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„Usability and consumer acceptance of tethered caps for beverage containers“

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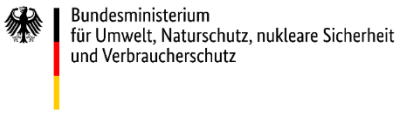

aufgrund eines Beschlusses
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Usability and consumer acceptance of tethered caps for beverage containers

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1. Short summary

Since the European Directive EU 2019/904 (Single-Use Plastics Directive) came into force on July 3, 2024, only single-use beverage containers with a volume of up to 3 litres whose lids remain attached to the container for the entire duration of use may be placed on the market in the European Union. However, numerous beverage and juice producers and dairies had already switched to tethered caps before the directive came into force in July 2024, with the result that a large number of different, more or less consumer-friendly tethered cap solutions are now already available on the market. Although first publicly available studies on consumer acceptance and usability of tethered caps already exist, these are only of limited value, either due to their reference to a specific closure model[1] or due to the study design[2], with regard to the usability of tethered caps, especially for particularly vulnerable groups (children and physically impaired and/or elderly people).

For this reason, the DIN Consumer Council has commissioned a study to obtain detailed feedback especially from children, older people and people with physical disabilities on the acceptance and usability of tethered caps and to derive corresponding recommendations for action for the European Commission and for standardisation on the basis of the feedback received.

1.1 Key Findings of the study

- Consumers interviewed for the study generally felt they hadn't been informed well enough about the introduction of the tethered caps.
- The interviewed consumers saw little environmental benefit arising from the tethered caps; a perception which further negatively impacts consumer acceptance of tethered cap solutions.
- Consumers interviewed complained about the confusing number of tethered cap solutions available. Having too many different systems in use is overwhelming in day-to-day use.
- Consumers are dissatisfied with the usability of the tethered cap closure solutions that are currently on the market. Opening and closing the tethered caps, as well as pouring or drinking out of the single-use beverage containers/bottles with tethered caps is found to be considerably more difficult than was the case with bottles where the cap could be removed completely.

[1] Packaginginsights.com, Accessed on 23.09.2024

[2] Sidel.com, Accessed on 23.09.2024

1.2 Recommendations for standardisation

- It is recommended to the European Commission to add the term “usability“ to Article 6, paragraph 3, of the Single-Use Plastics Directive so as to ensure usability for all consumers.
- Furthermore, based on the findings and insights, collected during this study, it is recommended to revise DIN EN 17665 “Packaging - Test methods and requirements to demonstrate that plastic caps and lids remain attached to beverage containers in order to take into account the opening strength, dexterity, cognition and methods and mechanisms of opening the package, as well as aspects of force and handling and other aspects as contained in DIN EN ISO 17480 “Packaging - Accessible design - Ease of opening”.
- It is also recommended to develop a standard on terminology and definitions regarding tethered caps. Additionally, it is considered advisable to conduct interlaboratory tests and then, based on the results of these ring tests, to develop a standard determining the optimal ratio between cap, container and required torque for all common beverage containers affected by the Single-Use Plastics Directive.

2. Background and objectives of the study

On June 5th, 2019, the European Parliament and the Council of Europe adopted EU directive EU 2019/904 to reduce the impact of certain plastic products on the environment. The directive, amongst other things, stipulates that from July 3rd, 2024, when it comes to single-use beverage containers with a volume of up to 3 litres, only those with caps that remain attached to the container throughout the entire period of use will be allowed on the market. These caps that remain attached to the container are also referred to as “Tethered Caps”. Even before the Single-Use Plastics Directive came into effect in July 2024, many beverage manufacturers and dairies had already begun to switch to tethered caps for beverage containers for which the directive would require them. This early switch has resulted in a multitude of different closure systems on the market, some of which are more user-friendly and others less so.

There is very little representative consumer feedback about tethered caps. So far, the only publicly available studies that have been done on the subject were initiated by manufacturers of tethered caps (see Chapter 4: State of research / Status Quo). Although there are publicly accessible published studies investigating consumer acceptance and fitness for purpose/usability of tethered caps, they are not very conclusive for vulnerable

consumer groups (children and/people with physical impairment) due to the fact that they focussed on a specific design of tethered cap, or because of the study design.

For this reason, the DIN Consumer Council has commissioned a study to obtain detailed feedback especially from children, older people and people with physical disabilities on the acceptance and usability of tethered caps and to derive corresponding recommendations for action for the European Commission and for standardisation on the basis of the feedback received.

The focus of the questions was:

- How do consumers generally feel about tethered caps?
- What are the pros and cons of the different types of tethered caps?
- What are the challenges and problems that emerge in day-to-day use (both for specific individual target groups and also across all target groups)? Did any injuries or similar problems occur when using tethered caps?
- How well are consumers able to open the tethered caps on their own, i.e. without help?
- Does the usability of the tethered caps affect consumers' purchase decisions?
- What are the needs and wishes that consumers have when it comes to a user-friendly design of tethered caps?

3. Methodical approach

3.1 Status Quo

Based on European and national legislation on tethered caps, including EU Directive 2019/904 (in particular Article 6), Chapter 4 of this study summarizes the legal requirements for manufacturers and suppliers as well as the results of previously published studies on consumer acceptance and usability of tethered plastic closures. This is based on publicly available publications at the time this study was compiled. In addition, the relationship between EU Directive 2019/904 and DIN EN 17665:2023-05 "Packaging - Test methods and requirements to demonstrate that plastic caps and lids remain attached to beverage containers" is shown.

3.2 Qualitative Study

The main focus of this study lays on the detailed feedback from the consumers surveyed on the tested tethered cap solutions. In order to represent an approximate social cross-section of the group of users of tethered caps and to focus on particularly vulnerable groups, the following five target groups, each with a balanced gender ratio, were surveyed as part of this study (see Figure 1):

- 6 children aged 6 to 9 years
- 6 consumers with reduced dexterity/hand strength (e.g. due to rheumatoid arthritis)
- 6 consumers with age-related impairment, i.e. consumers over the age of 70
- 6 consumers with visual impairment (e.g. with corneal astigmatism)
- 6 consumers without any impairments

Overview of study sample

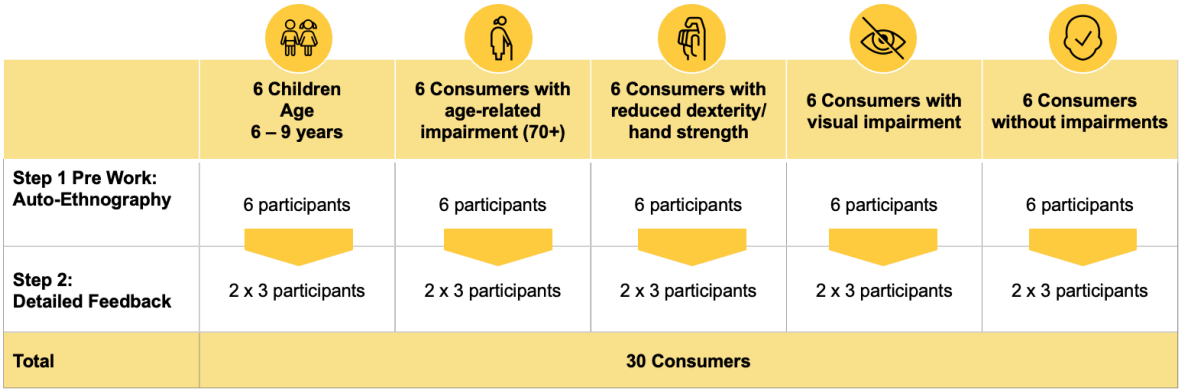

Fig. 1: Structure of the sample

In reference to Jakob Nielsen (2000)[3] in the field of Usability Research, it can be said that within a given target group, in terms of information gained, a saturation point is achieved from a sample size of five participants. Any additional respondent contributes very little in terms of new or relevant insights. They merely confirm or reinforce information and theories already collected. It is with this in mind that the number of six respondents per sub-group was deemed adequate.

[3] https://www.nngroup.com/articles/why-you-only-need-to-test-with-5-users/

Research sites/location

The consumer feedback primarily depends on criteria such as age, presence of an impairment, etc. In which part of the country the consumers surveyed live has barely any impact at all. The usage of beverage containers with tethered caps, with all their strengths and weaknesses, doesn't differ at all between Hamburg and Munich. This is why it was decided to conduct the study only in Berlin.

Three-stage research design

The study involved 3 stages:

1. Autoethnography, done in advance (of discussion).
2. Detailed discussion in the context of matched triads (3 consumers all from the same target group per triad – see sample structure outlined above).
3. Expert interviews on viability and implementability of consumer needs and wishes.

3.2.1 Stage 1: Autoethnography (done in advance)

Day-to-day activities tend to largely be performed subconsciously, which also applies to the use of tethered caps. Consequently, during this phase, a great deal focus was placed on self-observation and documentation in everyday life.

More specifically, consumers used an app (MyInsights) to record their experiences with tethered caps over a 3-day period. This included providing:

- General feedback: The good and the bad things about tethered caps?
- Examples of the typical difficulties they encountered with the caps in day-to-day life – including descriptions and illustrative photographs. It was possible for the participants to document multiple examples.

Relevant user situations were captured and documented using photos, videos and voice recordings.

The autoethnography was analysed and used as an input for the consumer triads in the next stage.

3.2.2 Stage 2: Qualitative focus groups / triads

After completion of the autoethnography, all participants of the study got to exchange views in the form of qualitative focus groups, each of which was comprised of three participants all of whom were from the same subgroup (i.e. elderly, children or people with reduced hand strength/dexterity, etc.).

Limiting the size of the groups to three participants per group offered two key advantages:

- The groups of three consumers were more intimate and gave everyone a chance to express and exchange their thoughts and experiences. This exchange helped to expose and understand the breadth and diversity of these experiences. Every expressed observation or experience served as a prompt for other, new, input. Having only three respondents per focus group also reduced the amount of distraction and enabled a lively exchange of thoughts and opinions.
- Also, because there was always a second triad per sub-group, there was always a control group as well. This enabled the ascertainment that certain statements and challenges described by the participants were repeated, irrespective of the constellation of individuals within a focus group, thus solidifying and verifying the finding.

90 minutes were allotted to the exchange of views between the participants within the focus groups / triads. The venue that was used was a market research facility in Berlin, equipped with a one-way mirror, thus allowing the DIN Consumer Council to attend and follow the consumer feedback 'live'.

Moderation of the triads followed a structured topic guide that included the following complex of questions in accordance with the areas of interest and the objectives of the study:

1. Spontaneous reactions to tethered caps in general. What are the pros and cons of tethered caps generally (i.e. not for a specific tethered cap/solution)?
2. Specific review and discussion of their experiences during the autoethnography exercise:
   - In their experience at home, what were the specific strengths and weaknesses of tethered caps?
   - Did consumers require more / less / just as much assistance from others as before when using tethered caps? Were consumers able to open containers with tethered caps themselves, without any help? Did they suffer any injuries while using single-use beverage containers with tethered caps?
3. Testing of 13 different tethered cap solutions at the market research facility, collecting detailed consumer feedback on the usability. The cap solutions covered six typical cap/closure systems: Snap Caps (water and milk products), Clip Aside / Hinge Cap (two bottles for mineral water, soft drinks, a bottle of uncarbonated water), Twist Cap (two milk products), Sports Cap (two isotonic drinks), Lasso Cap (one mineral water) and a Heli Cap (juice, milk).[4] The capture of feedback about the 13 different cap solutions/systems was structured. Each participant was given a self-completion questionnaire on which they were

[4] It should be noted, that so far no standard on terms and definitions for tethered caps exists. Even manufacturers use different names for, at times, similar or identical cap systems. This problem will be addressed later in more detail in the chapter on State of research/Status Quo.

asked to put down their rating (on a scale of 1 to 10) for each cap/closure system after handling the tethered cap solution.

4. Their evaluation was then explored and discussed in more depth in the following questions:
   - What stood out for you?
   - What did you find positive / what was easy to use?
   - What were the challenges / what was the main problem for each type of tethered cap?
5. What expectations or wishes do consumers have for each respective tethered cap?
6. What are the features that an ideal tethered closure system should offer?

Overview of the six tethered cap types that were tested as part of the qualitative focus group surveys and that are representative of the closure models currently available on the market in this or a modified form (see Figure 2):

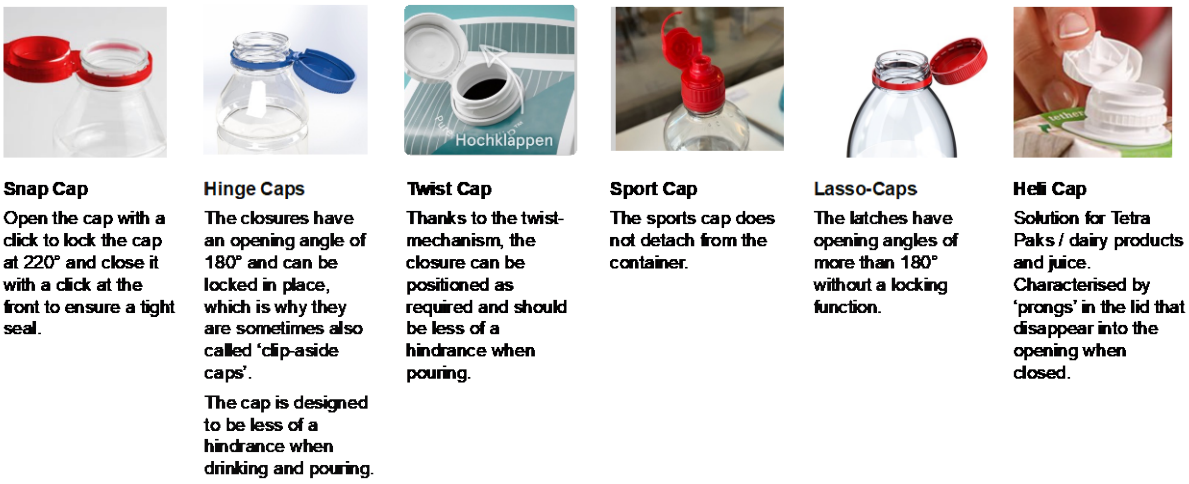

Fig. 2: Overview of the tested tethered cap types

3.2.3 Stage 3: Expert Interviews

One of the key aims of this qualitative study was to collect demands and wishes from the perspective of consumers regarding an ideal tethered cap solution. What do consumers expect from future tethered cap solutions? Which demands and expectations might be relevant for the improvement of the user friendliness of tethered caps? These demands and expectations were collected and then later discussed in the expert interviews to determine their value and viability (see Chapter 8, Feedback from manufacturers regarding the technical feasibility of the consumer design-related demands).

4. State of research /Status Quo

4.1 The Single-Use Plastics Directive

The EU directive (EU 2019/904) was adopted on June 5th, 2019, by the European Parliament and Council of Europe with the aim to reduce the impact of certain plastic products on the environment. The EU directive stipulates that from July 3rd, 2024, caps on single-use plastic beverage containers with a volume of up to 3 litres must remain attached to the container.[5]

A key trigger for the development of the EU directive was the increasing amount of plastic waste detected in the environment, particularly single-use plastic waste (such as plastic straws, bottle caps, etc.) and its negative impact on terrestrial, aquatic and maritime ecosystems and their respective fauna and flora.

The EU directive is in line with the UN sustainable development goals 12 and 14, for sustainable development, consumption and production patterns, with a particular aim to reduce marine pollution.

The harmonized standard DIN EN 17665 “Packaging – Test methods and requirements to demonstrate that plastic caps and lids remain attached to beverage containers” needs to be mentioned in the context of the single-use plastics directive, because it specifies Article 6 of the Single-Use Plastics Directive, defining requirements and tests in order to determine that the tethered caps remain attached to the single-use beverage container.

4.2 Tethered Caps – a dynamic market

Even before July 3rd, 2024, various manufacturers introduced single-use plastic containers and Tetra Pak packages with tethered caps. This resulted in a high number of different tethered cap solutions/systems coexisting at the same time. This study takes a closer look at six of these tethered cap solutions in Chapter 6. However, systems already on the market are continually undergoing optimisation. As a result, some of the systems that were tested in the

[5] https://www.bmuv.de/gesetz/richtlinie-eu-2019-904-des-europaeischen-parlaments-und-des-rates-vom-5-juni-2019-ueber-die-verringerung-der-auswirkungen-bestimmter-kunststoffprodukte-auf-die-umwelt

course of this qualitative research might already be ‚out-of-date' when the results of the study are published, because they have already been replaced with an improved system.
This ongoing dynamic development and continuous innovation of the tethered caps, makes it very difficult to get a full overview of existing cap solutions/systems. Added to this there is no standardised terminology used for the different types of tethered caps. Different names can be found for, in some cases even identical or at least very similar cap types, e.g. Twist Caps, Lasso Caps or Shift Caps.[6] Then there are also Screw Caps, Sport Caps, Snap Caps[7] … making it almost impossible for consumers to identify similarities and differences between the caps based on the name. Thus, it is recommended to develop a standard on terms and definitions in the context of tethered caps. Not only manufacturers, bottlers and waste disposal companies will benefit from such a standard; it will also make it easier for consumers to navigate through the market.

4.3 First manufacturer sponsored surveys: Consumer feedback

By now only two publicly accessible surveys with regards to the consumer feedback on tethered caps exist. Both surveys were commissioned by manufacturers of tethered caps.

The Sidel survey used online interviews and focus groups to collect consumer feedback about the different types of tethered caps from in total 3.200 consumers. The study covered the following cap types: Sport Caps, Snap Caps and Tethered Screw Caps.[8] Results from the Sidel survey were similar to the result of the present study, that confirms (see Chapter 5.2: Communication about the introduction of tethered caps), that most consumers were not aware of the reason for the implementation of the tethered caps, which is to reduce littering. The majority of the surveyed consumers considered the effectiveness of tethered caps to reduce littering as very low. Only a minority of 26% of the surveyed consumers believed there would be any beneficial effect; this although 87% agreed that plastic waste is detrimental to the environment, and that plastic caps are part of the problem.[9]

According to the Sidel survey usability was more important to the consumers than the environmental benefits, namely, how easy are the closures to open, to pour and drink out of? None of the tested tethered cap systems performed 100% well on these criteria. Snap Caps were considered as very unusual. Screw Caps were characterized by the fact that they hindered during

[6] https://www.tetrapak.com/de/solutions/packaging/openings-and-closures/tethered-caps
[7] https://www.corvaglia.com/de/tethered-caps/
[8] https://www.sidel.com/en/about/media/press-releases/tethered-caps-nw-344
[9] https://www.sidel.com/en/about/media/press-releases/tethered-caps-nw-344

the drinking process. Sport Caps showed a very low usability, especially when it comes to pouring the contents of the bottle into a cup or a glass.

Bericap, another tethered cap manufacturer, also invited consumers, aged between 18 and 80, to test bottles with a Hinge or a Clip Aside Cap in day-to-day use over a period of one week in order to gather feedback from the consumers.[10] The majority of the surveyed consumers in the Bericap study assessed the usability of Clip Aside Caps positive:

> "*A majority of consumers surveyed, rated Bericap's tethered caps more positively than conventional closures. The users praised the easy and intuitive handling when opening, closing and drinking, and the hygiene benefits of the closures, since it is impossible for the closure to fall to the ground and get dirty, which can occur with conventional closures."*[11]

In Chapter 5, it is illustrated that in the present study the consumer reactions towards the previously motioned tethered cap solutions were less positive.

Both studies conclude that for consumers, usability aspects outweigh environmental aspects when evaluating tethered caps.

Based on the two studies, the key benefits of tethered cap systems are:

- **Hygiene**: Caps cannot fall to the ground and get dirty/contaminated
- **Handling**: Opening and closing of the "Clip Aside Tethered Caps", according to the Bericap survey, is intuitive and unproblematic. Because the Clip Aside caps are barely different from the familiar twist off caps, most consumers in the Bericap survey were able to open the bottles intuitively, without any prior knowledge and without looking for instructions on the bottle.[12] Also the "Snap-on Caps" tested in the Sidel study stood out for their ease of use, allowing opening and closing of the cap with just one hand.[13]
- **Durability**: The Clip Aside Caps remained watertight and firmly attached to the bottle, even after being opened and closed 30 times. Because of this feature, the Clip Aside Caps convey an impression of security and dependability for the surveyed consumers.[14]

[10] https://www.packaginginsights.com/news/bericaps-tethered-caps-find-favor-with-consumers-in-real-life-scenario-testing.html

[11] https://www.packaginginsights.com/news/bericaps-tethered-caps-find-favor-with-consumers-in-real-life-scenario-testing.html

[12] https://www.packaginginsights.com/news/bericaps-tethered-caps-find-favor-with-consumers-in-real-life-scenario-testing.html

[13] https://www.sidel.com/en/about/media/press-releases/tethered-caps-nw-344

[14] https://www.packaginginsights.com/news/bericaps-tethered-caps-find-favor-with-consumers-in-real-life-scenario-testing.html

The disadvantages from the perspective of the consumers according to Sidel survey are:

- **Handling**: Tethered Screw Caps are cumbersome for drinking because they often push up against the user's nose. Sport Caps are also suboptimal because their design makes it difficult to pour the contents of the bottle into a glass or a cup.[15]

The following section shows the extent to which the results of this study coincide or differ from those of the manufacturers.

5. Overall acceptance of the new closure systems – irrespective of specific closure system solutions

5.1 Clear spontaneous rejection and negative comments

Overall, consumer reactions towards tethered caps were far more critical and negative in the present study than in the two manufacturer-sponsored surveys by Sidel and Bericap. The surveyed consumers were asked to express their overall satisfaction with tethered caps, expressed on a scale of 1 to 10 (1 = dissatisfactory, 10 = very good). With an overall average rating of 3,8, the consumer reactions were very different in this study, and even more so in the sub-group of people with a reduced dexterity/hand strength, where the average satisfaction rating was only 2,8.

The ratings on the scale of 1 to 10 are also reflected in statements voiced by participants during the qualitative focus groups, where the consumers were again very critical:

"Terribly annoying", "it completely gets in the way", *"it's poorly done, not user-friendly the way it's is. It makes one aggressive"*, "*I get it; I understand all of that. But it must also have a practical benefit for me"* (reduced dexterity), *"I find it tedious"*, *"irritating", "it sucks"* (elderly respondent), *"completely irritating"* (visual impairment), *"super annoying"* (no disability/impairment).

The spontaneous rejection arises from different factors:

1. **Communication**: The introduction of the tethered caps was communicated inadequately or not at all from the point of view of the surveyed consumers.
2. Scepticism about the **relevance** of the impact on the reduction of littering and environmental protection.

[15] https://www.sidel.com/en/about/media/press-releases/tethered-caps-nw-344

3. The **variety** and **unstandardised** nature of tethered cap systems make it more difficult for the consumers to use or to get used to the tethered cap systems in everyday life.
4. From the point of view of the surveyed consumers, **the design of the tethered caps** makes using single-use bottles/containers more difficult; things like opening, pouring, drinking out of and re-closing the bottle/container are considered as more difficult than with untethered caps. (see Chapter 6, Criteria for evaluation of the different closure systems). On top, the elderly consumers or those with a physical impediment, couldn`t use their opening aids anymore, as they no longer fitted on or over the tethered cap, making it impossible for these consumers to open the single-use bottles/containers with tethered caps on their own.

5.2 Suboptimal information with regards to the introduction of the tethered caps

The surveyed consumers generally felt poorly informed about the introduction of tethered caps, although informing and sensitising/raising awareness among consumers in order to build acceptance of tethered caps is one of the major goals of the Single-Use Plastics Directive.[16]
From the point of view of the surveyed consumers the information regime was suboptimal, resulting in a relevant point of criticism, but also a negative overall perception and a lack of acceptance of tethered caps. The surveyed consumers felt ‚sucker punched' and unprepared towards the tethered caps in their day-to-day lives. Suddenly being confronted with these new closures is a source of irritation, but also gives rise to the impression that they, the consumers, are not taken seriously, but are just lumped with the fait accompli, the done deal - without any prior explanation.
"I knew nothing about this regulation; I felt taken by surprise. I don't see the relevance (of it)" (visually impaired)
"I don't understand why this has been introduced." (elderly)
"I saw little about this in the press. It was just suddenly there. I don't know if a lot was said/communicated about it." (no impairment)
"First of all, I feel that nothing was said about this. There is no information. This is not good at all. … If it were to be explained well, I would be a lot more understanding. This way I, as a consumer, feel that they have gone right over my head. All of a sudden the cap stays attached, leaving me to ask why." (reduced dexterity).

[16] https://www.bmuv.de/gesetz/richtlinie-eu-2019-904-des-europaeischen-parlaments-und-des-rates-vom-5-juni-2019-ueber-die-verringerung-der-auswirkungen-bestimmter-kunststoffprodukte-auf-die-umwelt

5.3 Lack of relevance

Even the background information about the environmental protection intention behind the introduction of the tethered caps that was provided during the interviews of the focus groups had little impact on consumer acceptance of tethered caps. The findings of the present study differ in this regard from the findings of the already mentioned studies by Sidel and Bericap.

The size of the contribution of discarded plastic caps and their contribution to overall plastic waste in the environment is questioned. Most consumers assume everyone behaves the same way they do, meaning that they don't believe improperly discarded plastic caps from single use bottles/containers really represents a relevant environmental problem.

"I don't understand the background to this, are the things (caps) really thrown away separately? People don't do that!" (visually impaired)

"We've always screwed the cap back on. I don't understand the point (of this)." (reduced dexterity)

Generally speaking, the perception is that the problem that discarded caps represent in the context of the volume of global plastic waste is less important and its contribution small. This means that that the relevance of the whole idea of tethered caps is called into question by the surveyed consumers.

"The intention is good, but it by no means solves the overall problem. We have other environmental problems." (visually impaired respondent)

"I also don't believe that this is the right way to reduce plastic. It is not just the caps lying around." (without impairment)

"There are carpets of plastic floating off the Galapagos islands in the Pacific Ocean. Those are the problems that really matter. This (here) is just a placebo (measure)." (visually impaired respondent)

Target-group oriented communication, presenting facts and figures to underscore the problem would be both necessary and helpful to overcome the scepticism consumers have about the effectiveness of the adopted measures based on the Single-Use Plastics Directive. Something else that is sorely lacking is supporting evidence: facts and statistics that illustrate the scale of the problem posed by discarded plastic caps of single-use plastic bottles, thus giving these closure solutions relevance and meaning.

This negative reaction towards/rejection of the tethered caps is further strengthened by the overall scepticism towards EU Directives and political decisions made by the EU. The surveyed consumers repeatedly expressed the view that they thought that this decision by EU politicians was out of touch with reality:

"These are EU directives – but it is just window dressing." (without impairment).

"This too small of an issue for the EU to deal with." (visually impaired).
"What's the point of this? We have bigger problems. This has been implemented throughout the EU, but none of the issues that I find to be more important have been solved." (visually impaired)
Here an expression of distrust can be seen and the suspicion that lobbyism, which is far removed from reality, can lead to 'intruding and governing into my own life'. This just complicates everyday life further, offering no benefit and ultimately making little sense to consumers.
The defensive reaction of the consumers surveyed in the context of the resent study illustrates how urgent the need is to communicate and explain the added value of the EU directive regarding tethered caps to consumers. It is only through transparency and target group-oriented explanation that one will be able to break down scepticism amongst consumers.
The opinion of the consumers surveyed for this study is partly confirmed in the public discourse in the media. The FAZ (newspaper) for instance, in August 2024, quoted Prof. Markus Prem, who holds an endowed professorship at Kempten University for Packaging Technology, as saying: *"Will this really benefit the planet, or even Europe? To me the answer is a clear, no."* (FAZ Aug. 6th,2024). Rather, it is pure actionism... Similarly to our respondents in this study, he believes that *"We should be tackling the problem quite differently if we truly want to change things."* (FAZ Aug. 6th, 2024)[17]

5.4 Wish for unification

Finally, the consumers surveyed for this study complain about the complexity and sheer number of tethered cap systems on the market. Too many different types have been introduced in a very short timeframe and have served to confuse people going about their day-to-day business. The more different systems there are, the more confusing the handling of the tethered caps becomes for consumers. Accordingly, participants of this study wished for a unification of the systems:
"It would be good to have standardisation, like we have for charger cables. They should try to choose the best per group." (elderly respondent)
This identifies the first wish aimed at the packaging industry: For each bottle system or product requirement - e.g. Tetra Pak, non-carbonated soft drinks and carbonated soft drinks - there should ideally only be one tethered cap system that combines the best design properties in each case.

[17] FAZ, 6.8.2024 Wirtschaft „Kritik an fest angebundenen Getränkedeckeln"

5.5. Practical aspects

Spontaneous consumer feedback shows that the tethered caps do not provide adequate ease-of-use/easy handling. Consumers struggle more to open, pour, drink and close beverage containers with than with the untethered caps they had known before:

"I wasn't even able to close this brand's milk again. It is also no longer possible to pour from the bottle using only one hand. I have to keep the mouth open, so as not back to make a mess. Otherwise the stream will go straight into the cap." (elderly respondent)

"When you try to close the cap again, it slips (in your hand)." (reduced dexterity)

"It bothers me all the time while I am drinking. Some (of these) could even cause an injury." (visually impaired respondent)

5.6 Product switch motivated by lack of user-friendliness

The responses of the surveyed consumers make it abundantly clear that the packaging solutions market is heavily influenced by the usability of a product, particularly when it comes to the tethered caps on single-use beverage containers/bottles. Consumers give great importance to practical, easy-to-use closures and are sensitive to a lack of usability. If the tethered caps are considered to be awkward or cumbersome, consumers may switch their preference to alternative products:

"*If they don't come up with a new (better) cap, I will stop buying it. It is madness, (it's been) my favourite brand for over 20 years.*" (reduced dexterity)

This feedback clearly illustrates how dependent market developments are on the usability of products. Products that do not live up to this expectation risk losing loyal customers.

5.7 Advantages of tethered caps

There are very few positive reactions compared to the predominantly negative feedback. Once again, the findings of this study are similar to those of the surveys of Bericap and Sidel. The cited benefits are better hygiene (caps can't be dropped on the ground) and they cannot be misplaced or lost:

- Something that is both helpful and positive is that the caps can no longer be lost: *"You don't lose the cap anymore."* (without impairment)

- Also, the cap can no longer be dropped on the ground, which makes it more hygienic: *"It can't be dropped. Otherwise, I had to hunt around for it under the couch. It is especially bad (when it happens) out in the streets."* (visually impaired respondent)

6. Assessment criteria used for the different bottle closure systems

6.1 Assessment criteria from consumer perspective

During the interviews with the consumers four relevant criteria that are used to evaluate the tethered cap systems became evident. They cover the functions that are typical when using single-use bottles: opening, pouring, drinking and re-closing.

1. **Opening: Easy or difficult to open single-use beverage containers/bottles with tethered caps**

Challenges either mentioned or observed in this regard are:

- Inability to open the container, so either tools had to be used or help from a 3rd party was required
- Risk of injury while opening
- Spilling of contents while opening, because the amount of force required leads to a squeezing of the bottle/container, causing fluid to escape.

Another important observation that was made during the interactions with the surveyed consumers was that not only the tethered caps itself caused the above-mentioned problems with opening of the container. It was often a less-than-ideal combination of materials used for the cap and the container itself that caused problems. Generally, it can be said that the thinner the plastic that the body of the bottle is made of, the more difficult it is for consumers to open the tethered cap. The greater amount of force required to open the cap leads to increased squeezing of the container (bottle or Tetra Pak) and spilling of the contents.

This is why in the following section on assessments (see Chapter 6.2.) an additional note is made, whether the poor rating is attributed to a sub-optimal combination of the material that the cap is made of and the thickness of the bottle / Tetra Pak.

2. Pouring: easy or difficult to pour

The challenges and difficulties that were encountered by the surveyed consumers when pouring were:

- Cap couldn`t be adjusted well enough or slips around, which causes the cap to be in the way while pouring
- More frequent spills because the cap gets in the way when pouring

3. Drinking out of the bottle: easy or difficult to drink out of bottle / Tetra Pak

Problems that were frequently mentioned included:

- Cap in face is bothersome, gets in the way
- Cap even causes slight injury / scratches in face

4. Closing: easy or difficult to close (container)?

Recurrent challenges and problems that were mentioned or observed about closing were:

- More difficult to screw cap back on because of the bothersome tether on the cap, which impedes the alignment of the thread in the cap and that on the neck/mouth of the container. The tether makes it more difficult to place the cap flat on the neck of the opening.
- Fluid collects in the cap and then spills/drips out and makes a mess when closing or pouring (particularly true of milk products in Tetra Paks)
- Concern that closure will not close properly and will leak when carrying

6.2 Assessment matrix – evaluation of the individual closure systems

Structured evaluation of the tested closure systems consists in part of the consumer ratings during the focus groups (using a rating scale) of the six different tethered cap systems. The surveyed consumers rated each of the tethered cap systems using a rating scale of 1 to 10, where 1 = dissatisfactory and 10 = very good. It was deliberately decided not to offer any differentiated assessment criteria, because in real life, assessments are done spontaneously, intuitively and without applying any rational criteria. In this situation it is the “fast thought“ that counts.[18]

Of course, because this study had a sample for qualitative research, the average ratings obtained using the rating scale exercise are not sufficient on their own for the assessment of

[18]Kahnemann, Daniel: Thinking, Fast and slow.

the usability of the tested tethered caps. In addition to the ratings, each individual closure system was also assessed using the assessment matrix outlined below (see Table 1). Each of the criteria was evaluated (opening, pouring, drinking and closing) based on the possible problem areas identified in the conversation with the surveyed consumers.

The assessments in the following table are thus based on the one hand on the standardized ratings of consumers (rating scale), but also reflect the findings of the qualitative feedback and what were observed when watching the surveyed consumers using the tested closure systems during the qualitative focus groups.

Table 1: Rating matrix in combination with the average ratings

	Overall average	Opening	Pouring	Drinking	Closing
Hinge Cap	**6,9**	+ / -	+/-	+ / -	+++
Twist Cap	**6,9**	+++	+ / -	+ / -	+ / -
Lasso Cap	**6,7**	+++	-	-	+ / -
Snap Cap	**5,6**	- -	+++	+ / -	+++
Heli Cap	**4,9**	++	-	- -	- - -
Sports Cap	**3,8**	- -	+ / -	- - -	- -

The next chapter provides a detailed discussion and qualification of the findings from the interviews with the focus groups. Each tethered cap type is discussed in detail to identify and explain the specific strengths and weaknesses of each closure system and its handling/use.

6.3 Detailed discussion of the tested tethered cap closure systems

Hinge Caps (Clip Aside)

Hinge Caps are a classic type of a Twist Cap. The so-called “Clip Aside Cap“ is a further developed version of the Hinge Cap and allows the consumers to lock the cap into place on the side the neck of the bottle. In some cases, this ‚locking‘ function is accompanied by an audible click.

Overall, the Hinge Cap system was the one that fared best of all the tethered cap solutions tested within this study. It performed convincingly in terms of opening, pouring, drinking and closing, with mainly positive design attributes. In the qualitative focus groups, this closure system achieved an average rating of 6,8 on the scale of 1 to 10, making it the best rated closure system together with the Twist Cap.

Opening: Hinge Caps are relatively easy to open as long as the material that the single-use beverage container/bottle is made of, is suitable in combination with material of the cap. In other words: the plastic of the single-use plastic container/bottle must not be too thin for the amount of torque required to open the cap. Opening is also made easier when the cap offers texture to enable a good grip on it.

“The cap is easy to use, offers a proper surface to get hold of, and is sturdy/stable. It opens well and stays open. It’s great for me to drink and pour out of.“ (elderly respondent)

Fig. 3: Hinge / Clip Aside Cap

Drinking: This system mainly offers a benefit for drinking when the closure is a clip aside cap. This means that the cap can be pushed to one side and clipped out of the way (see Figure 3). Due to this feature, drinking out of the bottle and pouring are relatively unproblematic.

“It doesn’t get in the way when drinking, you hardly notice it. The edge is completely smooth, without any pointy bits.“ (visually impaired respondent)

This statement clearly illustrates that it is not only the type of closure system that is important for the evaluation, but also the characteristics of the cap which are important. Ideally tethered caps should have smooth edges so that they don’t scratch or scrape the face while drinking.

Pouring: A well-made Hinge Cap system, as already stated, means the cap can be clipped aside and kept out of the way (Clip Aside Cap). Ideally this function should also be accompanied by an audible click, giving consumers the reassurance that the container will stay open. An audible click can be particularly useful to people with poor eyesight. Thanks to the click

aside function, pouring and drinking out of single-use containers/bottle with this tethered cap system is unproblematic compared to the other tested closure systems.

Closing: Another advantage of this system is that it is easy to close it again by simply screwing or twisting the cap back on. This results in a secure and reliable closing of the container, meaning consumers don't have to worry that it might leak.

Summary: The Hinge Cap system offers handling/usability advantages that make it easy to use for consumers, the cap can be clipped into an open position where it is out of the way, and it can be closed again securely. Consumers particularly appreciate that the cap clips into position reliably and stays firmly in place while pouring. Problems with this system can occur though, when the cap isn`t opened wide enough.

Twist Caps

Twist Caps are characterized by a screw/twist mechanism and are attached by a thin tether to the container. Twist Caps feature the advantage that the cap can be moved around the neck into a position of the consumer's choice, but on the downside, unlike clip aside caps, they can`t be 'locked' into a favoured position (see Figure 4).

Overall, the twist cap system was rated just as positively in this study as the Hinge Caps by the surveyed consumers. The average overall rating for the twist cap system was 6,9 on the scale of 1 to 10, so Twist Caps are on the positive side of the scale on the whole.

Opening: Twist caps are particularly easy to open. This is mainly because of the twist mechanism with which's handling consumers are familiar with.

"Easy to open because it opens with little pressure." (elderly respondent)

"It is astonishingly easy to open!" (reduced dexterity)

Fig. 4: Twist Cap

Pouring: Twist Caps were rated positively by consumers in this study in terms of easy pouring, mainly because the open cap can be rotated to the side that is most convenient for the consumer:

"You can move the open cap around, so that you can pour with-out it getting in the way." (visually impaired respondent)

"You just need to make sure that you've moved the cap to the top, behind the opening/mouth." (elderly respondent)

However, some drawbacks when pouring did emerge. The residual fluid in the cap often drips, making a mess, especially when the consistency of the beverage is thicker, e.g. milk products.
*"It drips when pouring. There is still residue (liquid) left in the cap and it drips out. If it is water, I don't find to too terrible." (*reduced dexterity*)*

Drinking: The large opening of the two tested models made drinking unproblematic. Another positive feature is, that the position of the cap can be moved so that it is not much of a hindrance when drinking.

*"It is good for drinking out of; the cap doesn't get in the way." (*reduced dexterity*)*

Closure: To some extent, replacing the cap was slightly more difficult. The need to move the cap back into a better starting position to be able to screw it back on properly was criticised by the surveyed consumers.

"Sometimes it (the position) is here, sometimes there. And when it is facing down, you always have to move (reposition) it. Irritating." (without impairment)

Other aspects: Our two twist cap test samples also offered other attributes which positively affected the ease of opening, pouring and closing the caps:

- The caps on our two bottles tested in this study were relatively large
- The caps had a ribbed sidewall surface

These two characteristics make the caps easier to grip for opening, especially for people with physical impairment/reduced dexterity, resulting in positive feedback from consumers:

"The size of the cap is good. You really get a good grip on it, also the ribbing on the sides. You can get your hands around nicely." (reduced dexterity)

"The purchase on the cap is good. Milk with small caps is annoying. But here you can get a good grip on it." (no impairment)

Once again, this shows that in addition to the closure system, factors such as material properties and the finishing of the cap also impact the overall assessment. A material with a ribbed surface makes it easier to grip the cap firmly, thus making it easier to open and close the beverage container.

Furthermore, one of the test samples, a Tetra Pak, was designed so that the closure system was angled slightly (see Figure 5) so that there is air in the upper part of the container and the opening/mouth ensuring that it the contents will not unexpectedly gush out when opening and pouring the Tetra Pak.

"Here we have a positive example of a package (design), because there is air in the top part of the package, meaning that nothing can spill or splash out." (visually impaired respondent)

Fig. 5: Twist Cap with slightly angled packaging

Lasso Caps

The Lasso design is characterized by a cap which is attached to the container by a two-pieced ring (see Figure 6). The cap is connected to the upper part of the two-pieced ring, whilst the bottle is connected to the lower part/ring. Lasso Caps cannot be moved to the desired position (making them different to Twist Caps), nor can they be 'locked/fixed' in place (unlike Hinge / Clip Aside Caps).

Generally, Lasso Caps seem familiar to the surveyed consumers and are similar to untethered caps. Because of this feature the closure system does relatively well with consumers, with an average rating of 6,7 on the 10-point scale. This places Lasso Caps above the average score of all tested beverage containers and all closure systems, which is 5,9. Upon closer examination of the Lasso system, the drawbacks begin to emerge.

Opening: Opening Lasso caps is relatively unproblematic because the handling is similar to the untethered cap systems that consumers are already familiar with.

"The cap is foolproof." (no impairment)

"I find it easy to screw off/open." (visually impaired respondent)

Fig. 6: Lasso Cap

Pouring: Several of the surveyed consumers complained that the opened Lasso Caps could not be fixed in place, making pouring more difficult and requiring the use of a second hand to hold the cap out of the way.

"You need to use two hands to pour." (participant with reduced dexterity)

Drinking: Also when drinking out of a bottle with a Lasso Cap the problem is that the cap cannot be opened back far enough and cannot be fixed in the opened position, so the cap often bumps into the consumer's nose when drinking straight out of the bottle (see Figure 7).

"The cap doesn't stay back far enough." (elderly respondent)
„Drinking doesn't work so well, (because) my nose is obviously up against the cap." (reduced dexterity)
"I once really hurt myself with this (system)." (elderly respondent)

Fig. 7: Lasso Cap (variation)

Closing: For the closing of beverage containers with Lasso Caps some consumers in this study required help and support, in particular children and people with limited dexterity.
"I can't manage to close it properly." (reduced dexterity)
"Opening it was OK. Closing it was a bit awkward" (reduced dexterity)
In short, although the rating of Lasso caps lies just slightly over the average, from the consumer point of view there is still need for optimisation of the system. It should be possible to lock the opened into position so that it is not necessary to use two hands to pour. They should also generally be made easier to close.

Snap Caps

Snap Caps don't have a thread for screwing them on or off but have a sort of hinge instead (see Figure 8). This hinge opens to the right of the opening, where the cap has a fixed tether. This means that the cap stays where it is when pouring and drinking and doesn't slip. Consumers surveyed for this study were less familiar with Snap Caps and how to use them than with widely used twist/screw-on caps.
In the overall rating the Snap Cap system was rated average. In the qualitative focus groups, Snap Caps achieved an average rating of 5,6 on the 10-point scale. In terms of the main criteria for a consumer-friendly closure, (pouring, drinking and closing) it mainly performed well. It was only the opening of the cap system that was found to be more difficult than with other tested tethered cap solutions.
Opening: The main difficulty experienced with the Snap Cap system was to open it. To the surveyed consumer it was an unfamiliar mechanism which required a little more force/exertion than other Twist Caps. It was particularly difficult for those with reduced dexterity/hand strength and people with impaired vision.

"Well it is definitely not a twist off and, because my eyesight is not good, I have no idea how to open it." (impaired vision)

"It's difficult to open. My daughter will have to open these things. You need strength." (reduced dexterity)

Fig. 8: Snap Cap

Pouring: Ease pouring with the Snap Cap system was highlighted throughout all surveyed target groups. The cap can be bent all the way back when opened, and in some cases it stayed in the open position (similar to Clip-Aside Hinge Caps) (see Figure 9).

"It's super that it stays in place relatively well. This is a good solution for pouring." (reduced dexterity)
"Is this cap really leakproof?" (reduced dexterity)

Fig. 9: Snap Cap (variation)

Drinking: Because the cap stays fixed in the wide-open position, it makes it easier for consumers to drink out of the container. However, some consumers felt that the cap was too close the opening/mouth of the container, so that it bothered them while drinking.
Closing: Snap Caps are easy to re-close, something to which consumers reacted positively.
"*I know milk packages where involves a lot of fiddling to screw the cap back on again properly. You don't have that difficulty with this click-on (snap) cap. A click-on cap like this is easier."*(elderly)
"It's easy to close again." (reduced dexterity)

Still, the surveyed consumers were concerned about whether the cap really closes reliably and the bottle/beverage container is really watertight/leakproof.
Other aspects: One of the bottles with a Snap Cap tested was made of very thin plastic (see Figure 10). The combination of the thin plastic bottle and the plastic cap that required a relatively great amount of force to open, resulted in a very negative feedback from the surveyed consumers; something that also negatively affected the overall rating of the closure system. Holding the bottle too tightly promptly resulted in water spilling out of it. The interrelationship between the properties of the beverage container itself and the closure system is extremely

relevant and significantly affects overall satisfaction of the consumers with the tethered cap type.

"My grandmother no longer buys this. She doesn't have the necessary fine motor skills. It is too soft. The cap is too tight for the soft plastic of the bottle." (visual impairment)

"The plastic of the bottle is too thin. The amount of force required to open the bottle leads to water squirting out." (visual impairment)

Fig. 10: Snap Cap in combination with a bottle body made of very thin plastic

Once again, it becomes clear that other factors besides the actual closure system are relevant for the assessment of the usability. In this case, the interaction between the excessively thin plastic of the bottle body and the closure, which requires relatively high force, has an unfavorable effect on the usability. Overall, Snap Caps scored positively from the perspective of the surveyed consumers. The relatively low mean values of the consumer rating are mainly due to the mix of materials of the beverage container (thin plastic) and the closure (quite firm, hard plastic) described above for one of the test products used. The closure system itself, on the other hand, offers many advantages in principle: The cap is easy to adjust, does not interfere with pouring and is easy to re-close. However, Snap Caps require a little more force to open, which led to more problems for older people, people with manual limitations and people with visual impairments than with the other closure systems tested.

Heli Caps

The Heli Cap system has numerous drawbacks, so consumers in this study did not find it very convincing (see Figure 11). The system proved to be negative across all the relevant requirements of a consumer-friendly closure system (opening, pouring, drinking, closing), so it is not user-friendly. The average consumer rating is accordingly below the average for all tested closure systems. Heli Cap with an overall average rating of 4,9 (on the 10-point scale) was rated by the surveyed consumers to be one of the worst.

Opening: The Heli Cap system is easy to open and poses no notable problem for the surveyed consumers. However, there were also frequent problems here, as the material of the tested Tetra Pak container was soft and relatively unstable: due to the required pressure on the Tetra Pak to open the cap and the flexible material, the liquid spilled over when the Heli Cap closure was opened.

Pouring: Pouring out of a container with the Heli Cap system proved to be difficult. The cap couldn`t be pulled back far enough to open it wide and it also did not stay in position when opened, which means it gets in the way when pouring. All consumers, irrespective of whether they had an impairment or not, confirmed that this was a big problem with the Heli Cap.

Fig. 11: Heli Cap

"The cap always slips (around the opening) and is always in the way. It is totally irritating." (elderly respondent)
"It really difficult to pour." (visual impairment)

Drinking: Also drinking out of containers with a Heli Cap proved to be difficult. This is mainly due to the pointed cutting teeth, which consumers referred to as "sharks teeth", inside the cap (see Figure 12). These teeth are sharp and don't only get in the way, but even hurt while drinking:
"The teeth poke me while I am drinking from it." (children)

Fig. 12: Heli Cap (1)

"I definitely don't want to drink out of that. You can't get to it properly (with your mouth). The cap and your nose get in the way." (reduced dexterity)

"This will be in your face when drinking." (visual impairment)

Closing: The closing of the Heli Cap turned out to be particularly difficult for the surveyed consumers. Of all the closure systems tested, the Heli Cap was the worst with regards to closing. Because of the teeth in the cap it is necessary to adjust the cap precisely to find the right position for reclosure. This was particularly problematic for people with impaired eyesight:
"You need to fiddle with it to get it right. Why do they need to have these barbs in the middle?" (visual impairment)
"I am concerned that I was not able to close it again properly. It´s generally difficult to close. This is because of the combination of pressing and twisting motions that are needed, which is not good. (It) would be better to have only either the one or the other." (visual impairment)
If one is unable to find the correct adjusted position, the Heli Cap does not close properly. This represents a problem in the experience of the consumers. Taking a Tetra Pak with your when

out of the house or putting it in the fridge after the cap had been opened before is not safe. Most respondents were worried that the container would leak:

"I usually lie my things down when I put them in my fridge. But this cap doesn't close properly, which is a problem. I could not carry this with me in a bag/pocket." (no impairment)

Overall, Heli Cap closures, which are exclusively used on Tetra Paks, according to consumer feedback in this study are not consumer friendly. Although the closures were relatively easy to open, pouring, drinking and, in particular, reclosing was much more difficult than with the other closure systems tested.

Sport Caps

Sport Caps only achieved an average rating of 3,8 on the 10-point rating scale used in this study, resulting in the lowest overall rating. This is primarily because their main function, drinking from the bottle during a workout, is made considerably more difficult by the design of the tethered plastic cap. Many of the surveyed consumers literally ‚bumped into' problems, i.e. encountered problems while drinking.

Opening: The consumers surveyed in this study found it difficult to open the Sport Cap. This is because consumers are very set in their ways and opening routines, why it is difficult for them to find the right knack to opening tethered Sport Caps. This difficulty went so far that some of the surveyed consumers screwed off and removed the closure system entirely:

"I am completely blind. Even with glasses, I can't see properly. This is difficult. I didn't realise how far I was opening it." (visually impaired)

"I found this too stupid, which is why I screwed the entire thing off. It is really dumb." (no impairment)

Pouring: The surveyed consumers stated that ultimately bottles with Sport Caps were not intended for pouring the contents into a glass. As a result, they found this to be a contrived exercise, the outcome of which (success or failure) had little influence on their rating of the closure system.

Drinking: For Sport Caps the ability to drink out of the bottle is far more important than being able to pour from these bottles. This is because they were specifically designed for drinking out of while on the move. Yet, it is precisely this very function that is severely hampered by the tethered plastic cap. The surveyed consumers found it very difficult to drink out of the bottle, because the cap was always in the way. This is a serious flaw in the design of the tethered cap that was frequently voiced in all target groups. Another aspect that stands out is that in all target groups the consumers very frequently mentioned that the caps of this closure system scratched them in the face in the area around the mouth, nose and chin (see Figure 13).

Fig. 13: Sport Cap

"This is a bottle that you are supposed to put to your mouth and drink straight out of. It'll definitely scratch. There is no way around it. I didn't know how I was supposed to drink out of it. I once even cut my face on it." (reduced dexterity)

"It pokes me in the nose, but I can't move it out the way. I always have it in my face. This is the pits." (elderly)

Closing: As was the case with opening the Sport Cap, consumers also found it more difficult to close the tethered Sport Cap than the untethered one.

"I doesn't close again either. I recently had a bottle like this. I thought it was faulty, from a bad batch." (reduced dexterity)

In summary: As a result of the now tethered cap, Sport Caps have clearly lost their core function, namely, drinking straight out of the bottle while on the move or while doing sport. The surveyed consumers thus think that this is the poorest (tethered cap) solution and considered it as the most disappointing overall. In fact, it frustrated consumers so much that they often simply snapped off the tethered cap so as to improve and restore the closure's function. But this of course defeats the whole purpose of the system, which is to reduce littering.

"You'll remove the plastic thingy (tether), which would end up somewhere or another anyway." (visual impairment).

7. Preliminary conclusions: Demands and requirements from the consumer perspective

Needs and wishes for the design of an ideal tethered cap

In this study some overarching needs and demands crystalised that are applicable to all of the tested closure systems.

1. **Unification of the closure systems:** It is desirable to have standardised solutions that function in the same way, irrespective of the product or brand. This standardisation would make life easier for the consumers, because they would not constantly have to try to come to terms with the functionality of new closure systems.
   The clear wish the surveyed consumers have for the packaging industry: Only one closure system, combining all the positive features, per type of bottle/container or set of product requirements. For example, one for Tetra Paks, or for one for fizzy or uncarbonated soft drinks.
2. **For Tetra Paks**: From a consumer point of view the cutting teeth in the cap - ‚sharks teeth' or 'barbs' as they were referred to by the surveyed consumers - should be avoided. These teeth make it much more difficult to close the single-use beverage container. An **optimised click/snap system like that of the Snap Cap**, would be ideal; one that is easier to open, i.e. requiring less pressure, but that also gives consumers the confidence that the bottle is closed properly again and won't leak when carrying it with them or storing it horizontally in a fridge. Optimally it would be possible to 'lock' the cap in an open position as it can already be done with the Hinge / Clip Aside Caps.
3. For **single-use plastic bottles**: The Clip Aside closure system already does a good job of meeting the requirements for a consumer-friendly tethered plastic cap closure system: It is a tethered cap that can be opened wide and clipped/locked in that position.

Besides these expectations, which apply more narrowly to the closure systems themselves, the surveyed consumers also voiced general expectations that would make using and handling tethered caps considerably easier:

4. **Sturdy, non-slip textured material for the cap**: In addition to the type of closure system, the material that the cap is made of is also an important factor deciding how easy or difficult it will be for consumers to open or close the closure system. It is important, especially for people with either impaired eyesight or reduced dexterity/reduced finger strength, to have a cap that is large enough and non-slip. Non-slip or ribbed caps enable consumers to get a better grip on the cap, reducing the risk that the bottle or Tetra

Pak will slip out of the hands while opening it. This can be achieved by using structured (non-slip) surfaces, ribbing on the sides of the cap, or a slightly courser texture of the surface. Design features like this help to prevent slipping in the hands and also provide more control of the cap for consumers, thus making opening and closing of beverage containers with tethered caps easier for the consumers.

The cap size is another important factor. Caps that are big enough in size offer more surface to grab and to hold of, and require less precise movements. This is particularly helpful for those people with diminished fine motor function or hand strength, because they can grab hold of the cap more securely and can also twist the cap with less effort.

5. **Good combination/mix of material for Tetra Pak / bottle on the one hand, and the cap on the other**. It is crucial to have the right relationship between the cap and the material that the beverage container is made of, because the two materials interact with each other. The compatibility of these two materials affects both function and consumer acceptance / satisfaction with the closure. If the neck of the bottle/container is too short, it can make it difficult to open a normal sized cap because the lack of distance between the cap and the body of the container means less leverage. Less leverage means more strength/force is required to open the cap. The result is that consumers, especially elderly people and people with reduced dexterity/hand strength, find it more difficult to unscrew or open the cap. Added to this, the thickness of the material of the container also plays an important role. Material that is too thin (container) can be a problem, particularly for Twist-Off Caps, because the walls of the container are not rigid enough to withstand the pressure that is applied to the sides of the container when opening the cap. The sides of the container buckle inward, causing liquid to escape while opening.

8. Feedback from experts for packaging design regarding the technical feasibility of the consumer design-related demands

In this study, to determine the technical viability/implementability of the demands expressed by the consumers surveyed, three interviews were conducted with packaging design experts who are intensively involved in tethered cap production. These interviews were not solely focussed on discussing consumer feedback collected during the study, but also explored the thoughts and suggestions of the experts themselves as to how the packaging systems could

be optimised for consumers, and how implementable they thought these improvements would be.

The findings from the interviews with the packaging design experts show that tethered cap systems present great challenges not only to consumers, but also to the manufacturers of plastic closures.

Pressure of cost and competitive pressure: The new closure systems are more expensive to produce, which increases production costs. At the same time, they also reduce the appeal of the products for consumers, who find the new tethered closures annoying or find them difficult to use.

8.1 Unification

The experts interviewed in the course of this study were sceptical about a possible unification of the closure systems. Manufacturers stive to differentiate themselves from their competitors by providing tailored solutions and unique package design. This differentiation, often involving specific patents and product characteristics, is considered by manufacturers to be an essential part of their marketing strategy, outweighing consumer wishes for unification.

“How are manufacturers of (packaged) water to differentiate themselves then? Every manufacturer has their own tricks. They all own patents on their own solutions. It will be incredibly difficult to standardise this.“ (packaging engineer)

Even if there were market-wide preferences, manufacturers would still pursue their own individual approaches to achieve product diversification. Against this background and given the fact that standards are presently voluntary, they can only play a limited role in achieving unification.

Comprehensive unification of the different types of closure systems will only be possible if the European Commission issues an appropriate directive and passes the necessary standardisation request.

Given the various technical demands that the different types of beverages involve for closure systems, the packaging design experts interviewed for this study considered a complete standardisation as unrealistic at this juncture. However, a **visual unification** could help to provide consumers with a more consistent user experience, even though the underlying technologies might differ in order to meet the different demands of each type of beverage. This visual standardisation would mean that the closure systems would have a similar outer design, so that they

would look very similar or identical to consumers, irrespective of how different the closures technically might be. By standardising the outer design, shape and colours or fundamental structure of the closure systems, the appearance would be unified, making handling of the closures easier for consumers. Even though the closures might look identical from the outside, the underlying technologies could still differ to meet the respective requirement of e.g. carbonated beverages and uncarbonated beverages. This would preserve user-friendliness for consumers, whist still permitting technical adaptations in the background to the meet the needs of the respective products.

8.2 Consumer optimised tethered plastic caps for uncarbonated soft drinks

It will be technically difficult or even impossible to introduce standardised closure systems to be used for both carbonated and uncarbonated beverages. The Snap Cap, which performed according to the surveyed consumers very well for uncarbonated beverages, cannot not be used for carbonated beverages, because it would not be able to withstand the pressure of the carbonic acid: *"They need the twist"* (manufacturer, package designer)

The interviewed experts considered the Snap Cap system as the best solution for uncarbonated soft drinks. Production of the closures is relatively easy, and it is not too expensive either:

"It isn't so expensive, … just a few production steps, … material costs are comparatively low." (manufacturer, package designer)

The experts stressed the fact that also people with impaired vision and/or reduced dexterity are easily able to open and close this closure system.

It is only the amount of pressure that needs to be applied to open the Snap Cap that could be a problem, but this is perceived to be one that can be solved. The industry is currently already working on an improvement of the system, which involves reducing the thickness of the connection between the cap and the container, to make it easier to open. The connection here means the point of attachment between the cap and the container, which is typically either a thin band of plastic or a narrow point/joint where they are connected. Reducing the amount of material at the point of connection is supposed to reduce the amount of force required to open the cap, which will be particularly helpful for people with low hand strength or reduced dexterity, but without undermining the function of the tethered cap.

8.3 Consumer optimised tethered plastic caps for carbonated soft drinks

According to the interviewed experts, it will be particularly challenging to come up with a standardised solution for carbonated beverages. Here the interviewed experts considered the Hinge Cap / Clip Aside as the best system. It can be bent back relatively far, opening it wide and clips into place / can be locked in that position.

The problem: *"The cap is chosen to match the thread (on the bottle neck) and the shape of the bottle."* (packaging engineer). Bottles with a longer neck have an advantage over those with a shorter neck, because on a shorter neck the cap cannot be bent back far enough/opened wide enough (because there is not enough space).

Still, the experts consider the Clip Aside / Hinge Cap version as the best solution for single-use plastic bottles containing carbonated beverages. The idea to use a non-stick surface coating on the inside of the cap, to prevent/reduce the amount of liquid left in the cap when it is opened, is considered as a promising idea, but it will be challenging both from a technological and financial point of view.

8.4 Consumer wish for an 'easy to grip' cap or appropriately matched strong materials

According to the interviewed experts the wish for ideally matched materials for the bottle/container and its closure system applies mainly to companies and manufacturers of brand products. These companies are able to do extensive product tests and consumer acceptance and usability tests on different container and Tetra Pak systems in order to further improve and refine them.

The same goes for the wish for caps that are easier to get a firm hold on. The interviewed experts stressed that this sort of demand is deeply anchored in / associated with brand identity. While for some brands having a special closure design may be viewed as an essential part of their brand identity, other brands might not have the means to do this or might consider it as not important. The differences in brand identity and the respective requirements of a closure system further illustrates how difficult it will be to achieve a universal standardised solution in this regard, and how it will need to be adjusted individually.

As has already been mentioned when talking about standardisation earlier, because of the voluntary character of standardisation, a directive from the European Commission is needed, otherwise the effect will be limited.

9. Conclusions and recommendations for standardisation

In the course of this study it has become apparent that the market for packaging solutions, particularly when it comes to closure solutions for single-use plastic bottles, is self-regulating. Consumers show a distinct preference for products that come in a beverage container that has a practical and user-friendly closure mechanism. In cases where the plastic closure system / cap is found to be impractical or inconvenient to use, consumers interviewed in this study tend to switch to alternative products.

Even though the packaging industry is continually working on design improvements for tethered cap systems, the following recommendations regarding standardisation can be made based on the findings of this study:

It is recommended to the European Commission to expand article 6, paragraph 3 of the Single-Use Plastics Directive to include the term “usability” so as to ensure that the tethered caps in the European Union are not only robust, reliable and safe, but also that they offer unconditional usability to all user groups / consumer groups, including children, the elderly and/or people who have a physical impairment: “Those standards shall in particular address the need to ensure the necessary strength, reliability, safety and **usability** of beverage container closures, including those for carbonated drinks.”
It is recommended, that in order to ensure usability of tethered cap closures for all user groups in the European Union, mandatory target group testing should be done with consumers to test the ease of opening of tethered cap systems in accordance with appendix D of DIN EN ISO 17480 “Packaging - Accessible design - Ease of opening”.

Furthermore, based on the insights from this study, it is recommended to revise DIN EN 17665 “Packaging - Test methods and requirements to demonstrate that plastic caps and lids remain attached to beverage containers” in order to take into the account the requirements for opening strength (4.1.2), dexterity (4.1.3), cognition (4.1.4) and methods and mechanisms of opening the package (4.2.2) as well as aspects of force and handling (4.2.3) as contained in DIN ISO 17480 “Packaging - Accessible design - Ease of opening”.

During the research in preparation for this study it became evident just how much inconsistency there is when it comes to terms and definitions for tethered cap systems. For this reason, it is

recommended, to develop a standard on terms and definitions with regards to tethered cap closure systems.

Additionally, it is recommended to conduct ring tests / interlaboratory tests and to develop, based on the results, a standard on the optimal ratio / relationship between cap, beverage container and required torque – for all of those beverage containers affected by the Single-Use Plastics Directive. This measure would benefit manufacturers on the one hand, because it would save them time and costly usability testing of the beverage containers and the caps. But also, the consumers would benefit from beverage containers with an optimised usability irrespective of the manufacturer.

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