How Matters of Concern Invade Technologies: The Case of the Menstrual Cup

Franck Cochoy

Toulouse Jean Jaurès University, LISST-CNRS and Institut Universitaire de France, France / cochoy@univ-tlse2.fr

Abstract

Markets have evolved from classic markets to concerned markets – that is, markets that focus not only on economic efficiency and the utilitarian matching between supply and demand but also on the negative externalities produced by market products and exchanges. The menstrual cup is used as a good example to address such matters. This device has supplemented disposable tampons and pads, and if the original focus on practical and material dimensions remains (absorbency, lightness, smallness, disposability, etc.), new concerns have invaded the scene. Significantly, in the advertisements for menstrual cups, reusability, recyclability, safety or hypoallergenic issues have replaced the past quest for efficiency and feeling carefree. How have matters of facts and of concern been involved and with what implications? I propose to address this question based on a computer-assisted analysis of 5,235 consumer reviews (posted on Amazon.com) about the Star Cup (pseudonym), a leading product on the market for menstrual cups. The analysis points out that health and sustainability are only two of the many reasons behind the current use of menstrual cups. Various and often conflicting concerns are intertwined in cup consumption. This helps us understand that the development of sustainable technologies requires taking many more elements and dimensions into consideration than mere environmental friendliness.

Keywords: menstrual cup, health, sustainability, concerned markets, consumer reviews, digital humanities

The evolution of contemporary consumer markets provides evidence of the shift from 'matters of facts' to 'matters of concern'. Bruno Latour (2004a) coined the latter distinction as a new way to look at "things", that is, entities that combine objective and moral dimensions. For Latour, both dimensions, far from being opposed, are instead closely related – the unquestioned 'facts' of science and the material power of technological artefacts can (and even should) be discussed, not because of their 'social' or 'constructed' character, but because of the concerns they embody and raise at the same time (Latour, 2004a, 2004b). For instance, the myopic preoccupation with the functional aspect of technologies gives way to an increasing care for their impacts on human health and wellbeing, as well as on the environment. This leads to the emergence of 'concerned markets' – those that focus not only on economic efficiency and the utilitarian matching between supply and

demand but also on the negative externalities produced by market products and exchanges (i.e., discrimination, inequalities, exclusion, pollution, hazards, etc.), as well as how better market designs or public policies may avoid or alleviate such problems (Cochoy, 2014; Dubuisson-Quellier, 2018; Geiger et al., 2014).

Menstrual products represent a well-suited case to illustrate the evolution from classic to concerned markets. Their development has proceeded from focusing on absorbency and efficiency to questioning about their toxicity and polluting aspect (Cochoy, 2021). Menstrual management techniques have never ceased to exist, but it seems that they and the accompanying discourse have evolved. The menstrual cup and period underwear[1] have supplemented tampons and sanitary pads, and if the original focus on practical and material dimensions remains (absorbency, lightness, smallness, disposability, etc.), new concerns have invaded the scene. Significantly, in the advertisements for menstrual cups, reusability, recyclability, safety or hypoallergenic issues have supplemented the past quest for efficiency and feeling carefree. Similarly, the growing sensitivity to the vocabulary that is appropriate for describing female-related issues illustrates well how various concerns have invaded menstrual management technologies – or have been 'refracted' into them (Johnson, 2020). For instance, the will to get rid of the prejudices attached to 'hygiene' has led to the use of the phrase 'feminine care' or 'menstrual products' (Bobel, 2010; Fahs, 2016). Similarly, the determination to detach virginity from anatomic misconceptions has led to the abandonment (at least in Sweden?) of the misleading term 'hymen' in favour of the more appropriate 'vaginal corona' – that is, not a membrane but "a loose ring of skin that circle[s] the vaginal wall" (Johnson, 2020: 110).

Thus, the following questions are raised: what has fuelled the evolution from pads and tampons to cups? More importantly, how have matters of facts and matters of concern been involved in these consumer goods? Do health issues and environmental consciousness drive the production and use of menstrual cups? How is it possible, technically speaking, to trace such evolutions?

I propose to address these questions with an original computer-assisted technique aimed at grasping the themes involved in a corpus consisting of 5,235 consumer reviews (posted on Amazon.com) about the Star Cup (pseudonym), a leading product on the market for menstrual cups. In this paper, I focus on consumers' views about this cup, whose manufacturers now praise its supposedly safe and environment-friendly character yet with little concern for the practicalities of using such products. Indeed, the analysis points out that health and sustainability often clash with other concerns, such as comfort and practicality, thus raising the problem of a 'disorder of concerns'. After a brief overview of the research topic – the menstrual cup – and the kind of data that I rely on – online consumer reviews – I present the method chosen to make sense of these data, that is, a computer-assisted thematic analysis based on the Iramuteq open-source software. Finally, I review the results obtained. Various and often conflicting concerns are intertwined in cup consumption. This helps us understand that the development of sustainable consumption paradoxically requires taking many more elements and dimensions into consideration (see comfort issues, use conditions, etc.) than the mere environmental friendliness of consumer goods.

A brief presentation of the menstrual cup: A cyclical Phoenix-like product

There may be no better case than menstrual products for those who wish to study the development of markets and their social and moral underpinnings. These products claim to address a universal female bodily function and propose various solutions to do so. For over a century, sanitary pads tampons, and menstrual cups have undoubtedly contributed to easing women's lives and promoting better gender equality, especially as ways to help women 'pass' in the work and the public spheres. In the United States, before the widespread diffusion of disposable pads and tampons, physicians often presented menstruation as a periodic illness and recommended that women should stay home during their periods. The new technologies have helped in fighting against such

prejudices; they have assisted women in better managing their menstrual flow, keeping it private and showing that they are fully able to participate in every event of social life, whatever their periodic state might be (Vostral, 2008).

The analysis of the available literature, on one hand, and the close examination of patents for menstrual products, on the other hand (Cochoy, 2021), show a series of interesting developments. At first glance, the history of the market for such products provides evidence of a clear succession of a series of more or less familiar technologies: napkins, tampons and cups (more recently joined by menstrual panties and reusable pads). However, the same history shows a strong asymmetry; whereas pads and subsequently tampons quickly became mass products in the first half of the 20th century, the cup – although present from the late 19th century, well before its successful competitors – remained far behind them for a long time. This asymmetry is reflected in the literature; there are countless publications on menstruation issues, specifically on pads, tampons and other menstrual management methods, in sharp contrast to the literature on cups. The device has been largely neglected in related studies, apart from Shure's (2016) press article, O'Donnell's (2017) pioneering paper on the history of the menstrual cup or brief mentions in Vostral's (2008) comprehensive history of menstrual technologies. Significantly, of the 71 chapters of the impressive *Palgrave Handbook on Critical Menstrual Studies* (Bobel et al., 2020), none focuses on the menstrual cup as its main topic. Similarly, recent papers that investigate cups more closely do so as part of studies focused on other devices (Gaybor, 2019; Dutrait, 2022). Additionally, the available literature often takes the cup as a generic good and focuses on its adoption dynamics in various contexts (Fahs and Bacalja Perianes, 2020; Hytte et al., 2017; Mason et al., 2015; Oster and Thornton, 2012; Phillips-Howard et al., 2016; van Eijk et al., 2019). This literature highlights both drawbacks and merits of cups in terms of price, hygiene, health or sustainability, without paying close attention to technological aspects and use details. Drawing on Dutrait's (2022) care for the latter dimensions, and following works focused on materiality and body experience in the case of female-oriented technologies (Della Bianca, 2022; Hamper, 2020; Johnson, 2020), I aim to review the reasons behind the modest adoption of the cup. I explore the relations between the cup and down-to-earth body issues, use matters, technological aspects and market practices, on one hand, and larger societal issues, on the other hand. Of course, a lot of work has been done on embodiment issues in the fields of feminism, STS and other social sciences (for a review of the literature, see Shilling, 2016). For instance, Haraway (1988) renewed our vision of the complex relations among sex, gender and technologies. In this paper, I adopt a slightly different focus. I approach issues related to the body from the perspective of consumerism by showing that practical issues (e.g., the ways to use menstrual devices, adjust them to the body and cope with the use environment) should be taken into account better when developing and promoting such products.

Despite the common yet mistaken understanding, which views the menstrual cup as one of the latest innovations in menstrual products, this device was developed even before the invention of sanitary pads and tampons. 'Menstrual receptacles' or 'catamenial[2] sacks' had been devised long ago by several single innovators, as evidenced by the series of 19th-century patents.[3]

However, the subsequent history of menstrual cups has proven to be as cyclical as the periods they are meant to address. Pioneers' proposals went nowhere, probably because of the awkwardness of some of the early designs and the inventors' failure to advance their prototypes to production and marketing. However, in the late 1930s, a woman, Leona Chalmers, eventually succeeded in turning a long-lasting patent idea into a real mass-marketed product, Tassette. This name is based on the French word *tasse* (cup) and the diminutive suffix *ette* (Tassette thus means small cup) (Waldron, 1982).

After an incredible cycle of market failures and 'remarketing efforts' and the parallel introduction of several technical improvements, including the design of "air vents" to avoid suction effects during removal (US Pat. No. US1996242A, 1935), or the adoption of latex rubber (in 1987) or medical-grade silicone more recently, as well as other innovations in terms of better design and various sizes,

the cup market seems to have eventually gained ground (O'Donnell, 2017). In 2018, the value of the global menstrual cup market accounted for around $1.2 billion (Kunsel and Sumant, 2019) compared with the $29.1-billion value of the total market for menstrual products (pads, tampons and cups) (MarketWatch.com, 2022), that is, a modest but growing 4.1% global value share.

How could we explain the recent breakthrough of menstrual cups, which for the first time seems to have brought them to the scale of a globally marketed and now irreversible product, despite their modest market share? How has eco-friendliness been embedded into menstrual cups and to what extent/against what obstacles? More generally, how do technological features (matters of fact) and moral and political issues (matters of concern) interact, as well as articulate and contribute to this shift?

I draw on the latter distinction between matters of fact and matters of concern to address the above research questions. The two notions are borrowed from Latour. According to him,

> Reality is not defined by matters of fact. Matters of fact are not all that is given in experience. Matters of fact are only very partial and, I would argue, very polemical, very political renderings of matters of concern and only a subset of what could also be called *states of affairs* (Latour, 2004a: 232, emphasis in original).

By matters of concern, Latour means what people care about and also what social scientists should care about for them. Examples of such concerns are "family, love, religion, health, sex, security, education, justice, money, food, violence, sports, the environment, and so on" (Stephan, 2015: 214). In other words, matters of concern amount to the realm of emotions and meanings, values and valuation processes. As such, matters of concern echo David Stark's (2009) framework of the orders of worth (based on Boltanski and Thévenot's *Economies of Worth*, 2006). In the same way that, according to Stark, people and objects are valued along multiple orders of worth – such as the classic price dimension and other valuation criteria, including performance, creativity, fame and so on – I suggest that actors care about human and non-human entities along varied *orders of concern*, for instance, their comfort, economic, environmental or health dimensions. Similar to Stark's (2009) orders of worth, orders of concern may be presented as part of a 'heterarchy', that is: an organised set of valuation principles. However and as explained in this paper, they may also appear as elements of a messier and even self-contradicting whole, for example, when environmental issues clash with health ones.

Matters of concern have been attached to cups in the course of various events and societal evolutions. It was only in 1976 that menstrual products were classified as medical devices by the US Food and Drug Administration and thus submitted to test procedures and subjected to the related concern about toxicity – even if this regulation came too late to be applicable to the Rely tampon responsible for the Toxic Shock Syndrom (TSS) (Vostral, 2008, 2011, 2018). The latter scandal strongly contributed to spreading the concern about toxicity among the general public. More generally, it also favoured the broader distrust in menstrual products and their subsequent association with environmental concerns, eco-feminism and menstrual activism (Bobel, 2008), the rejection of single-use disposable products (Hawkins, 2018, 2020), the criticism of the business of menstruation (Arveda Kissling, 2006; Mørk Røstvik, 2022) and the quest for safer and more sustainable alternatives (Armstrong and Scott, 1992; Bobel, 2006; Costello et al., 1989).

As shown in this paper, networks do not only bind tangible entities but also connect artefacts and persons with abstract feelings, responsibilities and values. More recently, the Internet has made an important difference by embedding matters of facts and matters of concern even further. The Internet is a material infrastructure (Bowker et al., 2010) with the power to convert private and isolated experiences into public and shared expressions, that is, turn intimacy into 'extimacy'. Of course, consumers have not waited for the Internet to sometimes express their views publicly, from the level of their local neighbourhoods and communities to formal consumer associations or through readers' letters to various newspapers (Cohen, 2003). Nonetheless, the Internet and related channels have contributed to changing such expressions' form, scale and visibility. Until

recently, product qualification was overwhelmingly controlled by the top-down discourse of marketing and advertising. However, with the new interactive media, corporate discourse can be challenged by bottom-up and shared expressions of the public, whether on websites and webzines (Bobel, 2006), blogs, forums, social media or in consumer reviews. It is precisely this ability of digital media to express and share consumer concerns on a global scale that I explore further, through a detailed analysis of a collection of consumer reviews posted on Amazon.com.

Consumer reviews: Potentials and caveats

How can consumers' concerns about the products they use be accounted for? Are sustainability and health issues the key drivers behind the recent spread of the menstrual cup? Considering the global market for menstrual products, it makes sense to approach it based on global data. To trace and analyse these views at the worldwide level, I have chosen to rely on digital methods, which are among the best means to address social practices on a global scale (Lupton, 2012; Marres, 2017; Rogers, 2013). I focus on consumer reviews, given this type of expression's growing importance for contemporary markets (Beuscart et al., 2016) and society (Blank, 2006). I retrieved the complete collection of consumer reviews posted on Amazon.com about the leading product on the market for menstrual cups worldwide, that is, 5,235 reviews posted between 2005 (two years after the product development) and 2019. In some respect, the choice of the database is somewhat contingent; I favoured a source for which a simple scraping procedure existed.[4] Hopefully, working on Amazon data makes sense; as the largest online marketplace, it covers the global market and thus offers the largest and most diversified number of reviews. For a point of reference, I also scraped the reviews about leading disposable sanitary pads and tampons (288 and 318 reviews, respectively).[5] I shall not mention product names because my purpose is obviously not to present a kind of comparative advertising. In the following developments and for the sake of simplicity, I refer to the three products as disposable sanitary pads, tampons and cups, but it is important to keep in mind that I refer to particular brands and models, not generic products. First, I shall extract some basic facts and insights from this comparison.

Consumer reviews constitute a novel and rich source of information about consumer behaviour. With some exceptions, they amount to a kind of voluntary, global and massive expression, in contrast to solicited, situated and more or less directed interviews and questionnaires. Additionally, since most consumer reviews are about products purchased and often used for the first time, they help us gather information about consumer experience in terms of both practice and feelings. Several studies have explored the role of online consumer reviews in purchase decisions (e.g., Hu et al., 2014; Karimi and Wang, 2017; Maslowska et al., 2017; von Helversen et al., 2018). Of course, relying on online reviews as historical data also provides evidence of serious drawbacks. One is anonymity, which prevents analysts from knowing the characteristics and the structure of the underlying population. Another caveat is the now classic suspicion about fake reviews. It is difficult to directly overcome the first problem, but at least two observations can be made. First, even if anonymous, countless reviews reveal details about their writers, such as gender, occupation and so on. Second, the importance of social characteristics depends on the research objectives. Because my aim is not to assess the cup usage of the overall population but to analyse the way that consumers evaluate the products they have bought, the lack of systematic information about these consumers' backgrounds is acceptable, if not optimal. The third drawback of consumer reviews is their individualised and market-oriented character; each review comes as a specific testimonial, with little or no consideration for the neighbouring ones, and focuses on a particular brand from a consumer point of view. This contrasts with online forums or Facebook groups where participants share their views, debate and interact with one another, adopt many more perspectives than just a commercial one and thus have the potential to bring additional insights. For instance, Gaybor's (2019) study, partly based on such data, covers better political views fuelled by menstrual activism; her inform-

ants seem to envision the cup as an empowering tool, far beyond the view of a mere hygiene device that most Amazon reviewers tend to convey.

As far as fake reviews are concerned, several resources help address the issue. First, now there is extant literature about this problem. Based on various detection algorithms (Mukherjee et al., 2012, 2013), IT specialists have shown that the phenomenon is far more modest than what mass media claim; fake reviews generally represent 3–6% of the total (Anderson and Magruder, 2012; Ott et al., 2012). If Amazon claims that 99% of its reviews are legitimate because more than 99 percent of them are written by real shoppers who aren't paid for them[6], unscrupulous merchants use social media to flood the platform with fake reviews (Dwoskin and Timberg, 2018). Hopefully, special third-party detection tools, such as Fakespot and ReviewMeta, help provide a clearer view. In their reports, these service providers show that the proportion of fake reviews varies considerably according to the industry sector and may even exceed 50% for some products, including Bluetooth headphones or speakers, diet pills or testosterone boosters, which are often made in China.[7] However, for the menstrual cup that I focus on, the ReviewMeta search engine returns a score of 0% potentially unnatural reviews and shows less than 10% of the reviews using repetitive phrases. None of the reviewers admits receiving a free or discounted product in exchange for one's review.[8] Based on these clues, cup reviews seem overwhelmingly authentic, an impression congruent with the longer than average length of these reviews – a clear sign of real consumers' willingness to share their experiences.

The comparison among pad, tampon and cup reviews conveys significant results. The particular single-use pads and tampons that I focus on, that is, items belonging to the category of absorbency-based products that dominate over 95% of the contemporary market for menstrual products, received far fewer reviews (72 and 35 on average a year for disposable pads and tampons, respectively) than their modest cup challenger (349 on average a year). The disposability and thus the endless repurchase of these products generate huge profits, all the more so that the industry builds on the feelings of embarrassment and stigma attached to menstrual management as ways to increase brand loyalty and rent effects (Patterson, 2014). The numbers of disposable pad and tampon reviews remained modest over time, with a maximum of 125 a year for pads and 82 for tampons. In contrast, the number of cup reviews experienced continuous and considerable growth; less than 100 reviews were posted from 2005 to 2010, but the figures subsequently increased, reaching a maximum of 1,021 reviews in 2015 and a relative decline afterwards (530 in 2018, the last full year of observation). The more pervasive the product, the less reviewed it is and vice versa.

Of course, the market for disposable pads and tampons is fragmented into multiple and frequently updated products, which could be thought of as the reason for the scarce number of ratings about the models I selected. However, comparing the lengths of reviews leads to another explanation. Whereas the average lengths of pad and tampon reviews are 120 and 150 characters, respectively, the average length of cup reviews reaches as high as 590 characters, that is, up to almost five times the length of pad reviews. Moreover, this figure hides a huge standard deviation of 735 characters (versus 169 for pads and 207 for tampons). In fact, less than one-fourth (23%) of cup reviews are shorter than the highest average length of pad and tampon reviews (150 characters). An impressive 17% of these cup reviews are 1,000 characters long or more, and the longest cup review consists of 14,250 characters. In contrast, only 2 tampon reviews and 2 pad reviews are 1,000 characters long or more, and these reviews are not longer than 1,633 and 1,353 characters, respectively.

Before thoroughly scrutinising the content of cup reviews, I focus on one last external aspect of the three collections of reviews – consumer ratings. Consumers can rank Amazon products on a scale ranging from 1 to 5 stars. The average marks are very close: 4.2 for pads, 4.4 for tampons and 4.4 for cups. Further examination is thus needed to find whether differences exist in rating patterns. If the ratings are simplified into the mere opposite ratings of "bad" or "good", where "bad" corresponds to 1–3 stars, and "good" corresponds to 4–5 stars,[9] a slight difference is observed:

80–87% of the three products receive positive ratings (green zone), with the least favourable ratings for disposable pads and the most favourable ones for cups, although just two points above tampons. However, a closer examination shows an interesting difference: the share of intermediary ratings (2, 3 and more importantly, 4 stars) is significantly higher (28%) for cups than for the other two products (15% for pads and 21% for tampons). Stated the other way around, extreme ratings are fewer for cups; 1 and 5 stars account for 73% of all given marks compared with 85% for pads and 80% for tampons (Fig. 1).

Overall, cups clearly attract far more reviews, much longer reviews and (slightly) more positive (although more balanced) ratings than pads and tampons. The reason behind such discrepancies is obvious. Disposable pads and tampons are what economists call 'experience goods', whose purchase mostly entails repeating the previous consumption to refill consumers' stocks and rarely triggers comments, except mostly as short and binary judgements expressing satisfaction or dissatisfaction. In contrast, reusable cups are 'search goods', that is, things experienced as novel

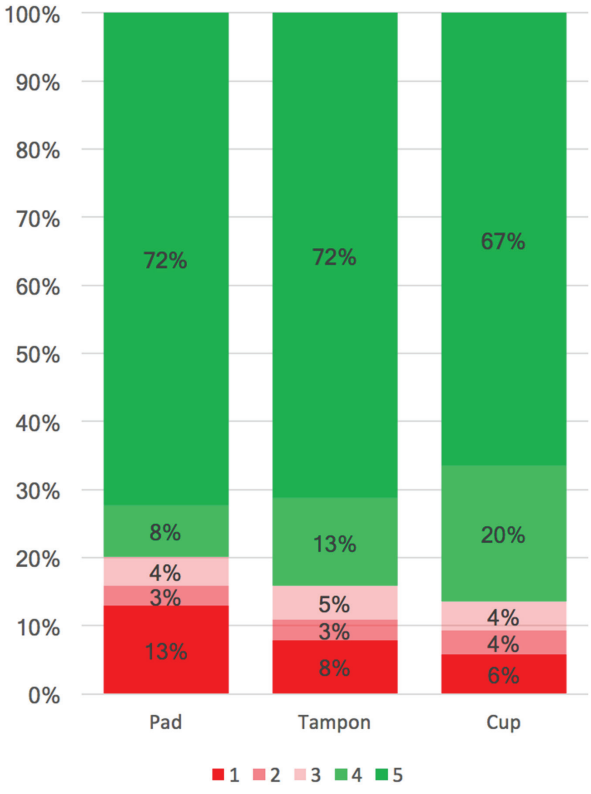

Figure 1. Consumer ratings of pads, tampons and cups

products, involving real adventures and highly disrupting changes in use, intimacy, physical experience and so on, with tremendous promises yet high uncertainties (Nelson, 1970). Cups thus entice a higher involvement from consumers and tend to lead them to post more reviews (note the spectacular asymmetry: 5,235 reviews for cups versus 288 and 318 for pads and tampons, respectively) and develop more precise, careful and nuanced valuations. Moreover, cup users, who are often beginners, feel the need to share at length not only their overall judgement but also their varied experiences, emotions, worries, feelings, tips and so on.

For instance, the following review reports the experience of a new user:

> I was so excited to try this! I hate how much waste is created by tampons, plus the bleach and synthetic materials are scary… The first day of my period I was too nervous to use it since I would be working all day and the only restroom at work is a 6 stall bathroom and someone always seems to be in it. I read through the instructions and reviews when I got home and almost chickened out again after reading a couple reviews where some women couldn't get it out, but I womaned up and tried it! I got it in surprisingly easily and I didn't get the "weird feeling" some women mentioned; I couldn't feel it at all! I didn't need to trim the stem either. I left it in for a few hours then decided to take it out before I went to bed. I started getting nervous again and read the directions again and read through some more reviews for tips. It came right out, no problem at all! Just a little strange to see a cup of your own menstrual blood, but definitely preferable to tampons – the gross string, bleach, waste, and cost! (Review no. 3715, 2017, 5 stars)

As the review shows, this user is eager to share her first time with her new device and to express a wide array of concerns, from environmental issues (see the second sentence: "I hate how much waste is created by tampons […]") to economic matters (see the last word: "cost"), and more private concerns in terms of anxiety, privacy, technical problems, disgust and so on.

Textometric analysis of cup reviews: A 'thlemmatisation' method

If reusable cups are search goods, they also belong to a class of merchandise that marketing specialists call high-involvement products (Petty et al., 1983), that is, items whose purchase and consumption elicit high reflexivity, information-search efforts, various trials and experiments, calculation and valuation procedures,[10] value investment and sometimes even moral and political commitment. Nonetheless, systematically conducting such an analysis is a task beyond a single researcher's capacity, given the size of the corpus. The full collection of reviews amounts to 3.9 million characters or 673,633 words, that is, 1,444 single-spaced A4 pages using 12-point Courier font. To overcome the problem, I propose to complement the classic reading of reviews with the assistance of Iramuteq, a well-known software program for automatic text analysis.

To better trace what and how concerns are expressed in these reviews and with what implications, I have developed and implemented a procedure that I label 'thlemmatisation'. This neologism is a contraction of 'thematisation' and 'lemmatisation'. The idea is to code active forms of a given corpus based on a list of thematic categories where they belong and to replace lemmas with their corresponding themes. For instance, words such as "durable", "earth friendly", "eco-friendly", "ecological", "green", "natural", "organic", "recycle" and so on, are replaced by the theme, "environment friendly" (see the Appendix for a full presentation). This strategy helps in combining the focus on particular research themes (in my case, the issues of health, the economy and environmental protection) and the work of automatic text analysis. As will be shown, 'thlemmatising' a corpus is a good way to simplify it according to *a priori* research interests and to increase the readability and the significance of the graphs obtained through classic textometric procedures. It would be wrong to perceive this method as tautological; by definition, if thlemmatising a corpus emphasises the notions that are focused on, these notions function as starting points, not as expected results (the contrary would be absurd). The aim is to start from the elements involved in the research effort in order to better identify and trace the other (often unknown) elements to

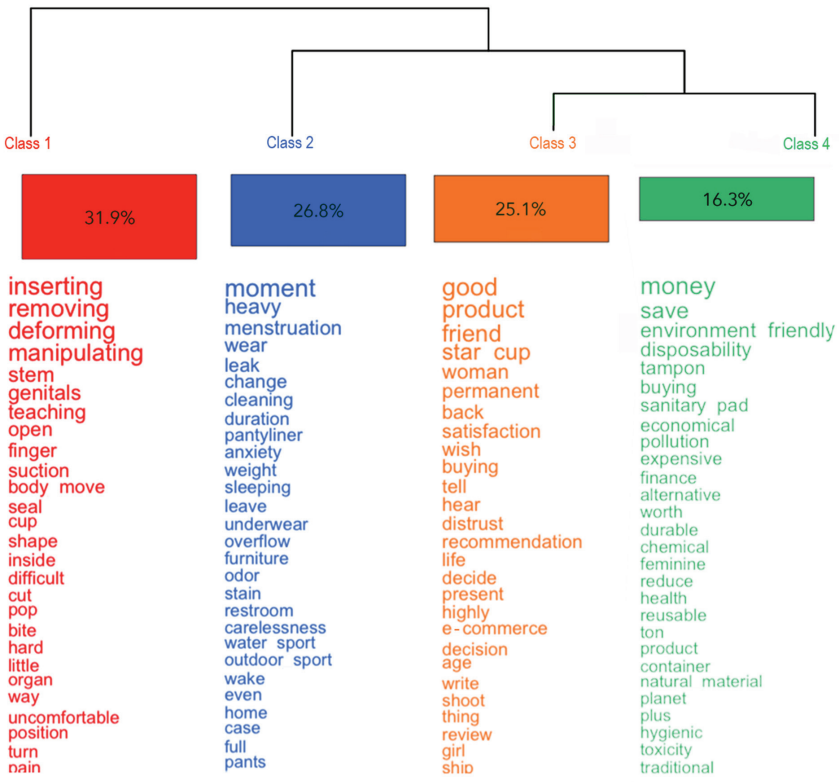

Figure 2. Reinert classification of the corpus

which they are connected. This kind of approach is not novel[11] but rarely used, probably because too many digital analysts tend to favour a 'one-click' analysis and avoid tedious handmade recoding practices. The following developments present the results of my analysis of the thlemmatised corpus.

Because the thlemmatised corpus is more readable and better suited to the research objectives than the standard version, I exclusively rely on it in the following developments. First, I have performed a Reinert classification of the thlemmatised corpus to identify the main types of concerns expressed in the consumer reviews. In the Reinert classification, the forms that are most frequently associated together in the corpus are grouped into classes (see the Appendix for more details).

Four clear categories emerge from the classification (see Fig. 2). Class 1 comprises almost one-third of the forms (31.9%). This class is clearly about handling the cup and the related problems (inserting, folding and removing it, knowing how to use one's fingers, avoiding suction effects, etc.). The three other classes account for more distant concerns. Class 2 (26.8% of the forms) is about the context of use in terms of both time (at what moment, for how long, etc.) and space (in restrooms, in sports practice, at home, etc.), with expressions of the associated risks ("leak", etc.) and complex feelings (from carelessness to anxiety). Class 3 (25.1% of the forms) is consumerist, dealing with gaining knowledge about the cup, judging it and sharing one's view with other menstruators through varied forms of media. Class 4 (16.9%) combines health, economic and environmental concerns, that is, the dimensions on which the product can be judged. It is mostly interesting to find that practical concerns largely outweigh the others: practice-oriented concerns belong to the first two more important classes and account for the majority of the forms (the total share of classes 1 and 2 is 58.7%), while issues such as economic concerns occupy a smaller position.

To better identify the reasons and the logic behind this broad picture, I propose (according to the theoretical framework presented in the previous section) to concentrate on the core subject of consumer concerns. To achieve such an objective, I have neutralised two dimensions. First, I have excluded tampons and sanitary napkins by unselecting the corresponding themes. Indeed, if cup users frequently compare their use with the available classic alternatives, removing the latter from the analysis helps me focus better on what is stated specifically about cups. Second, I have renounced sentiment analysis and thus excluded positive and negative views by unselecting the "good" and the "bad" themes, even if they account for an impressive number of positive and negative forms. Indeed, the generally rich, lengthy and wordy collection of reviews shows that what matters for menstruators is less the overall judgement (still available through the ratings; see above) and more the varied experiences to which it is connected. Similarly, what is important for them is less the general criteria on which valuation procedures can be based and more the incredible array of topics and worries emerging from the intimate experience of cup use. Consequently, I suggest temporarily disregarding the notion of the 'orders of worth' addressed in valuation studies (Stark, 2009) and focusing on what I label 'orders of concern'.

I have conducted a similarity analysis accordingly, that is, a procedure based on graph theory that maps the network of associations between the words of a given corpus. On the network map, a word appears as a node, and an edge reflects the co-occurrence between the two related words. To ensure maximum readability, I have thlemmatised the corpus for the forms (lemmas and themes) that appear at a frequency of 100 times or more (sanitary pad, tampon, bad and good themes excepted, along with menstruation, i.e., one of the most frequent themes but to the point of being meaningless). I have performed the similarity analysis for the 299 remaining forms. I have exported the underlying data from Iramuteq to Gephi, a large graph network analysis software program particularly suited to handling such data and increasing their readability. I have made the size of the labels and the thickness of the edges proportional to the underlying frequencies. I have highlighted the communities based on the modularity class (0.74) and adjusted the colours accordingly (with mixed colours for the edges bridging different communities). The overall result is displayed in Fig. 3.

Results: From orders of worth to (dis)orders of concern

The graph conveys at least five major, clear and meaningful results.

Trademark cup versus generic cup

The first and most striking result is the bimodal way that menstruators account for the menstrual cup. Indeed, as Fig. 3 shows, the evocation of the device is split into two disconnected communities. On the graph's right periphery, the cup appears as "Star Cup", that is, the brand of the particular device that consumers discuss in their Amazon.com reviews. In contrast, on the centre left, the "cup" appears as a generic device with no specific name. When evoked as the trademark "Star Cup", the device is compared with competing products (all the other brands are combined under the "competing cup" theme). It is something that consumers do not take as a matter of fact only (see above) but also address with broad concerns in mind (e.g., "economical", "health", "environment friendly"). It is a product about which consumers search for information ("reading"), and it works as a topic about which users are eager to share their personal views (e.g., "write", "review"). In contrast, when sharing their experiences, menstruators forget the brand, report about the device in more generic terms and shift to more intimate concerns, such as bodily sensations, anatomical issues and so on. This second approach to the device significantly occupies a central position in the network and leads to a much richer array of satellite concerns.

A networked cup

The second result is that this central version of the cup is immediately connected to an incredible array of items. It would be too long to comment about all of them, but readers might notice the strong presence of the body (e.g., "body state", "bottom", "genitals", "finger", "leg", "head"), as if the cup functioned as an artificial organ. This hybrid cup–body entity calls for the intervention of technical elements (e.g., "stem", "component", "tool") and human expertise (e.g., "medical", "health professionals"). These observations confirm Dutrait's (2022) and Gaybor's (2019) findings

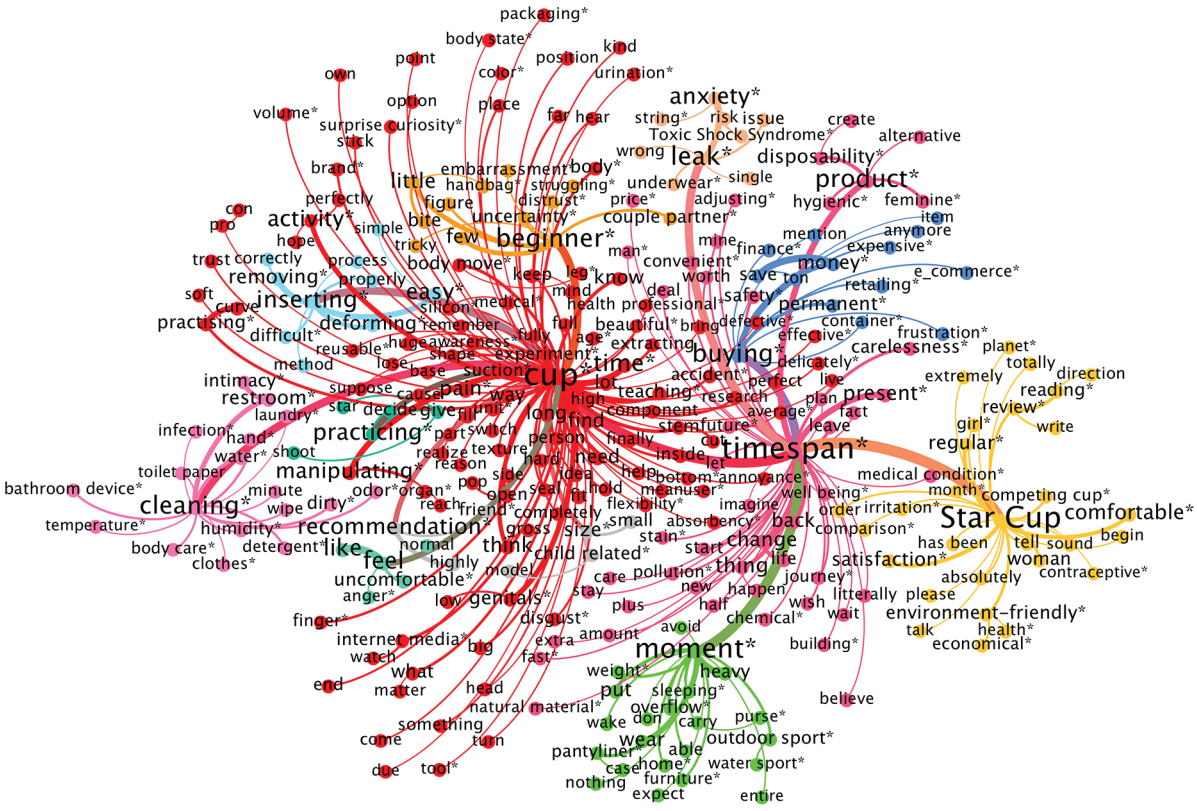

Figure 3. Similarity analysis of the thlemmatised corpus (*thlemmas)

that present the cup as a way to learn about one's body. The cup is also closely related to varied sensations. These feelings are both physical and psychological, ranging from "pain" and "suction" to "disgust" and "surprise curiosity". Last but not least, it is highly significant that the "reusable" aspect of the cup is highlighted, in strong contrast to the remote evocation of other "products" and their disposable aspect ("disposability"). These elements show that the socio-technical networks dear to the actor-network theory cannot be restricted to the classic associations between humans and non-humans for two reasons. First, prosthetic objects (Callon, 2008) become parts of the human being herself, thus merging subjects and objects into cyborg-like entities (Haraway, 1985) – such entities could be named 'actorants', that is, combinations of actors and actants. Second, the shift from matters of facts to matters of concern helps us understand that networks do not bind tangible entities only but also connect artefacts and persons with abstract feelings, responsibilities and values (Geiger et al., 2014; Hawkins, 2020).

A matter of trajectory, practice, sharing, cleaning

The third result is that the cup is connected to a series of major, hub-like themes, each leading to similar dimensions. First, consumers relate cup use to their consumer trajectory. In so doing, they highlight the particular position of the "beginner" that they often occupy, as well as the relative burdens ("distrust", "embarrassment", "struggling", "tricky", etc.) and "uncertainty", to the point that beginners soon feel the need to share their intimate problems with their "couple partner". Second, such problems are gathered around the "inserting" theme. Complementary handling operations, such as appropriately "deforming" and "removing" the device, are obviously prominent in this respect, with a distinct care for the relevant knowhow (e.g., "method", "process", "correctly", "properly"), and varied feedback about its implementation (e.g., "easy" versus "difficult"). Consequently, consumers stress that cup use needs a lot of "practice". Third, the knowledge acquired through practice may eventually lead to experience-sharing attitudes ("recommendation"). Fourth, practical problems do not stop after use. An important concern involves "cleaning" the device, with the related problems of preserving "intimacy" in public "restrooms", the necessary resources (e.g., "toilet paper", "detergent", "water", "bathroom device"), sensory burdens (e.g., "humidity", "odor") and hygiene risks ("infection").

A time-related device

The fourth result indicates the prominent importance of time; the main "hub-like" theme connected to the cup is "duration", a notion that gathers several time units, including "minute", "hour", "day", "week" and so on. Of course, this makes sense in the use of a device related to menstruation. However, it is more interesting that more specific concerns are connected to various durations. Some of these concerns are linked to unexpected events, such as "stain(s)" and other types of "accident(s)". Significantly, a major satellite concern involves the risk of "leak(s)" and the related "anxiety". More importantly, "duration" is heavily connected to various "moments", a theme that qualifies the particular points in time when events are likely to occur ("morning", "mid-day", "afternoon", "evening", "night", etc.). As shown, time is connected to space. The concern for moments varies according to the place and the related activity (when "sleeping" or at "home", when practising "outdoor sports" or "water sports"). This unveils the web-like character of cup use, which is part of a much wider agencement than the components of the product itself. Eventually, duration also leads to the time it takes not only to use the device but also to buy it, with the relative care for the "money" spent by a consumer, the retail outlets used ("retailing" versus "e-commerce") and so on.

The disorder of concerns

Last but not least, the fifth result is that health and environmental issues, even if 'boosted' by thlemmatisation, appear as somewhat lost concerns among the many other more down-to-earth and practical worries that I have just reviewed. This helps in balancing the importance of the eco-friendliness of the cup highlighted in previous research based on qualitative investigations (Gaybor, 2019) and the value of more practical

concerns. Once again, it seems as if environmental issues are disconnected from the underlying practicalities. To summarise, the analysis of the thlemmatised corpus makes it clear that cup use is primarily a highly practical and material matter, a 'use story', and this pragmatic dimension is obviously connected to an incredible web of interrelated concerns. In other words, if consumers often buy their goods by relying on various external "orders of worth" (e.g., price, fair trade, sustainability, corporate social responsibility, etc.), they use these goods by depending on an infinite array of 'orders of concern'. The latter includes all previous ones, as well as more practical and intimate matters, such as comfort, embarrassment, privacy, anxiety and so on. In this respect, it should be even more appropriate to discuss 'disorders of concern', to the extent that the web of concerns is largely unstable, messy and entangled, far more than the 'heterarchic' world governed by orders of worth.[12] Several of these preoccupations contradict one another or even clash; for instance, menstruators often find it difficult to reconcile their eco-friendly values with the burden of the periodic use of the cup, as if a sort of material dissonance is supplementing the classic cognitive one (Festinger, 1957).

Discussion

Latour notes that no 'inflatable parliament' exists; building a satisfactory political organisation cannot be limited to the hard sell of generic democratic ideas but also needs a long and tortuous effort aimed at complying with local situations (Latour, 2005: 24). Similarly, there is no easy road from problematic to healthy or responsible menstruation control. Finding the proper way is surely possible but only by taking into account all the little down-to-earth, personal, pragmatic and over-practical stories that the reviews convey. Marketing an alternative, eco-friendly product such as the menstrual cup is a solution, but to make it workable, one should also pay attention to bodily issues, use operations, surrounding infrastructures and so on. This final example mirrors the first quote cited in this paper but with a more negative tone:

> I was so, so, so excited to get a Star cup. […]. I have been using it for two cycles now, and I have to say, I am totally disappointed. […] Maybe it's my frame or my vaginal canal, but ladies, I cannot get this thing to work for me. I have read so many forums and watched so many videos and looked at so many diagrams, and no matter how much I fiddle and do ridiculous acrobatic moves in my shower or on the toilet, this thing always leaks. Always. I've gotten to a point where I can put it in […], and put on a pantyliner, and it will just leak a small amount, but come on! That is not why I bought the Star cup. I wanted something with no waste, that felt really secure, and something that I could take backpacking and swimming without worrying about anything. Thus far, it is not serving that purpose at all, and I have to say, I am so sad! I was really looking forward to my brand new Star cup lifestyle! I was going to be a changed woman! I was going to wear white pants year round, and dance in them with hopeful music playing and not worry about a damn thing! But alas. I suppose the tampon wearing version of me will have to do. […] (Review no. 1093, 2014, 2 stars)

This consumer expresses the great hope she placed in the Star Cup and her environment-friendly values, all the efforts she made to adopt the device, then her extreme frustration when facing failure but softens with benevolence when generously citing her specific anatomy as a probable cause. Nonetheless, independently from success or failure, this example seems to show that too much pressure is placed on consumers, when it should be, if not placed elsewhere, at least better distributed.

Since the beginning of the 21st century, the social sciences have tended to present lay people's practices as the best ways to address major political issues. This approach is promoted in the abundant literature on "political consumerism", which presents every consumer purchase as a way to vote in favour of higher stakes (Bostrom et al., 2018; Micheletti, 2003; Micheletti et al., 2003). The same approach is developed in political science, focusing on the participative forms of democracy as viable alternatives to classic representative institutions and procedures (Callon et al., 2009). There are several reasons behind this shift from top-down to bottom-up politics. The most ancient influence is that of pervasive yet important theo-

retical evolutions. Garfinkel's (1967: 68) famous claim that people are not "cultural dopes" framed by remote structures but are fully reflexive "members" capable of structuring the world they live in started the process. The movement has ceaselessly been enriched since then, notably with the practice and the pragmatist turns. Practice theoreticians insist on actors' capacity to pursue varied goals through a complex articulation of materials, competencies and meanings (Shove et al., 2012). Such views have attracted considerable attention for their novelty, seductive rhetoric and ability to present classic regulations as outmoded and irrelevant, due to their supposed lack of subsidiarity, blind top-down rationale and actor unfriendliness. Meanwhile, the rise of Web 2.0, social media and the related boom of innumerable forms of participation and activism have strongly supported the idea of actor-based production (for the popular idea of 'prosumption', see Ritzer and Jurgenson, 2010) and politics (for the literature on 'ethical consumption', see Dubuisson-Quellier, 2013). Last but not least, the study on such actor-based politics is also favoured because of its easier accessibility in fieldwork. Indeed, ordinary consumers and citizens are far easier to approach than larger companies and institutions.

However, if ordinary actors are obviously not cultural dopes, critique and action are nevertheless not accessible to everyone at the same level. In this respect, it is politically dangerous to propose politics that are supposed to rest on street-level initiatives only. Surely, serious health and environmental issues need to be addressed. Menstrual products certainly contribute to the alleviation of both problems. Nonetheless, does it mean that solving the latter should be the responsibility of consumers only, by urging them to adopt the safest and most sustainable products and shaming them if they refuse or fail to do so? This would be acceptable if the problems were limited to menstrual products and if these products themselves were fully equivalent, independently from their contribution to the problems at stake. My research results show that these two conditions are far from being fulfilled. The differences between disposable tampons and pads, on one hand, and reusable cups, on the other hand, are not restricted to their more or less innocuous or sustainable character. Furthermore, these differences matter. Indeed, they raise a series of concerns regarding embarrassment, privacy, practicality, reliability, comfort, wellbeing and so on, and these concerns often conflict with political ones. Of course, companies care about their consumers and try to improve their products according to consumer needs and wishes (Hartman, 2020; Fahs and Bacalja Perianes, 2020), all the more since doing so meets the manufacturers' best interests. However, the latter may be slow in addressing concerns that were previously ignored. They often cannot stretch the inherent limits of the technologies they promote, especially when their devices are mass produced and cannot be individually adjusted, apart from a limited set of forms and sizes. Moreover and as found in this study, user problems are not confined to the products themselves but involve the larger web-like agencement to which they belong. It would indeed be a mistake to regard customers as the sole acting entities. As Strengers and colleagues (2016) convincingly show, consumption is not just the effect of consumer action but also the outcome of the articulation of complex human and non-human agencies. Thus, an honest call for shifting practices would require a complete transformation of practice environments.

Conclusion

This study makes both methodological and substantial contributions. Regarding the method, an *ad hoc* digital procedure has been used and adapted to show how various concerns are embedded in the use of technologies. It is important to stress that such a method cannot suffice in itself. It is also essential to emphasise that consumer reviews are written by consumers who do not mind in sharing their intimate experiences. This material does not account for the full female population and probably underrepresents the feelings of embarrassment and stigma that dominate the history of menstruation and remain largely pervasive (Johnston-Robledo and Chrisler, 2013). A researcher understands and analyses the results better when reading at least part of the underlying corpus and when complementing it with additional data and literature.

Understanding the meaning of contemporary consumer reviews about menstrual cups requires knowledge of past history, contemporary practices, as well as greater knowledge of the market and the society where they fit in. Nonetheless, if additional research would be needed to provide a more complete account and full answers to the research questions, the reviews provide at least part of the answers by focusing on the consumers' points of view, while most available data focus on the industry. With this paper, I join the plea for using digital humanities beyond specialised scholars, disciplines and journals (Gold and Klein, 2016; Jockers, 2013). The method used in this paper is not restricted to the digital age but can be applied to older data, for instance, to the patents themselves, thanks to the growing optical character recognition of historical archives (Cochoy, 2021). Accordingly, the method is just a means, and what matters most constitutes the substantial results that it conveys.

From this substantial perspective, it is tempting to perceive the recent rebirth of the menstrual cup, with its supposed reusability and safer materials, as an obvious answer to both environmental and health threats and a way to introduce "sustainability" and "non-toxicity" into the products themselves. However, my analysis of the large corpus of consumer reviews posted on Amazon.com about the "Star Cup" shows a more complex picture. As discussed in this paper, cup users do not take the device as a generic good but pay attention to the details of the particular cup they experience; they do not perceive it as just an object (a matter of fact) but connect it to broad issues such as economic, health and environmental aspects (matters of concern). They do not report an abstract experience but relate the cup use to their menstrual trajectory and context- and time-dependent practices. Overall, it clearly appears that if health and environmental concerns surely exist and motivate some of the consumers, these issues belong to a much wider array of varied, intertwined and sometimes conflicting concerns. Women do not restrict the menstrual cup to abstract health or environmental stakes but account for all its dimensions, with even a major focus on practical issues, such as proper use, handling problems, psychological and physical effects, and so on. Consequently, it seems important to acknowledge this experience, unveil the responsibility of all involved stakeholders and thus relieve menstruators of a possible sense of guilt, whatever the solutions they favour.

Acknowledgements

I warmly thank Antti Silvast, two anonymous reviewers, a proofreader, Jean-Samuel Beuscart, Cédric Calvignac and Claire Dutrait for their helpful comments, suggestions and guidance on previous versions of this article.

References

Anderson M and Magruder J (2012) Learning from the crowd: Regression discontinuity estimates of the effects of an online review database. *The Economic Journal* 122(563): 957-989.

Armstrong L and Scott A (1992) *Whitewash: Exposing the health and environmental dangers of women's sanitary products and disposable diapers: what you can do about it*. Toronto: Harper Perennial.

Arveda Kissling E (2006) *Capitalising on the Curse: The Business of Menstruation*. London, Boulder, CO: Lynne Rienner Publishers.

Beuscart J-S, Mellet K and Trespeuch M (2016) Reactivity without legitimacy? Online consumer reviews in the restaurant industry. *Journal of Cultural Economy* 9(5): 458-475.

Blank G (2006) *Critics, Ratings, and Society: The Sociology Of Reviews*. Lanham: Rowman & Littlefield Publishers.

Bobel C (2006) 'Our revolution has style': Menstrual product activists 'doing feminism' in the third wave. *Sex Roles: A Journal of Research* 54: 331–345.

Bobel C (2008) From convenience to hazard: A short history of the emergence of the menstrual activism movement, 1971–1992. *Health Care for Women International* 29:738–754.

Bobel C (2010) *New Blood, Third-Wave Feminism and the Politics of Menstruation*. New Brunswick NJ: Rutgers University Press.

Bobel C, Winkler I T, Fahs B, Hasson K A, Arveda Kissling E and Roberts T-A (eds) (2020) *The Palgrave Handbook of Critical Menstruation Studies*. London: Palgrave Macmillan. Available at: https://link.springer.com/book/10.1007%2F978-981-15-0614-7 (accessed 2.12.2022).

Boltanski L and Thévenot L (2006) *On justification. Economies of worth*. Princeton, NJ: Princeton University Press.

Boström M, Micheletti M and Oosterveer P (eds) (2018) *The Oxford Handbook of Political Consumerism*. Oxford: Oxford University Press, Oxford Handbooks online.

Bowker G C, Baker K, Millerand F and Ribes D (2010) Toward information infrastructure studies: Ways of knowing in a networked environment. In: Hunsinger J, Klastrup L and Allen M (eds) *International Handbook of Internet Research*. New York: Springer, pp. 97-117.

Callon M (2008) Economic markets and the rise of interactive agencements: From prosthetic agencies to "habilitated' agencies. In: Pinch T and Swedberg R (eds) *Living in a Material World: Economic Sociology Meets Science and Technology Studies*. Cambridge, MA: MIT Press, pp. 29-56.

Callon M, Lascoumes B and Barthe Y (2009) *Acting in an Uncertain World: An Essay on Technical Democracy*. Cambridge MA: MIT Press.

Cochoy F (2008) Calculation, qualculation, calqulation: Shopping cart's arithmetic, equipped cognition and clustered consumers. *Marketing Theory* 8(1): 15-44.

Cochoy F (2014) Afterword. Concerned markets: facing the future, beyond "interested' and "contested' markets. In: Harrison D, Geiger S, Kjellberg H. and Mallard A (eds) *Concerned Markets, Economic Ordering for Multiple Values*. Cheltenham, UK, Edward Elgar, pp. 238-255.

Cochoy F (2021) Patents as vehicles of social and moral concerns: The case of Johnson & Johnson disposable feminine hygiene products (1925–2012). *Science, Technology & Human Values* 46(6): 1340-1364.

Cohen L (2003) *A Consumer's Republic: The Politics of Mass Consumption in Post-War America*. New York: Knopf.

Costello A, Vallely B and Young J (1989) *The Sanitary Protection Scandal.* London: Women's Environmental Network.

Della Bianca L (2022) Configuring the body as pedagogical site: Towards a conceptual tool to unpack and situate multiple ontologies of the body in self-tracking apps. *Learning, Media and Technology* 47: 65-78.

Dubuisson-Quellier S (2013) *Ethical Consumption*. Blackpoint, Nova Scotia: Fernwood Publishing.

Dubuisson-Quellier S (2018) From moral concerns to market values: how political consumerism shapes markets. In: Boström M, Micheletti M and Oosterveer P (eds) *The Oxford Handbook of Political Consumerism*. Oxford: Oxford University Press, Oxford Hanbooks online.

Dutrait C (2022) Faire avec le flux. Tampons, coupes, complications et implications. *Techniques & Culture* 77, Available at: https://journals.openedition.org/tc/17112 (accessed 2.12.2022).

Dwosin E and Timberg C (2018) How merchants use to flood Amazon with fake reviews. *The Washington Post*, April 23.

Fahs B (2016) *Out for blood: Essays on Menstruation and Resistance*. Albany, NY: Suny Press.

Fahs B and Bacalja Perianes M (2020) Transnational engagement: Designing an ideal Menstrual Health (MH) curriculum—Stories from the Field. In: Bobel C, Winkler I T, Fahs B, Hasson K A, Arveda Kissling E and Roberts T-A (eds) *The Palgrave Handbook of Critical Menstruation Studies*. London: Palgrave Macmillan., pp. 449-465. Available at: https://link.springer.com/book/10.1007%2F978-981-15-0614-7 (accessed 2.12.2022).

Festinger L (1957) *A Theory of Cognitive Dissonance*. New York: Harper.

Garfinkel H (1967) *Studies in Ethnomethodology*. Englewood Cliffs, HJ: Prentice-Hall.

Gaybor J (2019) Empowerment, destigmatization and sustainability: The co-construction of reusable menstrual technologies in the context of menstrual activism in Argentina. *Gender, Technology and Development* 23: 111-129.

Geiger S, Harrison D, Kjellberg H and Mallard A (eds) (2014) *Concerned markets*. Edward Elgar: Cheltenham.

Gold M K and Klein L F (2019) *Debates in the Digital Humanities 2019*. University of Minnesota Press, online edition. Available at: https://dhdebates.gc.cuny.edu/projects/debates-in-the-digital-humanities-2019 (accessed 2.12.2022).

Hamper J (2020) 'Catching Ovulation': Exploring women's use of fertility tracking apps as a reproductive technology. *Body & Society* 26:3-30.

Haraway D (1985) Manifesto for cyborgs: Science, technology, and socialist feminism in the 1980s. *Socialist Review* 80: 65–108.

Haraway D (1988) Situated knowledges: The science question in feminism and the privilege of partial perspective. *Feminist Studies* 14(3): 575-599.

Hartman A J (2020) Designing menstrual products for disabled bodies. In: Bobel C, Winkler I T, Fahs B, Hasson K A, Arveda Kissling E and Roberts T-A (eds) *The Palgrave Handbook of Critical Menstruation Studies*. London: Palgrave Macmillan, pp. 340-343. Available at: https://link.springer.com/book/10.1007%2F978-981-15-0614-7 (accessed 2.12.2022)

Hawkins G (2018) Plastic and presentism: The time of disposability. *Journal of Contemporary Archaeology* 5: 91–102.

Hawkins G (2020) Detaching from plastic packaging: Reconfiguring material responsibilities. *Consumption, Markets & Culture* 14: 1–14.

Hu N, Koh NS and Reddy SK (2014) Ratings lead you to the product, reviews help you clinch it? The mediating role of online review sentiments on product sales. *Decision Support Systems* 57: 42–53.

Hytte M, Faldt Thomsen C, Luff B, Storrusten H, Nilah Nyakato V and Tellier M (2017) Drivers and challenges to use of menstrual cups among schoolgirls in rural Uganda: A qualitative study. *Waterlines* 36: 109–124.

Jockers M L (2013) *Macroanalysis, Digital Methods & Literary History*. Champaign, IL: University of Illinois Press.

Johnson E (2020) *Refracting Through Technologies: Bodies, Medical Technologies and Norms*. Abingdon and New York: Routldge.

Johnston-Robledo E and Chrisler JC (2013) The menstrual mark: Menstruation as social stigma. *Sex Roles* 68: 9–18.

Karimi S and Wang F (2017) Online review helpfulness: impact of reviewer profile image. *Decision Support Systems* 96: 39–48.

Kunsel T and Sumant O (2019) *Menstrual Cup Market by Product Type (Disposable and Reusable), Material (Medical Grade Silicone, Natural Rubber, and Thermoplastic Elastomer), and Distribution Channel (Online Stores and Pharmacies & Retail Stores). Global Opportunity Analysis and Industry Forecast, 2019–2026* .AlliedMarketResearch.com. Available at: https://www.alliedmarketresearch.com/menstrual-cup-market (accessed 2.12.2022).

Latour B (2004a) Why has critique run out of steam? From matters of fact to matters of concern. *Critical Inquiry* 30(Winter): 225–248.

Latour B (2004b) *Politics of Nature: How to Bring Science into Democracy.* Cambridge, MA: Harvard University Press.

Latour B (2005) From realpolitik to dingpolitik or how to make things public. In Latour B and Weibel P (eds) *Making things public: Atmospheres of democracy*, Cambridge MA: MIT Press pp. 14-41.

Liu B (2012) *Sentiment Analysis and Opinion Mining.* San Rafael, CA: Morgan & Claypool.

Lupton D (2012) *Digital Sociology*. Sydney: University of Sydney.

Marchand P and Ratinaud P (2012) L'analyse de similitude appliquée aux corpus textuels : les primaires socialistes pour l'élection présidentielle française. *Actes des 11èmes Journées internationales d'Analyse statistique des Données Textuelle*, pp. 687–699.

Maslowska E, Malthouse EC and Viswanathan V (2017) Do customer reviews drive purchase decisions? The moderating roles of review exposure and price. *Decision Support Systems* 98: 1–9.

MarketWatch (2022) Feminine hygiene products market is expected to grow at a CAGR of 4.6% by 2027 with segments, leading players, application and forecast analysis, report, Available at: https://www.marketwatch.com/press-release/feminine-hygiene-products-market-is-expected-to-grow-at-a-cagr-of-46-by-2027-with-segments-leading-players-application-and-forecast-analysis-report-145-pages-2022-09-14 (accessed 2.12.2022).

Marres N (2017) *Digital Sociology: The Reinvention of Social Research.* Cambridge: Polity Press.

Mason L, Laserson K, Oruko K et al. (2015) Adolescent schoolgirls' experiences of menstrual cups and pads in rural western Kenya: A qualitative study. *Waterlines* 34(1): 15-30.

Micheletti M (2003) *Political Virtue and Shopping: Individuals, Consumerism, and Collective Action*. Palgrave: Macmillan.

Micheletti M, Follesdal A and Stolle D (eds) (2003) *Politics, Products, and Markets: Exploring Political Consumerism Past and Future*. New Jersey: Transaction Press.

Mørk Røstvik C (2022) *Cash Flow, The Businesses of Menstruation*. London, UK: UCL Press.

Mukherjee A, Liu B and Glance N (2012) Spotting fake reviewer groups in consumer reviews. *Proceedings of the 21st International Conference on World Wide Web*, 191–200.

Mukherjee A, Venkataraman V, Liu B and Glance N (2013) *Fake review detection: Classification and Analysis of Real and Pseudo Reviews*. Technical report, Department of Consumer Sciences, Chicago, IL: University of Illinois at Chicago. Available at:https://pdfs.semanticscholar.org/4c52/1025566e6afceb9adcf27105cd33e4022fb6.pdf (accessed 2.12.2022).

Nelson P (1970) Information and consumer behavior. *Journal of Political Economy* 78(2): 311-329.

O'Donnell K (2017) 'The whole idea might seem a little strange to you:' Selling the menstrual cup. *Technology's Stories*, December 4. Available at:http://www.technologystories.org/menstrual-cups/ (accessed 2.12.2022).

Oster E and Thornton R (2012) Determinants of technology adoption: peer effects in menstrual cup take-up. *Journal of the European Economic Association* 10(6): 1263-1293.

Ott M, Cardie C and Hancock J (2012) Estimating the prevalence of deception in online review communities. *Proceedings of the 21st International Conference on World Wide Web*, 201–210.

Patterson A (2014) The social construction and resistance of menstruation as a public spectacle. In: Farris D Davis M and Compton D (eds) *Illuminating How Identities, Stereotypes and Inequalities Matter through Gender Studies*. Dordrecht: Springer, pp. 91-108.

Petty R E, Cacioppo J T and Schumann D (1983) Central and peripheral routes to advertising effectiveness: The moderating role of involvement. *Journal of Consumer Research* 10(2): 135-146.

Phillips-Howard PA, Nyothach E, ter Kuile FO et al. (2016) Menstrual cups and sanitary pads to reduce school attrition, and sexually transmitted and reproductive tract infections: A cluster randomised controlled feasibility study in rural Western Kenya. *BMJ Open* 6: 1–11.

Ratinaud P and Marchand P (2015) From lexical scopes to social representations. A preliminary thematic approach to the National Assembly debates (1998-2014). *Mots. Les langages du politique* 108: 57-77.

Ritzer G and Jurgenson N (2010) Production, consumption, prosumption: The nature of capitalism in the age of the digital prosumer. *Journal of Consumer Culture* 10(1): 13–36.

Rogers R (2013) *Digital methods*. Cambridge, MA: MIT Press.

Shilling C (2016) The rise of body studies and the embodiment of society: A review of the field. *Horizons in Humanities and Social Sciences* 2 (1): 1-14.

Shove E, Pantzar M and Watson M (2012) *Dynamics of Social Practices*. New York: Sage.

Shure N (2016) Why has it taken the menstrual cup so long to go mainstream? *Pacific Standard*, June 14. Available at: https://psmag.com/news/why-has-it-taken-the-menstrual-cup-so-long-to-go-mainstream (accessed 2.12.2022).

Stark D (2007) For a sociology of worth. Working paper. Available at : https://www.researchgate.net/publication/251651120_For_a_Sociology_of_Worth (accessed 2.12.2022).

Stark D (2009) *The Sense of Dissonance. Accounts of Worth in Economic Life*. Princeton and Oxford: Princeton University Press.

Stephan P F (2015) Designing 'matters of concern' (Latour): A future design task? In: Jonas W, Zerwas S and von Anshelm K (eds) *Transformation Design – Perspectives on a New Design Attitude*. Basel: Birkhäuser, pp. 202-226.

Strengers Y, Nicholls L and Maller C (2016) Curious energy consumers: Humans and nonhumans in assemblages of household practice. *Journal of Consumer Culture* 16(3): 761–780.

van Eijk AM, Zulaika G, Lenchner M et al. (2019) Menstrual cup use, leakage, acceptability, safety, and availability: A systematic review and meta-analysis. *Lancet Public Health* 4(8): e376–e393.

von Helversen B, Abramczuk K, Kopeć W and Nielek R (2018) Influence of consumer reviews on online purchasing decisions in older and younger adults. *Decision Support Systems* 113(September): 1–10.

Vostral S L (2008) *Under Wraps. A History of Menstrual Hygiene Technology*. Plymouth, UK: Lexington Books.

Vostral S L (2011) Rely and Toxic Shock Syndrome: A technological health crisis. *Yale Journal of Biology and Medicine* 84: 447-459.

Vostral S L (2018) *Toxic Shock: A Social History.* New York, NY: New York University Press.

Waldron J W (1982) The History of Tassaway and the Market for Feminine Hygiene Products. January 15, Autumn Stanley Papers, MS 659, Special Collections Department, Iowa State University Library.

Notes

1 Cups and period underwear are both reusable alternatives to tampons and pads (respectively). In this paper, I focus on cups only.

2 Catamenial is a synonym for menstrual (from the Greek *katamenios*, i.e., menses), widely used in early company records.

3 Hockert (US Pat. 70843, 1867); Johnston (US Pat. 182024, 1876); Farr (US Pat. 300770, 1884); Vernier (US Pat. 467963, 1892); Dautrich (US Pat. 535980, 1895); Beach (US Pat. 599955, 1898). Source: United States Patent and Trademark Office.

4 I used Google's web scraper, a Google plugin aimed at scraping web information from a given site. To scrape Amazon reviews, Google web scraper requires two elements: the URL of the product and the JSON of Amazon reviews (i.e., a file describing the structure of Amazon reviews). This latter file is available at https://gist.github.com/scrapehero/cefaf014076b953f865a63ad453d507b#file-amazon-reviews-json

5 It is important to note that fabric reusable pads and period underwear are currently a growing market. Conversely, disposable cups also exist.

6 The remaining 1% amounts to the Amazon Vine program, which offers free products to selected customers in exchange for their impartial reviews, each shown with a note that states, "Vine customer review of free product".

7 https://marketingland.com/study-finds-61-percent-of-electronics-reviews-on-amazon-are-fake-254055

8 https://reviewmeta.com/

9 In this case, 3 out of 5 stars are considered poor judgements in order to balance them with e-consumers' acknowledged propensity to provide quite generous ratings (Beuscart et al., 2016).

10 Calculation and valuation are two sides of the same cognitive process that I call "qualculation" (Cochoy, 2008).

11 See the "EQUIV" function available in Spad-T during the 1980s and other tools aimed at performing similar recoding procedures based on lists offered by more recent software packages (e.g., Taltac). Thlemmatising a corpus is also close to topic modelling, that is, tagging the key notions that the researcher focuses on, although with thlemmatisation, the aim is not to train machine-learning software to categorise texts that convey these notions (e.g., consumer reviews) but to better trace how the tagged notions are related to others in the entire corpus.

12 "As the term suggests, heterarchies are characterised by minimal hierarchy (lateral accountability) and by organizational heterogeneity (diversity of evaluative principles)" (Stark, 2007: 5).

Appendix

Additional information about the thlemmatisation method

Iramuteq is a powerful tool, which helps in conducting various investigations aimed at unveiling conceptual classes or network patterns hidden in huge textual databases.

The first treatment is the Reinert classification. This method divides the corpus into text segments (identified by punctuation). It then builds a presence/absence table that crosses the text segments with the full forms of the corpus. The objective of this table is to bring together text segments that tend to contain the same forms in sets called "classes". A form's membership to a given class is established according to its independence, as measured by a chi-square test. With this procedure, the software is able to identify the different themes addressed in the corpus and the words that are most associated with each theme.

Another treatment is similarity analysis. This type of processing, based on graph theory, entails tracing co-occurrence patterns among the words in a given corpus. Once the co-occurrences among the words have been identified, the software draws the corresponding graph. This figure displays the overall network of forms, with both their spelling and the ties among them, and it clearly highlights the subcommunities of frequently associated notions, indicated by appropriate colours or "halo" zones (Marchand and Ratinaud, 2012).

However, when performing a similarity analysis on a large corpus with a rich vocabulary, the researcher quickly understands that the resulting graph will be truly readable only if the number of forms considered is reduced. Indeed, without prior selection, too many forms overlap on the resulting graphs. Iramuteq designers are of course well aware of the problem and have provided a means to overcome it. To help the researcher reduce the vocabulary before performing the analysis, the software proposes a list of selectable forms, sorted according to their frequency. Of course, it is perfectly possible not to focus on the upper part of the list. The researcher can click on the available forms as he or she wishes, keep some and ignore others, but with thousands of forms, such manual selection quickly proves impossible to implement. The researcher cannot make any rigorous selection without using a set of well-defined criteria, which requires acquiring knowledge of the entire list before performing the selection. Even when such preparatory work has been undertaken, selecting the words manually from the whole list proposed by Iramuteq proves far too tedious. It is important to note that the software is in no way responsible for the problem. Indeed, deprived of any way of knowing the meanings of the words, Iramuteq can only propose word frequency as the lesser evil to assist in word selection, despite the claim about the relative irrelevance of this criterion.

Another existing approach can be used to overcome the difficulty. Instead of ordering words according to frequency, why not group them based on their meanings? The idea is to focus on lexical fields and find a way to lead Iramuteq to account for the latter. This approach is better than frequency filters because it is purely focused on meaning. To cite a basic example from my case study, when evaluating a product on a commercial website, people use innumerable qualifiers, either positive ("amazing", "fantastic", "great", "terrific", "wonderful", etc.) or negative ("awful", "deceptive", "dreadful", "horrible", "terrible", etc.). Textometric software can know neither what these words have in common (i.e., being valuation adjectives) nor what makes them different (i.e., being either positive or negative). For the software, these words are just words, similar to all of the others. Of course, given their close meanings, it is highly probable that positive and negative adjectives will be associated with similar words in the corpus and be part of homologous syntaxic structures, thus appearing in the same area of the graph. However, graphically superimposing close notions faces the risk of unnecessarily blurring the reading. Similar adjectives will overlap at best and be scattered at worst, with the risk of becoming invisible, while expressing the same frequent and strong idea.

To counter such effects and help Iramuteq take into account the meanings of words, I propose "thlemmatising" the corpus where these words belong. This neologism combines two notions: themes and lemmas. As generally known, a lemma is the common linguistic root shared by a set of parent forms (e.g., "find" is the lemma for "find", "finds", "found" and "finding"). Iramuteq is able to

connect the forms to their corresponding lemmas, due to an underlying table (a dictionary). Similarly, given his or her topic and research questions, a researcher knows which words denote the same meaning. According to Iramuteq's specialists, "a theme can be defined as a set of plain and co-textual forms tied together by their object and context" (Ratinaud and Marchand, 2015: 57–58). Thus, the idea is that if themes matter, instead of just waiting for the results to identify just a few of very broad ones, why not cheat the software to lead it to learn from scratch how to grasp a much wider diversity of particular meanings? This can be done due to a reconfiguration of the dictionary. The operation consists of replacing lemmas with themes to force the software to consider different forms as resorting to the same lexical field (theme) instead of the same root (lemma). In the same way that lemmatising a corpus involves bridging the varied forms of a given word under their linguistic root, thlemmatising a corpus entails bridging the varied words that are used to express the same idea under a general equivalent. In the above-cited example, a researcher interested in 'sentiment analysis' – accounting for the varied feelings expressed in a given corpus (Liu, 2012) – will declare the theme "good" as the lemma for "amazing", "fantastic", "great", "terrific", "wonderful" and so on (and of course, the theme "bad" as the lemma for "awful", "deceptive", "dreadful", "horrible", "terrible", etc.). The researcher will thus replace the existing lemmas of the dictionary accordingly.

At the heart of the thematisation strategy lies this intriguing paradox: obtaining a sharper view of a given corpus (highlighting concerns that matter) rests on a blurring procedure (merging quasi-synonymous notions into a single equivalent). Another paradox is that the procedure is workable and useful only if applied partially. In fact, lemmatisation and thlemmatisation work hand in hand. On one hand, given his or her research objectives, literature reviews, previous investigations, exploratory studies (see, e.g., my account of the history of menstrual products – Cochoy, 2021) and inductive reading of the entire lexicon or the corpus, the researcher identifies and constructs the lexical fields that deserve to function as key themes under which part of the lexicon can be thlemmatised. On the other hand, the researcher leaves all of the other words unchanged, with their lemmas as they exist in the standard dictionary.

There are several reasons for conducting a partial thlemmatisation instead of a full one. Some of these reasons are trivial. Because a corpus counts thousands of words, designing lexical fields is highly time consuming and possibly very tricky (it is often difficult and even impossible to figure out which theme could encompass some rare, isolated or special notions). However, these are not the main reasons. No theme exists in itself – in contrast to lemmas, themes are not generic and universal; their number and definitions depend on the research at stake and are thus necessarily limited. Moreover, partial thlemmatisation helps highlight the chosen themes among the corpus. Because a given theme gathers and replaces several underlying notions, its frequency amounts to the sum of the thlemmatised forms, thus making their hidden importance visible by increasing the overall frequency. In other words and paradoxically, distorting reality appears as a good means to show it in the right way. Conversely, thlemmatisation may also be used to quickly exclude some themes from the analysis. Because some forms have been replaced by the corresponding overarching theme in the dictionary, ignoring whole sets of notions just requires "deselecting" the name of their theme on the list of available forms provided by Iramuteq. Last but not least, because thlemmatisation significantly reduces the number of forms in the entire corpus, selecting part of these forms based on the frequency list becomes faster, clearer and easier.

Conducting the whole operation, from the thlemmatisation of the corpus to the theme selection and analysis, is a long trial-and-error process. A good approach consists of three steps. First, the researcher identifies large themes (in my case study, a list of concerns, including "psychological state", "body sensation", "economy", "environment", etc.). Second, the researcher attributes these themes to the vocabulary on a spreadsheet and sorts the results according to the themes. Third, the researcher splits these themes into subfields under the third column on the spreadsheet and recodes the vocabulary accordingly (e.g., "psychological state" is shifted

to anger, annoyance, anxiety, awareness, carelessness, confidence, disgust, distress, distrust, embarrassment, frustration, intimacy, safety, satisfaction, surprise curiosity, trust, uncertainty and wellbeing). Each subtheme encompasses a large number of original forms (e.g., "anxiety" is the subtheme I have chosen for afraid, alarming, anxiety, anxious, anxiously, apprehensive, concern, concerned, danger, dangerous, fear, frightening, hazardous, insecure, insecurity, intimidate, intimidating, nervous, panic, panicky, paranoia, paranoid, risky, scared, scary, stress, stressful, terrify, terrifying, terror, threat, unsafe, warn, warning, worried, worries, worrisome, worry and worrying). I have applied such a procedure to the entire corpus (10,756 forms), hapaxes excepted (4,451 forms). Out of the 6,305 reviewed forms (10756 - 4451), 2,643 have been thlemmatised (41%) according to 60 broad themes and 290 subthemes. Only subthemes have been used for thlemmatising the corpus. The choice to operate at the subtheme level has been considered a good compromise between the search for increased readability and respect for lexical diversity. The underlying idea is to respect the classic lexical analysis procedure while slightly simplifying the vocabulary somewhat according to a basic logic of synonymy.