should be mentioned that the basis of these two models are in many respects the same.

¹ J. N. Lanting and J. van der Plicht. "De ¹⁴C-chronologie van de Nederlandse pre- en protohistorie. III: Neolithicum." *Palaeohistoria* 41/42 (1999/2000): 1-110.

² J. N. Lanting and J. van der Plicht. "De ¹⁴C-chronologie van de Nederlandse pre- en protohistorie. IV: bronstijd en vroege ijzertijd." *Palaeohistoria* 43/44 (2001/2): 117-262.

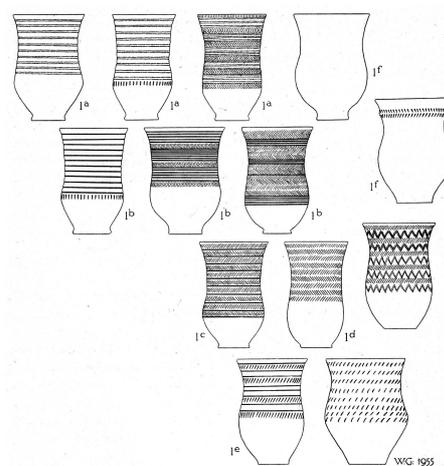


Figure 1. Typological subdivision of the SGC beakers. Notice that f. e. the type 1a includes several varieties. After Van der Waals & Glasbergen 1955.

Both are primarily based on more or less archaeologically complete vessels, associated with burials. Furthermore they are both grounded in typo-chronological considerations. In view of the following setbacks this comes as no surprise, there are practically no (pottery) stratigraphies and although there are associations these are far from common. Moreover, ¹⁴C-dates appear to be unsuited for high-precision dating. A two sigma

calibration covers usually a time span of several centuries. Therefore, considering the importance that typo-chronology has, the overall goal of the present study is to contribute to the improvement of the current pottery typologies. In our view they show several shortcomings which results from the fact that the potential the pottery has is yet to be fully exploited. The current typologies are too broad and thus inaccurate, as the case of the 1a type SGC beaker illustrates (see Figure 1).³ The type includes vessels with only cord impressions and beakers with other forms of decoration, such as herringbone motifs. The cord impressions can constitute either an uninterrupted or a zonal decoration, *i. e.* a regular alteration of decorated and plain strips. As these varieties are related to differentiation in time and space, a subdivision of the 1a type would be useful.⁴

Another limitation is that the current typologies shed too little light on the variation in vessel shape. As indicated above, the classification of SGC beakers *f.e.* is based on decoration. It is worth mentioning, that none of the typological subdivisions to date have been established with the aid of a computer. A classification of the Late Neolithic and Early Bronze Age vessels from the Netherlands with the SECANTO computer program would therefore be a first.

This study specifically aims to test both the unilinear model and the two-track model and evaluate which of the two is the most plausible, with the focus of the study being the vessel shape itself as this area until now, has largely been neglected. The present analysis is being carried out in the framework of the PhD research by the first author, which focuses on the Late Neolithic from the Netherlands. The final results of the present investigation will be integrated into the dissertation, specifically into a chapter about the emergence and development of bell beakers.

³ According to the subdivision by Van der Waals & Glasbergen. See J. D. van der Waals and W. Glasbergen. "Beaker types and their distribution in the Netherlands. Intrusive types, mutual influences and local evolutions." *Palaeohistoria* IV (1955): 5-46.

⁴ See E. Drenth and A.E. Lanting. "De chronologie van de Enkelgrafcultuur in Nederland: enkele voorlopige opmerkingen." *Paleo-aktueel* 2 (1991): 42-46.

2 Late Neolithic and Early Bronze age pottery: a general overview of earlier studies

A milestone in Dutch Late Neolithic beaker research is a paper by Van der Waals & Glasbergen in *Palaeohistoria* IV from 1955⁵. It may be considered as being the first attempt of a systematical typological subdivision, seeking to explain differences in pottery in terms of cultural diversity and as differentiations in time and space. The subdivision of the SGC beakers uses variations in decoration, as does the group of All-Over-Ornamented (AOO) beakers. In the case of the ('true') bell beakers, not only ornamentation, but also the form of the vessel are seen as being significant. The typology by Van der Waals & Glasbergen is still today the standard used to classify Late Neolithic beakers. The fact that several additions and redefinitions have been made does not change this.⁶

Over time the theories of Dutch researchers about the chronological and cultural relations between the SGC and the BBC have changed profoundly. Van der Waals & Glasbergen claimed in 1955 that the SGC and the BBC were two separate cultures, which were partially contemporary. But in the 1970s Lanting & Van der Waals⁷ argued in a series of articles, that in the Lower Rhine Basin, basically comprising the Netherlands and the bordering Belgian and German regions, the BBC followed the SGC. A high degree of continuity between the two is suggested, with regard to both culture and

⁵ J. D. van der Waals and W. Glasbergen. "Beaker types and their distribution in the Netherlands. Intrusive types, mutual influences and local evolutions." *Palaeohistoria* IV (1955): 5-46.

⁶ For an historical overview of the alterations with regard to AOO beakers and bell beakers see E. Drenth and J.W.H. Hogestijn. "Bekers voor Bakker. Nieuwe ideeën over de oorsprong en ontwikkeling van klokbekers in Nederland." In *Tussen D26 en P14: Jan Albert Bakker 65 jaar*, edited by J. H. F. Bloemers, 33-146. Amsterdam: Amsterdams Archeologisch Centrum, 2007.

⁷ *e.g.* J. N. Lanting and J.D. van der Waals. "Beaker Culture relations in the Lower Rhine Basin." In *Glockenbechersymposium Oberried 1974*, edited by J.N. Lanting and J.D. van der Waals, 1-80. Bussum/Haarlem, 1976.

population. A similar view is held by Lanting⁸ of the BWC in the Netherlands and northwestern Germany, which is believed to have derived from the indigenous BBC. Among the arguments put forward are the strong similarities in burial customs. The pottery associated with both cultures is also used to illustrate this continuity.

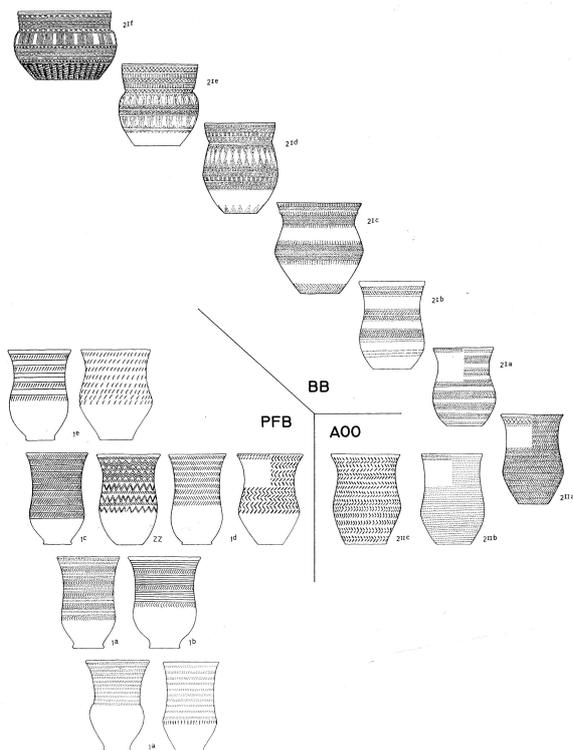


Figure 2. Typological development of beakers in the Netherlands according to Lanting & Van der Waals (1976). Legend: PFB = SGC beakers; AOO = All-over-Ornamented beakers; BB = bell beakers.

According to Lanting & Van der Waals, the group of All-Over-Ornamented (AOO) beakers developed (Figure 2) from the SGC beakers, which are decorated with impressions on the vessel's upper half or up to and including the largest belly circumference. As suggested by their typological name, the AOO is characterized by ornamentation covering (almost) the entire outer surface. The next stage in the beaker development is thought to be represented by the bell beaker of maritime type or, the 2Ia type bell beakers. These beakers also show a decoration applied to more or less the entire outer surface. However, in contrast to the AOO beakers,

⁸ J. N. Lanting. "Laat-Neolithicum en Vroege Bronstijd in Nederland en N.W.-Duitsland: continue ontwikkelingen." *Palaeohistoria* XV (1973): 215-317.

the ornamentation is zonal, *i. e.* a regular alternation of decorated and plain zones, both of about equal height. There is one type in particular amongst the group of AOO beakers which Lanting & Van der Waals consider the predecessor of the maritime bell beakers: the 2IIa type beaker (Figure 3).

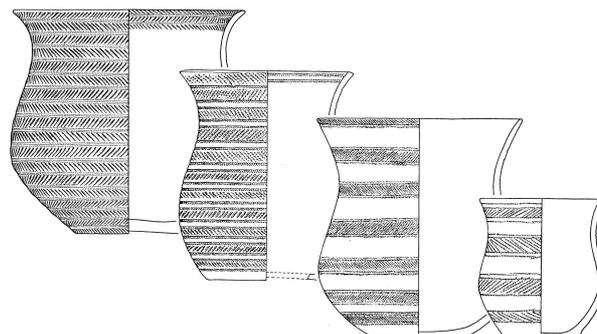


Figure 3. Gradual transition from the AOO beaker type 2IIa to the bell beaker of maritime type as envisaged by Lanting & Van der Waals (1976).

This development is thought to have been a fluent one, in which the height of undecorated zones on beakers gradually increased. The two scholars further believe that the maritime bell beaker was the earliest ("true") bell beaker, from which all other (decorated) bell beakers originated. Or, to put it differently, the remainder of decorated bell beaker types from the Netherlands supposedly have their roots, either directly or indirectly, in the maritime type bell beakers.

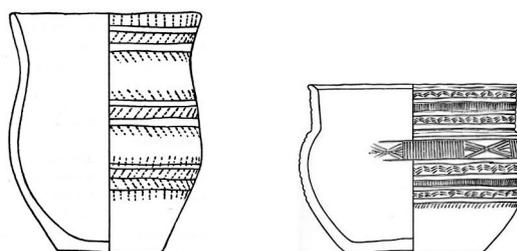


Figure 4. Examples of an "epimarine" bell beaker (left) and a bell beaker of Veluwe type (right). After Lanting & Van der Waals 1976.

Very recently Lanting has reiterated this view.⁹ On the basis of the bell beakers not classified as

⁹ J. N. Lanting. "De NO-Nederlandse / NW-Duitse klokbekeergroep: culturele achtergrond, typologie van het aardewerk, datering, verspreiding en grafitueel." *Palaeohistoria* 49/50 (2007/8): 11-326.

maritime type beakers two regional groups have been identified: one encompassing the district of the northeastern Netherlands (the provinces of Drenthe, Groningen and Overijssel as well as parts of the province of Friesland and the area within the province of Gelderland E of the rivers IJssel and Oude IJssel), the other occurring in roughly the remainder of the country. It has been suggested that each region had a beaker development of its own.¹⁰ Among the characteristic types from the first district are rated the “epimaritime” bell beakers (Figure 4, left), while in the rest of the Netherlands the bell beakers belong predominantly to the bell beakers of the Veluwe type (the Veluvian bell beakers) (Figure 4, right; see also Figure 2: the types 21^{d-f}).

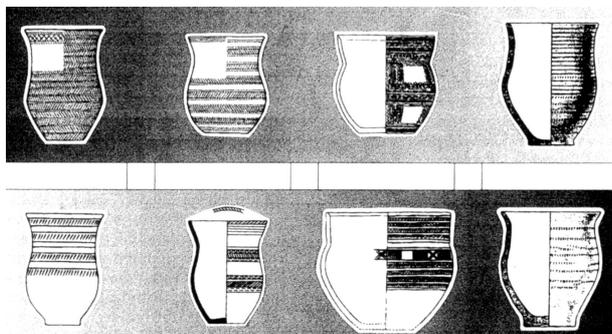


Figure 5. The two-track model as proposed by Drenth & Hogestijn (2007). Please note that the beakers depicted are only examples of “halfway down” decorated beakers (bottom row) and beakers with a (practically) completely decorated outer surface (top row). So, they are not displayed in a “genetic” sequence though in a chronological order, starting with the late SGC on the left and ending with the BWC.

In conclusion, the unilinear model envisages the development of beakers as the following sequence: SGC beakers -> AOO beakers -> bell beakers of the maritime type -> other (decorated) bell beaker types. Due to the crucial position given to the maritime bell beaker this theory of beaker development has been named the unilinear model by Drenth & Hogestijn¹¹. They have however

challenged this model, by pointing out that from the late SGC until the BWC the beakers can basically be divided into two groups: “halfway down” decorated beakers and beakers whose outer surface is (practically) decorated from rim to bottom (Figure 5).

They arrived at this conclusion after measuring the height of the decoration on several hundreds of vessels. The beakers of the late SGC, for example, fall into two groups: the SGC beakers, which belong to the “halfway decorated” group of beakers, and the AOO beakers, that represent the group with an outer surface ornamentation of 95-100%. This bimodal distribution can also be identified in bell beakers and BWC beakers, suggesting that Late Neolithic and Early Bronze Age beakers in the Netherlands may have developed along these two “lines”. Accordingly, Drenth & Hogestijn have introduced the term “two-track model” to explain the emergence and development of Dutch bell beakers.

In addition, they have drawn attention to the wide variety of decoration present during the late SGC as well as the developed and late BBC, stressing how positioning a maritime bell beaker phase in between would not be consistent with the notion of cultural continuity, the foundation of the unilinear model in its latest version. In such a phase the decorated bell beakers would exclusively be associated with the maritime type beakers, decorated with herring-bone motifs in combination with horizontal lines. The two-track model overcomes this inconsistency, by suggesting that the ornamentation found on beakers of the late SGC, continued to be applied although frequently in an altered form. In other words, there never was a decline in the decoration variety during the early BBC. Instead, the motifs used in the late SGC either continued or were transformed in the course of time, examples of which being the herring-bone and zigzag motifs. The triangles and lozenges that are found on several early bell beakers may well be rooted in the late SGC cross-hatching.

¹⁰ See e.g. J. N. Lanting. "De NO-Nederlandse/NW-Duitse klokbekeergroep: culturele achtergrond, typologie van het aardewerk, datering, verspreiding en grafritueel." *Palaeohistoria* 49/50 (2007/8): 11-326.

¹¹ E. Drenth and J.W.H. Hogestijn. "De Klokbekeercultuur in Nederland: de stand van onderzoek anno 1999." *Archeologie* 9

(1999): 99-149; see also E. Drenth and J.W.H. Hogestijn. "Bekers voor Bakker. Nieuwe ideeën over de oorsprong en ontwikkeling van klokbekeers in Nederland." In *Tussen D26 en P14: Jan Albert Bakker 65 jaar*, edited by J. H. F. Bloemers, 33-146. Amsterdam: Amsterdams Archeologisch Centrum, 2007.

Let us discuss in further detail the likeliness of a maritime bell beaker phase. In addition to the aforementioned arguments Drenth & Hogestijn have disputed its existence on other grounds. Firstly, no sites are known which have produced unequivocal evidence for such a stage in time. Secondly, during the late SGC, daggers made of French flint and stone battle-axes seem to have served as high status objects or prestige items in flat and barrow graves. The stone wrist-guards or bracers and copper daggers dating to the BBC period probably fulfilled the same role. Yet, none of the maritime bell beakers from graves in the Lower Rhine Basin have been found in association with these high status items. The existence of a maritime bell beaker phase would therefore imply severe socio-economic changes, which would contrast strongly with the overall concept of cultural continuity. Thirdly, it should be pointed out that in the case of a maritime bell beaker phase, regional differentiation would be less distinct. In other words, if this phase is rejected regional differences are clearly discernible without interruption throughout the Dutch Late Neolithic, from the early SGC onwards up to and including the late BBC.

Last but not least, it should be mentioned that sherds decorated in maritime style have been recovered from late SGC settlements in the province of North Holland. This places doubt on the existence of a maritime bell beaker phase, although admittedly this still does not exclude the possibility that during the very beginning of the BBC the decorated bell beakers were all decorated in a maritime style. At the moment the exact dating of the maritime type is unclear. There are indications that it was also present during the onset of the BBC.¹²

3 The data set

The data set we have so far analyzed, comprises c. 240 vessels, all of which are tripartite in form. The majority of these vessels are usually being labeled as beakers. The remainder consists of vessels

¹² E. Drenth and J.W.H. Hogestijn. "Bekers voor Bakker. Nieuwe ideeën over de oorsprong en ontwikkeling van klokbekers in Nederland." In *Tussen D26 en P14: Jan Albert Bakker 65 jaar*, edited by J. H. F. Bloemers, 33-146. Amsterdam: Amsterdams Archeologisch Centrum, 2007.

traditionally known as "beaker pots", dating from the BBC and the BWC, a proto-pot beaker of the late SGC, and bowls belonging to the BBC. Each piece of pottery has been published in the form of a drawing in publications. To mention each and every publication upon which our data set rests in this article is obviously not possible; however they will of course be referred to in the final report. Here it suffices to cite the major works from which the data derive.¹³

To conclude this section, it should be stressed that the analyzed sample only includes vessels which are complete or at least archaeologically complete, by which we mean that a complete profile is present.

4 The SECANTO computer program

The SECANTO computer program is a sophisticated version of the "sliced method" as developed by Shennan & Wilcock in order to classify bell beakers from Central Germany.¹⁴ Vessel profiles are divided into equidistant slices along the vertical axes and the 'distances' between the vessels are calculated as a sum of squares of the distances between the points on the outer surfaces of the vessels (Figure 6). To incorporate not only the shape of the outer vessel wall, but also the overall vessel width, the distances between the longitudinal axes are added as well.¹⁵

¹³ Major works from which the data were derived: Clarke, D.L.. *Beaker Pottery of Great Britain and Ireland*, Cambridge, 1970; J. N. Lanting. "Laat-Neolithicum en Vroege Bronstijd in Nederland en N.W.-Duitsland: continue ontwikkelingen." *Palaeohistoria* XV (1973): 215-317; J. N. Lanting. "De NO-Nederlandse/NW-Duitse klokbekeergroep: culturele achtergrond, typologie van het aardewerk, datering, verspreiding en grafitueel." *Palaeohistoria* 49/50 (2007/8): 11-326; J. N. Lanting and J.D. van der Waals. "Beaker Culture relations in the Lower Rhine Basin." In *Glockenbechersymposium Oberried 1974*, edited by J.N. Lanting and J.D. van der Waals, 1-80. Bussum/Haarlem, 1976; Lehmann, L.Th.. "Placing the Pot Beaker." *Helinium* V (1965), 3-31; Modderman, P.J.R. "Grafheuvelonderzoek in Midden-Nederland." *Berichten van de Rijksdienst voor het Oudheidkundig Bodemonderzoek* V (1954): 7-44.

¹⁴ S.J. Shennan and J.D. Wilcock. "Shape and style variation in Central German Bell Beakers. A computer- assisted study." *Science and Archaeology* 15 (1975) 17-31.

¹⁵ For more specific information about SECANTO see V. Mom "SECANTO, the SECTION ANALYSIS TOol." In *The World is in your eyes, Proceedings of the XXXIII Computer Applications and Quantitative Methods in Archaeology*

The advantage of the SECANTO computer program over the slice method is its greater accuracy. Apart from that it has several advantages when compared to the traditional intuitive classification. The main one being that it measures exactly the distance between the overall shape of vessels. Such a procedure is more precise, objective and repeatable (and therefore easier to check) than an intuitive classification such as "beaker A looks very similar to B, however specimen C has entirely different shape". Such a statement does not include a precise quantification of the degree of similarity.

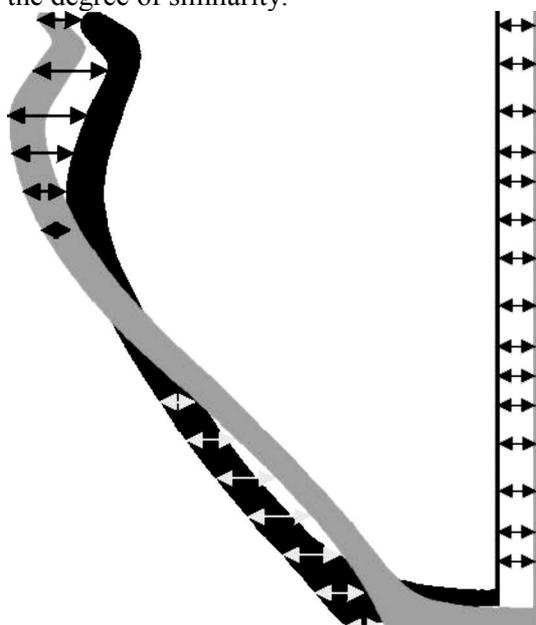


Figure 6. The basis of the SECANTO computer program illustrated, in this instance by a comparison between two Dutch vessels from the Roman Iron Age.

Conference (March 2005 - Tomar, Portugal), edited by Alexandra Figueiredo and Gonçalo Velho, 95-101. Tomar, CAAPortugal, 2007; V. Mom "Where Did I See You Before... A Holistic Method to Compare and Find Archaeological Artifacts" In *Advances in Data Analysis. Studies in Classification, Data Analysis and Knowledge Organization*, edited by R. Decker and H.-J. Lenz, 671-680. Berlin 2007; and V. Mom and H. Paijmans. "SECANTO, a Retrieval System and Classification tool for Simple Artifacts." In *Layers of Perception, Proceedings of the 35th International Conference on Computer Applications and Quantitative Methods in Archaeology (CAA) Berlin, Germany, April 2-6, 2007*, edited by A. Posluschny, K. Lambers and I. Herzog, 171. Bonn, Dr. Rudolf Habelt GmbH, 2008.

It should be emphasized that the SECANTO computer program focuses on the overall vessel shape and, therefore, ignores any details. Accordingly, nominal traits, such as inverted rims, protruding foots and carinated profiles, are not seen as being important, in contrast to traditional typologies.¹⁶ This is certainly the program's major disadvantage. It means that analyzing a data set with SECANTO does not automatically result into a ready to use typology, since grouping vessels is something which in our opinion must be done by taking, not only the overall shape but also form details, such as the shape of a rim and the foot, into consideration.

5 Preliminary results

The SECANTO analysis has resulted into the distinction of 13 individual shape groups. Several of these groups are very similar or even identical to the groups of earlier classifications. To give an example, Lanting has distinguished the category of large Barbed Wire pots¹⁷, using both the decoration and the vessel shape as criteria, the latter, having an egg-shaped body, a small foot and an short inverted high placed neck. This form is typical of one of the groups resulting from the SECANTO analysis (Figure 7, left).

Two other shape groups consist of vessels with a relatively wide base, no protruding foot and a slightly everted or more or less cylindrical neck. The main difference between these two groups is the relative height of the belly. These two groups mainly contain vessels which traditionally are classified as Veluwe type beakers.¹⁸ However our study has also produced a number of new groups or at least groups that have not been published as

¹⁶ e. g. J. D. van der Waals and W. Glasbergen. "Beaker types and their distribution in the Netherlands. Intrusive types, mutual influences and local evolutions." *Palaeohistoria* IV (1955): 5-46.

¹⁷ J. N. Lanting. "Verspreiding en datering van wikkeldraadaardewerk." *Nieuw Drentse Volksalmanak* 87 (1969): 31-49 (191-209). and J. N. Lanting. "Laat-Neolithicum en Vroege Bronstijd in Nederland en N.W.-Duitsland: continue ontwikkelingen." *Palaeohistoria* XV (1973): 215-317.

¹⁸ J. D. van der Waals and W. Glasbergen. "Beaker types and their distribution in the Netherlands. Intrusive types, mutual influences and local evolutions." *Palaeohistoria* IV (1955): 5-46.

such. An example is a group of vessels with an S-shaped profile, of which the maximum belly diameter is situated relatively low, about 1/5 to 2/5 of the vessel's height (measured from the bottom). Judging by the decoration, the majority of the vessels under consideration must be rated among the SGC beakers (Figure 7, right).

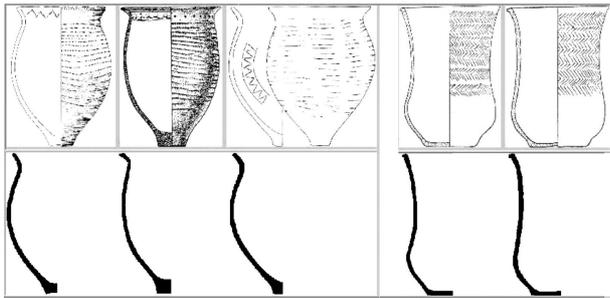


Figure 7. left: One of the shape groups distinguished with the SECANTO computer program. Notice that not only the vessels are morphologically similar, but also resemble one another in decoration (barbed wire motifs). One of the figures after Lanting 1973. Right: Two SGC beakers from the primary central grave of barrow II on the Ermelose Heide, mun. of Ermelo, prov. of Gelderland (after Modderman 1954). The overall shape, the herringbone motif, the height of the decoration and the lip at the rim on both beakers as well as the context from the pottery derives suggest that they are the products of the same potter.

As noted before, we were compelled to take a closer look at specific shape traits, as the SECANTO computer program does not take these into account. This led to two discoveries of note: firstly, it is possible that two SGC beakers were produced by the same maker. The rim of these beakers is characterized by a small lip (Figure 7, right), a feature which is further unparalleled in the sample group. In addition to this trait there are two other arguments that support the view that they were produced by the same hand. The first argument is a geographical one, since the beakers were found together in the central primary grave of barrow II on the "Ermelose Heide", situated in the Veluwe region (prov. of Gelderland) in the center of the Netherlands. The second reason being that apart from sharing a very rare and typical kind of rim, they are almost identical in both shape and decoration. As regards the former, the SECANTO analysis shows that within the sample investigated

these beakers are one another's closest matches. Furthermore, both are decorated with a herringbone motif. Equally the height of the decoration is very similar, *i. e.* in both instances covering *c.* 64% of the outer surface.

The second discovery concerns three bell beakers recovered in the northeastern part of the Netherlands. The beakers were found in the central grave of barrow I at Diever, mun. of Westerveld, a probably secondary grave in barrow Otterberg II at Drijber, mun. of Midden-Drenthe, and the primary central grave of a burial mound at Odoorn, mun. of Borger-Odoorn. All three barrows are located in the province of Drenthe. Typologically the beakers belong to regional beaker types.¹⁹ What sets these three beakers apart, from other examples of the regional beaker types in the northeastern Netherlands²⁰, is the internally beveled rim. Rims with an internal bevel are more often encountered in bell beakers of the Veluwe type.²¹

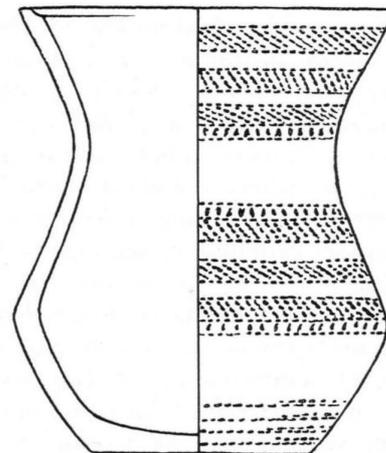


Figure 8. Bell beaker from Odoorn, prov. of Drenthe, in the northern part of the Netherlands (after Lanting & Van der Waals 1976). Notice the internally beveled rim, a feature which is rarely

¹⁹ J. N. Lanting. "De NO-Nederlandse/NW-Duitse klokbekergroep: culturele achtergrond, typologie van het aardewerk, datering, verspreiding en grafritueel." *Palaeohistoria* 49/50 (2007/8): 11-326.

²⁰ Cf. J. N. Lanting. "Laat-Neolithicum en Vroege Bronstijd in Nederland en N.W.-Duitsland: continue ontwikkeling." *Palaeohistoria* XV (1973): 248.

²¹ J. D. van der Waals and W. Glasbergen. "Beaker types and their distribution in the Netherlands. Intrusive types, mutual influences and local evolutions." *Palaeohistoria* IV (1955): 25.

encountered in the local and regional bell beakers. Such a rim type is however frequently found in the bell beakers of the Veluwe type. The beaker type has its main distribution in the western, central and southern districts of the Netherlands.

Therefore, we can assume that the beakers from Diever, Drijber and Odoorn display influences from elsewhere, since the core area of the Veluvian type bell beakers in the Netherlands encompasses roughly the western, central and southern part of the country.²² Our suggestion is supported by the fact that a few bell beakers of Veluwe type have come to light in the northern Netherlands.²³

6 Conclusions

It goes without saying that the pottery analysis with the help of the SECANTO computer program is a step in the establishment of a new typological subdivision. Apart from shape, vessels have other relevant traits. Decoration is usually considered, at least from a typological point of view, as one of the major ones. By combining different traits we hope to arrive at meaningful and useful units. But what is useful and meaningful? In our opinion, creating a typology with these qualities requires not only an assessment of a combination of the intrinsic features that individual vessels have, but should also include extrinsic aspects (contextual information).²⁴ In other words, the typological approach we have chosen is holistic. The aforementioned results, notwithstanding their preliminary character, illustrate this. The advantage of typologies based on this approach is that the line of reasoning can be followed and the outcomes can be tested. The use of the SECANTO computer program is well suited to this method.

²² See for more information J. N. Lanting. "De NO-Nederlandse/NW-Duitse klokbekergroep: culturele achtergrond, typologie van het aardewerk, datering, verspreiding en grafitueel." *Palaeohistoria* 49/50 (2007/8): 52-53.

²³ J. N. Lanting. "De NO-Nederlandse/NW-Duitse klokbekergroep: culturele achtergrond, typologie van het aardewerk, datering, verspreiding en grafitueel." *Palaeohistoria* 49/50 (2007/8): 11-326.

²⁴ Adams, W.Y. and E.W. Adams. *Archaeological Typology and Practical Reality. A Dialectical Approach to Artifact Classification and Sorting*, Cambridge, 1991.

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