The DGE Nutrition Circle – Presentation and Basis of the Food-Related Recommendations from the German Nutrition Society (DGE)

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Summary

The three dimensional food pyramid and the DGE Nutrition Circle were established by the German Nutrition Society and portray nutritional recommendations for adults. The circle is based on D-A-CH reference values for nutrient intake and depicts quantitative aspects of nutrition, as supported by the available scientific evidence; the pyramid also includes qualitative aspects of nutritional physiology. The individual segments of the DGE nutrition circle are proportional to the quantities of the individual nutrient groups that are required for adequate and well balanced nutrition. Compliance with the nutritional recommendations can contribute to the prevention of chronic diseases. It has been confirmed that these food-based recommendations are practicable.

Keywords: Food-related nutritional recommendations, adequate nutrition, prevention, reference values for nutritional intake, food groups

Introduction

There are essentially two different ways to portray nutritional recommendations for different sorts of food. A circle is often used to depict the optimal contribution of each food group to the overall food intake [1, 2].

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On the other hand, a two dimensional pyramid or triangle has often been preferred. This can portray a hierarchy of food groups and is often used to advocate moderation in the consumption of food at the tip of the pyramid [3]. This approach was pioneered by the U. S. Department of Agriculture (USDA), which introduced the Food Guide Pyramid in 1992 [4]. Since then, the food circle has been used less frequently to depict recommended food intake, as the pyramids had novelty value and evoked considerable interest from institutions, societies, food industry and individuals. As a result, there were more than 100 different pyramid models by 2004 [5].

Food-related nutritional recommendations are of increasing scientific interest, as they indicate how nutrition can support health or reduce the risk of specific diseases and can complement reference values for food intake.

An ad hoc working group of the German Nutrition Society (DGE) on the theme of food-related prevention has studied the concept of food-related nutritional recommendations; they have already published an article in the Ernährungs Umschau [6] and have provided support for the present article. This will be followed by a further publication, with an assessment of the current status of food-related recommendations and the requirements for future recommendations. The present article will discuss the status of the diagrams which the DGE has developed in this area, together with their scientific foundation.

The DGE diagrams to portray food-related recommendations

In order to implement their recommendations for adequate and well balanced nutrition – to support health and prevent illness –, the DGE has established two graphic models.

The DGE Nutrition Circle

The DGE Nutrition Circle (◆Figure 1) portrays the reference values for nutrient intake for adults [7] and represents the food-related recommendations for adequate and well bal-

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anced nutrition [8, 9]. The basic form of the DGE Nutrition Circle was first introduced in 1955 [10] and has been continuously developed. The current version was presented in 2005 and was calculated on the basis of Version II.3 of the German Nutrient Data Base (BLS). The most important conclusions portrayed in the DGE nutrition cycle are that food should be selected daily from all 7 food groups, that the relative quantities should be as presented and that a variety of foods should be selected in each group.

The special feature of the current DGE Nutrition Circle is that it is segmented on the basis of the calculated quantities of food. The segments represent the relative quantities of the different food groups which are required for an adequate and well balanced diet.

Figure 1: **DGE Nutrition Circle**

The nutrition cycle implements the D-A-CH reference values for nutrient intake [7] at the level of food. It is also in accordance with the results of evidence-based guidelines and systematic reviews by the DGE and other professional societies. The nutrition circle implements the recommendations for high consumption of vegetables, fruit [11–13] and cereal (particularly cereal dietary fibre) [13–15], the guarantee of adequate fish consumption [11, 16–18] and the reduction in the consumption of meat (particularly red meat) and sausages [11, 13–15]. It is also thought to be important to reduce consumption of fats, particularly of saturated fatty acids [13, 17–19].

Based on weekly menus

Comprehensive calculations [9] were performed for 4 groups of persons – separately for men and women and separately for the two age groups of 25 to 51 years old and at least 65 years old. PAL was assumed to be 1.4. On this basis, sample menus were prepared for one week, which were planned to provide mean food intake for 7 days which fulfilled the reference values. With this procedure, the energy intake ranged between 1 600 kilocalories or 6.9 MJ (women, over 65 years, 55 kg body weight) and 2 400 kilocalories or 10.2 MJ (men, 25 to 51 years, 74 kg body weight). In addition to the reference values, the conversion to foods was based on the "10 DGE Rules" and the recommendations from the "5 a day" campaign (5 portions of vegetables and fruit per day, 400 g vegetables, including raw vegetables; 250 g fruit) [20].

The meals were based on conventional foods, assuming practicable methods of preparation. Foods which were less nutritionally desirable – foods with low nutrient density and/or high energy density, such as sweet or fatty snacks, alcoholic drinks and lemonades containing sugar – were excluded. It is in fact possible to fulfil the reference values without using enriched foods or food supplements, as long as there is adequate exposure to the sun, in order to ensure endogenous vitamin D synthesis. To ensure iodine intake, it was assumed that 2 g iodinated cooking salt per day was consumed. The fact was ignored that pregnant women require folic acid supplementation [7].

In the sample menus, the proportion of fat was from 28 to 31 energy %, of protein from 16 to 17 energy % and of carbohydrate from 52 to 53 energy %.

Food Groups

In the next step, the foods used were subsumed into 6 groups and evaluated by weight. The size of each segment in the nutrition cycle was calculated from the percentage share of the total weight of food in the daily plan. The total weight of the drinks was almost as great as that of the other foods. To represent this and to

show their physiological importance, drinks were placed in the centre of the circle. It was accepted that the area for the drinks was then smaller than it should have been according to the calculation.

The DGE Nutrition Circle is a portrayal in which the size of the segments (◆ Figure 2) is in fact a measure of the quantity of each food. It also makes a qualitative statement, as only nutritionally desirable foods are shown. It is made clear that adequate and well balanced nutrition must be based on plant foods, such as cereal products, preferably whole grain, as well as vegetables and fruit. This foundation is best complemented by low fat milk, low fat meat, fish and plant oils. Adequate concomitant fluid intake is also necessary.

As an orientation, ◆ Table 1 lists suggested weights for foods in the different groups. The figures are for a single day, with the exception of group 5, for which the total weight for 1 week is given. The nutrition circle does not separate the individual days. A range is given for the weights of each of the foods. The lower values apply to a low energy intake and the higher values to high energy intake. The division of the foods into segments shows that the nutrition circle offers a basic orientation for the selection of foods, rather than strict rules for specific meals, methods of preparation or products. The food should be lightly boiled with low fat. It is recommended that some of the vegetables should be eaten raw.

Food selection in accordance with the DGE Nutrition Circle provides a reliable foundation for adequate and well balanced nutrition, based on the implementation of the reference values. It is intended for healthy adults and ensures that the intake of nutrients and dietary fibre is in accordance with the reference values. Moreover, it prevents the intake of excessive levels of individual nutrients or undesired food components (such as fat or cholesterol), as well as allowing a high intake of secondary plant components. In this way, it helps to prevent health disorders which are at least partially related to nutrition [7].

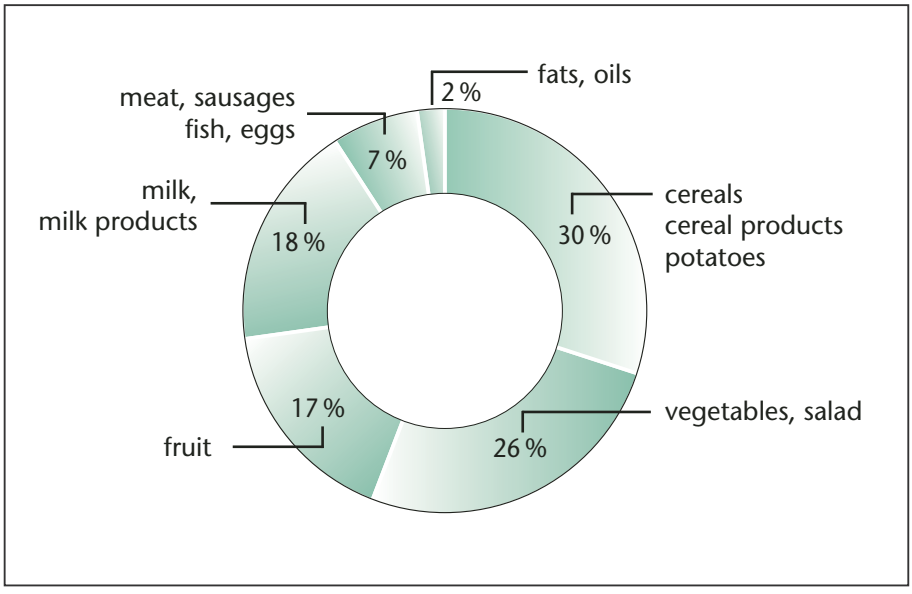

Figure 2: **The proportion of the individual segments in the overall weight of food – excluding drinks, expressed as weight percent**

Use of the DGE Nutrition Circle in nutritional advice

Aside from the three dimensional pyramid, the DGE Nutrition Circle is the diagram most often used by opinion leaders in Germany in nutritional advice, in order to visualise nutritional recommendations [21]. In work with adults, these opinion

In the EPIC Potsdam study, the association between adherence to the food-related recommendations of the DGE Nutrition Circle and the risk of cardiovascular diseases, type 2 diabetes mellitus and cancer, was examined for 23 531 volunteers. A Healthy Eating Index (HEI-DGE) was calculated, which assessed the ratio between the actual and the recommended consumption of individual food groups [6].

A higher score then indicates better implementation of the recommendations. For men – but not for women –, the HEI-DGE exhibited a statistically significant inverse correlation with the risk of cardiovascular diseases, type 2 diabetes mellitus and overall chronic diseases. No association was found for cancer. It therefore appears that good adherence to the recommendations of the DGE nutrition circle reduces the risk of chronic diseases. One possibility for the lack of statistical significance with women is that women – particularly obese women – have a greater tendency than men to misrepresent what they consume. On the other hand, it is conceivable that there are gender-specific differences in the constellation of the risk factors for some diseases (e. g. cardiovascular diseases) which could reduce nutritional effects in women.

leaders most often use the Nutrition Circle.

The DGE Nutrition Circle is the trend setter and symbol for adequate and well balanced nutrition. Nevertheless, it allows adequate scope for menu planning. The circle is not a map of eating habits, but shows how to achieve the optimal form.

The nutrition circle is an established method of illustrating nutritional recommendations and is undergoing a renaissance in the USA too. In June 2011, the previous pyramid model was replaced by My Plate [22]. One plate contains four differently coloured fields, as a roughly simplified portrayal of individual food groups or food suppliers – fruits, cereals, vegetables and proteins. The illustration is completed with milk products in the form of a symbolic drinking vessel. Thus, the shape of the pyramid had been changed to a circle – a return to the nutrition circle, which had been established in the USA in 1940 [23].

Food	Approximate Values for Adults
Group 1: cereals, cereal products, potatoes	*daily* – 4–6 slices (200–300 g) of bread **or** 3–5 slices (150–250 g) of bread and 50–60 g cereal flakes and – 1 portion (200–250 g) potatoes (boiled) **or** 1 portion (200–250 g) noodles (boiled) **or** 1 portion (150–180 g) rice (boiled) Full grain products preferred
Group 2: vegetables and salad	*daily* – at least 3 portions (400 g) vegetables 300 g lightly boiled vegetables and 100 g raw vegetables/salad **or** 200 g lightly boiled vegetables and 200 g raw vegetables/salad
Group 3: fruit	*daily* – at least 2 portions (250 g) fruit
Group 4:	*daily* – milk and milk products – 200–250 g low fat milk and milk products and – 2 slices (50–60 g) low fat cheese
Group 5: meat, sausages, fish and eggs	*weekly* – 300–600 g low fat meat (prepared) and low fat salami and – 1 portion (80–150 g) low fat sea fish (prepared) and – 1 portion (70 g) fatty sea fish (prepared) and – up to 3 eggs (including processed eggs)
Group 6: oils and fats	*daily* – 10–15 g oil (e.g. rape, walnut or soya oil) and – 15–30 g margarine or butter
Group 7: drinks	*daily* – about 1.5 L energy-free or low energy drinks preferred

Table 1: Quantities of food in the DGE Nutrition Circle

Nutrition circle and three dimensional food pyramid

The DGE Nutrition Circle is the base of the three dimensional food pyramid and is therefore a core element of the food-related recommendations here too. During several workshops and consultations with the aid infodienst and the Federal Ministry of Food Agriculture and Consumer Protection (BMELV), the three dimensional food pyramid was developed by the DGE as a complement to the DGE Nutrition Circle. It was intended to be a new graphic model for the implementation of nutrition recommendations [24]. This three dimensional food pyramid has the novel feature of combining quantitative statements (nutrition circle) with qualitative statements in a *single* model.

A qualitative food hierarchy is developed on the four faces of the pyramid – plant foods, animal foods, oils and fats, and drinks –, primarily on the basis of energy density and nutrient content, as well as other nutritional physiological criteria and epidemiological knowledge. Because of their different characteristics, specific criteria are needed for each face of the pyramid [25].

The three dimensional food pyramid does not only include desirable foods, but also products of daily consumption. For example, nutritionally desirable foods include vegetables, fruit, fish, low fat milk and milk products, low fat meat, rape oil and water. These foods are low in the corresponding faces of the pyramid. Less nutritionally desirable foods include energy drinks, lemonades, sweets, munchies, lard, butter, eggs or fatty meat products. These are placed at the top of the corresponding face of the pyramid. This makes it clear that only small quantities of these foods should be used within this group.

Use of the 3D pyramid in nutritional advice

To check the acceptability of the three dimensional food pyramid, both the concept and design of the pyramid were presented to various

Shortly after the publication of the three dimensional food pyramid, the journal Ernährungs Umschau carried out an on-line survey [27]. 84 % of responders were already familiar with the new food pyramid from professional journals; only 5 % had heard about it in daily newspapers or on TV or radio.

59 % had read the article in the Ernährungs Umschau on the graphical implementation of nutritional recommendations [25]. Most of the Ernährungs Umschau readers had a favourable opinion of the new three dimensional food pyramid. 39 % of the readers were convinced that the model would be established in practice. 46 % would use the new three dimensional food pyramid to inform clients, customers or pupils about nutritional guidelines.18 % would use it for the information or further education of opinion leaders. 38 % were still undecided. 45 % considered that the three dimensional food pyramid was well designed. The colouring made it easier to understand and the change in colours from green to red simplified qualitative food selection. 56 % of the participants considered that the three dimensional food pyramid facilitated the transmission of nutritional guidelines and nutritional knowledge.

groups of opinion leaders during its development. All these groups considered that the approach was comprehensible and that the graphical implementation was attractive. It was regarded as good material for the discussion of adequate and well balanced nutrition with various target groups [26].

An evaluation was performed of the benefits, strengths and weaknesses of the DGE three dimensional food pyramid [28]. Students were found to be more positive than nutritional experts. The clearness and ease of handling of the model were rated favourably, as were the close connection between the developed materials and the link between quantity and quality. The study participants advocated enhanced orientation to target groups and would have liked additional supporting materials.

Conclusion

The DGE Nutrition Circle is unique in that the size of the segments of the food groups is an objective measure of the corresponding quantities of the foods. If the food-related recommendations are adhered to, the D-A-CH reference values for food intake are fulfilled and aspects of disease prevention are taken into consideration. Depending on the target group and the medium, the DGE Nutrition Circle and the three dimensional pyramid can be successfully used for nutritional advice and information. Work with specific target groups is facilitated by various written and electronic media dealing with the DGE Nutrition Circle and the three dimensional food pyramid.

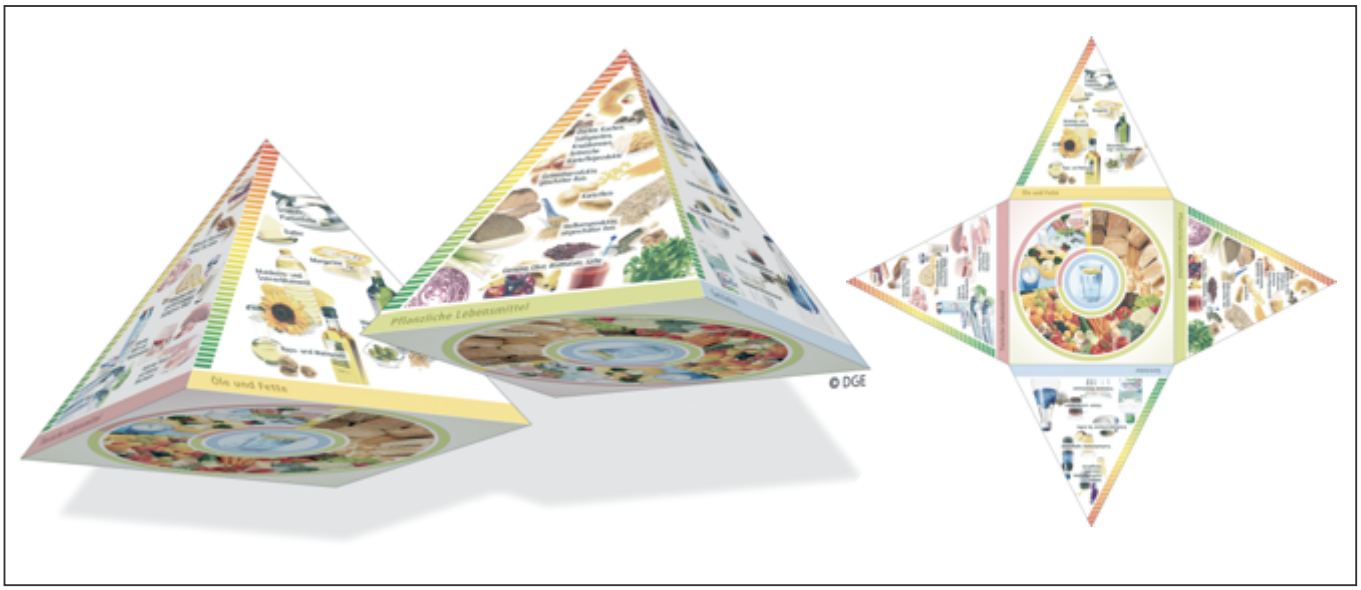

Figure 3: **3D pyramid – spatial presentation and unfolded**

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Conflict of Interest
The authors declare no conflict of interest according to the guidelines of the International Committee of Medical Journal Editors.

References

1. *FAO (Food and Agriculture Organization). Examples of foods in current sets of dietary guidelines and food guides. In: Preparation and use of food-based dietary guidelines. Report of a joint FAO/WHO consultation. Nicosia, Cyprus (1996)*
2. *Painter J et al. (2002) Comparison of international food guide pictorial representations. Journal of the American Dietetic Organisation 102: 483–489*
3. *Welsh SO, Davis C, Shaw A. USDA's Food Guide: Background and Development. Miscellaneous Publication No.1514 (1993)*
4. *Shaw A, Fulton L, Davis C, Hogbin M. Using The Food Guide Pyramid: A Resource for Nutrition Educators. U.S. Department of Agriculture Food, Nutrition, and Consumer Services, Center For Nutrition Policy and Promotion (1998)*
5. *Leitzmann C (2004) Ernährungspyramiden unter der Lupe. UGB-Forum 3: 140–143*
6. *von Ruesten A, Feller S, Boeing H (2011) Beeinflusst die Einhaltung der Empfehlungen des DGE-Ernährungskreises das Risiko für chronische Erkrankungen? Ernährungs Umschau 58: 242–249*
7. *Deutsche Gesellschaft für Ernährung, Österreichische Gesellschaft für Ernährung, Schweizerische Gesellschaft für Ernährungsforschung, Schweizerische Vereinigung für Ernährung (Hg). Referenzwerte für die Nährstoffzufuhr. Neuer Umschau Buchverlag, Neustadt a. d. Weinstraße, 1. Aufl., 3. vollständig durchgesehener und korrigierter Nachdruck (2008)*
8. *Deutsche Gesellschaft für Ernährung (2004) Der neue DGE-Ernährungskreis. DGEinfo (4): 54–56*
9. *Deutsche Gesellschaft für Ernährung (2004) DGE-Ernährungskreis – Lebensmittelmengen. DGEinfo (5): 73*
10. *Deutsche Gesellschaft für Ernährung (Hg). Der Ernährungskreis. Frankfurt (1955)*
11. *WCRF (World Cancer Research Fund)/AICR (American Institute for Cancer Research). Food, Nutrition, Physical Activity, and the Prevention of Cancer: a Global Perspective. Washington DC (2007)*
12. *Deutsche Gesellschaft für Ernährung (Hg). DGE-Stellungnahme: Obst und Gemüse in der Prävention chronischer Krankheiten (2012) URL: www.dge.de/pdf/ws/DGE-Stellungnahme-Gemuese-Obst-2012.pdf Zugriff 07.02.12*
13. *WHO (World Health Organization). Diet, Nutrition and the Prevention of Chronic Diseases. WHO technical report series 916 (2003)*
14. *WCRF (World Cancer Research Fund)/AICR (American Institute for Cancer Research). Continuous Update Project Interim Report Summary. Food, Nutrition, Physical Activity, and the Prevention of Colorectal Cancer. (2011)*
15. *Deutsche Gesellschaft für Ernährung (Hg). Kohlenhydratzufuhr und Prävention ausgewählter ernährungsmitbedingter Krankheiten – Evidenzbasierte Leitlinie. Bonn (2011) URL: www.dge.de/leitlinie Zugriff 07.02.12*
16. *DDG, DAG, DGEM, DGE: Evidenzbasierte Ernährungsempfehlungen zur Behandlung und Prävention des Diabetes mellitus (2004) URL: www.deutsche-diabetes-gesellschaft.de/redaktion/mitteilungen/leitlinien/Uebersicht_leitlinien_evidenzbasiert.php Zugriff 07.02.12*
17. *Deutsche Gesellschaft für Ernährung (Hg). Fettkonsum und Prävention ausgewählter ernährungsmitbedingter Krankheiten – Evidenzbasierte Leitlinie. Bonn (2006) URL: www.dge.de/leitlinie Zugriff 07.02.12*
18. *Scottish Intercollegiate Guidelines Network SIGN: Heart Disease Guidelines (2007) URL: www.sign.ac.uk/guidelines/fulltext/93-97/index.html Zugriff 07.02.12*
19. *Deutsche Adipositas-Gesellschaft, Deutsche Diabetes-Gesellschaft, Deutsche Gesellschaft für Ernährung, Deutsche Gesellschaft für Ernährungsmedizin (Hg). Evidenzbasierte Leitlinie Prävention und Therapie der Adipositas (2007) URL: www.dge.de/leitlinie Zugriff 07.02.12*
20. *Deutsche Gesellschaft für Ernährung (Hg). 10 Regeln für eine vollwertige Ernährung. Bonn (2011)*
21. *Menzel C, Kessner L, Flothkötter M (2009) Nutzung von Modellen in der Ernährungsberatung. Ernährung im Fokus 9-06: 222–228*
22. *United States Department of Agriculture (USDA). My Plate (2011) URL: www.choosemyplate.gov/ Zugriff 07.02.12*
23. *USDA: A brief History of USDA Food Guides (2011) URL: www.choosemyplate.gov/foodgroups/downloads/MyPlate/ABriefHistoryOfUSDAFoodGuides.pdf Zugriff 07.02.12*
24. *aid-Infodienst, Deutsche Gesellschaft für Ernährung. DGE und aid beschließen gemeinsame Ernährungspyramide. Ergebnisse des aid-DGE Expertenworkshops vom 14.7.04. DGE-aktuell Juli (2004)*
25. *Stehle P, Oberritter H, Büning-Fesel M, Heseker H (2005) Grafische Umsetzung von Ernährungsrichtlinien – traditionelle und neue Ansätze. Ernährungs Umschau 52: 128–135*
26. *Oberritter H. Die Dreidimensionale Lebensmittelpyramide. Didaktisches Hilfsmittel für die Vermittlung von Ernährungswissen in Deutschland. Vortrag Jahrestagung von ÖGE, GÖCH und VOELB. In: Tagungsband Ernährung von Kindern – Lebensmittel für Kinder. ÖGE (2005)*
27. *Die neue Lebensmittelpyramide. Ergebnisse unserer Online-Umfrage. Ernährungs Umschau 52 (2005): 247*
28. *Johannsen U, Heindl I, Niemann D, Rademacher C, Oberritter H (2011) Evaluationsstudie zum Einsatz und Nutzen der Dreidimensionalen Lebensmittelpyramide in der Ernährungsbildung und -beratung. Ernährungs Umschau 58: 19–25*

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