

# Eye-Tracking Studies on Sustainable Food Consumption: A Systematic Literature Review

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**Abstract:** In recent decades, sustainable products have been increasingly investigated using eye-tracking. Eye-tracking is applied to the record eye movements and visual attention of consumers as they search for food, and from this, conclusions can be drawn about their sustainable food consumption. To obtain a comparative overview of the previous utilization of eye-tracking in studies on sustainable food and consumption, a systematic literature search following the guidelines of the PRISMA statement was applied. In total, 38 eye-tracking studies were identified, with six main areas of investigation emerging: eye-tracking application, labeling, consumer attention, consumer choice and preference, consumer attitude and behavior, and willingness-to-pay. The review is aimed at both researchers and managers. In future research, the sample size of eye-tracking should be increased or focused on certain age groups in order to uncover sustainable consumer habits. In addition, field and not just laboratory studies with eye-tracking need to be conducted. To obtain comparable results, it is necessary that researchers apply the same eye-tracking metrics and terms. Organic labels can influence consumer attention and purchase decisions if bottom-up factors of the labels are better aligned with other product information. Top-down factors, i.e., consumer attitude and choice, must also be taken into account.

**Keywords:** eye-tracking; systematic literature review; sustainability; food industry; sustainable consumption; visual attention



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## 1. Introduction

Sustainable consumption is understood as a normative concept through which people, in the interest of environmental protection and ecological integrity, should try to reduce the footprints they leave behind through the misuse of resources [1]. One possibility to minimize the impacts on the environment is by making consumers aware of sustainable food consumption or influencing their consumption behavior [2]. Since consumers are confronted with a large amount of information at the point of sale that can capture their attention and interest [3,4], the question is whether and how to raise consumer awareness so that they buy sustainable food and ultimately promote sustainable food consumption. To answer this, eye-tracking technology has been used in recent decades to examine consumers' visual attention and thus understand consumer preferences for food [5–7]. Research studies about food using eye-tracking have mainly focused on the role and use of eco-labels and provide recommendations for label improvements [7–10]. A major challenge, however, is to examine sustainable food consumption and the determinants of sustainable food purchasing decisions [11]. Through a systematic literature review, this review shows how eye-tracking has been used to investigate consumers' sustainable food consumption, what factors influence sustainable food consumption, and highlights future research opportunities. In addition, possible applications of eye-tracking are presented in detail. This study therefore provides a comparative overview of previous studies that have investigated sustainable food consumption using eye-tracking, thus expanding the knowledge of the applications and results of previous eye-tracking studies. The following

research questions are asked: what has been studied in the last 18 years using eye-tracking in terms of sustainable food consumption and how has it been investigated?

The attention consumers give to food depends on the stimuli that automatically act on them (bottom-up factors) and is also determined by their interests and goals (top-down factors) [6,12–16]. Bottom-up and top-down processing occur simultaneously and interact with each other [17,18]. Bottom-up factors act automatically on the consumer and include certain characteristics for processing basic stimuli such as size, color, or shape [13,17]. Top-down factors are related to the person themselves [9]. They include the consumer's voluntary search for and attention to specific product information [15] as well as the processing of individual experiences, motivations, and expectations [17]. Both factors can be considered and analyzed with eye-tracking since they influence visual attention [6,18], and their analysis can lead to a better understanding of consumer decision-making processes [17].

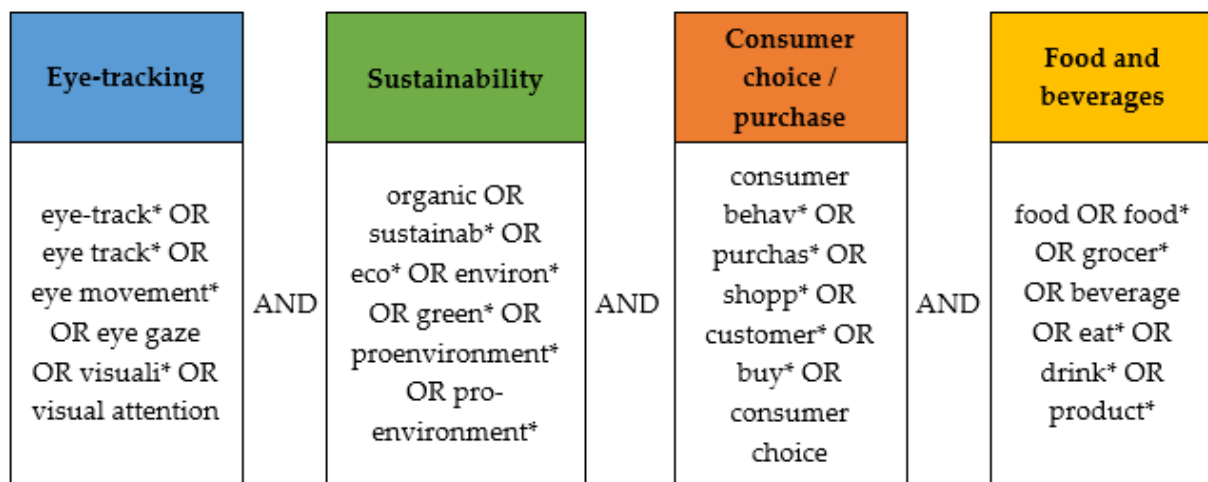
Eye-tracking makes it possible to obtain information about consumer decision-making by studying consumers' search strategies based on their eye movements and visual attention to food during the purchase process [7,19,20]. This involves constructing hypothetical purchase decisions using web-based, screen-based, or head-mounted eye-trackers in different test situations, i.e., test labs [17,21] or shopping environments [5,22]. The eye-trackers are used to measure the eye movements and visual attention of test participants and to record which elements trigger stimuli or which elements the focus is on [17,23]. Accordingly, eye-tracking is applied to determine the visual stimuli of food as well as the areas of interests (AOIs) with fixation times, fixation paths of the eye, and the percentage of fixated areas. In addition, the path of visual exploration up to the selection of a product can be recorded [24].

Organic products are products that are manufactured using environmentally friendly technologies and do not pose a risk to the environment [2,25,26]. Promoting sustainable food is crucial for the conservation of natural resources and sustainable development [2], as is environmentally friendly consumer behavior. Sustainable consumption can be influenced by economics and politics as well as by technologies and the marketing mix of companies [2]. In the food industry, consumers are confronted with a lot of information (often about food labeling) [7]. When consumers engage with this information, and in particular environmental aspects, and this is then reflected in their purchase decisions, it is referred to as sustainable food consumption [2,27,28]. To help consumers to choose sustainable food, the food industry provides information on production methods (e.g., organic farming, country-of-origin, genetic modification) and on ecological and ethical aspects of food production (e.g., carbon footprint, fair-trade, animal welfare) [7]. The influence of this information on consumers and their consumption has been investigated using eye-tracking [18]. In order to obtain a comparative overview of the previous applications and their results on sustainable food consumption using eye-tracking, as well as to provide recommendations for future research, this study was conducted.

The results of this review suggest that both researchers and managers can gain a comprehensive picture of sustainable food consumption through the application of eye-tracking. Researchers can base their future research on the conclusions mentioned below. They receive an overview of how eye-tracking is used in the context of sustainable food consumption, which eye-tracking measures are applied, and which sustainability labels are investigated with eye-tracking. In addition, previous research gaps are identified, e.g., conducting field research that concentrates on specific foods or consumer groups, which needs to be taken into account in future. By using previous studies to summarize what consumers paid attention to when buying sustainable food, i.e., how sustainable labels affect them, whether and how sustainable food is preferred and selected, what should be taken into account in terms of consumer attitudes, behavior, and willingness-to-pay, managers can draw conclusions to improve the marketing of sustainable foods. This can ultimately lead to an optimization of sales of sustainable food. The material and methods of the study are described in Section 2, followed by the results and discussion in Section 3. The study is concluded with recommendations for future research streams in Section 4.

## 2. Materials and Methods

The systematic literature review was conducted in accordance with the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [29,30]. The checklist for the PRISMA guidelines can be found in the Supplementary Material. Two databases (Business Source Premier (BSP) and Web of Science (WoS)) were used to search for relevant literature. The final search was conducted on 23 October 2023 with the following search terms: (1) “eye-track\*” OR “eye track\*” OR “eye movement\*” OR “eye gaze” OR “visuali\*” OR “visual attention” AND (2) “organic” OR “sustainab\*” OR “eco\*” OR “environ\*” OR “green\*” OR “proenvironment\*” OR “pro-environment\*” AND (3) “consumer behav\*” OR “purchas\*” OR “shopp\*” OR “customer\*” OR “buy\*” OR “consumer choice” AND (4) “food” OR “food\*” OR “grocer\*” OR “beverage” OR “eat\*” OR “drink\*” OR “product\*”. The wildcard (\*) was used to include spelling variation and reduce the number of phrases while still providing a comprehensive search result. Figure 1 outlines the search strategy.



**Figure 1.** Search strategy.

The first search for articles resulted in a total number of records of  $n = 909$  ( $n = 229$  BSP and  $n = 680$  WoS). An article was included if it was (1) written in English, (2) published in a peer-reviewed journal, (3) a primary source (i.e., neither a conceptual paper nor a review), (4) published in the period 2005–2023, and (5) examining sustainable food consumption using eye-tracking. After removal of duplicates ( $n = 125$ ), non-peer-reviewed journals ( $n = 19$ ), and review papers ( $n = 33$ ), the titles and abstracts of 732 articles were scanned (screening). In total, 681 articles were excluded and 51 full-text articles were assessed for eligibility. Thereafter, 13 full-text articles were excluded because they did not meet the indicated inclusion criteria. In total, 38 articles were included in the final analysis (see Figure 2, which shows the different stages of study selection for the systematic review following the PRISMA statement [29,30]).

### *Methodological Assessment*

The 38 articles included in the final analysis were reviewed for following general information: authors, year of publication, journal, sampling country, food, sample size after eye-tracking and participant information, sustainable stimuli, apparatus, methodology, and measures. Table 1 shows the summary of all studies included in the systematic literature review. Because the focus of the review was on eye-tracking, all articles used at least eye-tracking as method of data collection. Only three studies used the eye-tracking methodology alone. In all other studies (92.1%), at least one other method was used. In addition to eye-tracking, questionnaires (26 studies), choice experiments (19 studies), interviews (3 studies),

implicit association test (2 studies), experimental auction (1 study), observation (1 study), and face reader (1 study) were used as additional data collection methods.

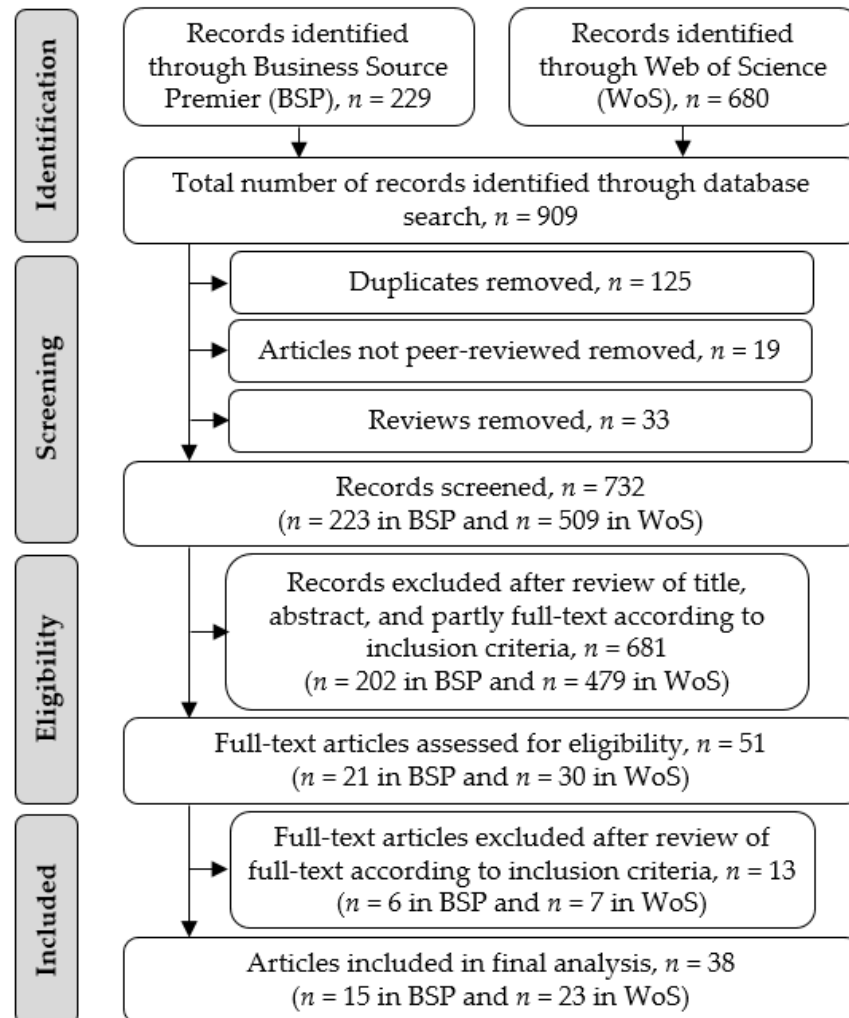


Figure 2. Flow chart of the systematic literature review according to PRISMA (adapted from [29,30]).

The studies were conducted in 15 countries (see Figure 3). Of these, most studies were conducted in the USA (31.6%), followed by Germany (13.1%) and Italy (10.5%).

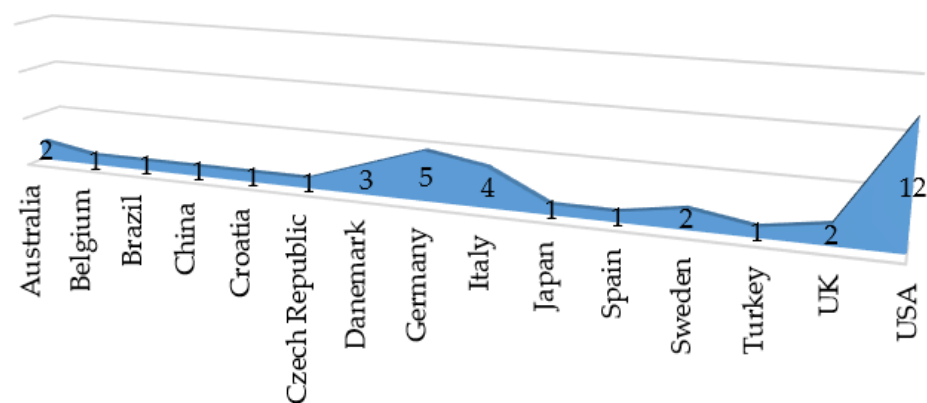


Figure 3. Overview of the countries in which the eye-tracking studies were carried out.

**Table 1.** Summary of all studies included in the systematic literature review.

Author (Year)	Sampling Country	Food	Sample Size after Eye-Tracking and Participant Information	Sustainable Stimuli	Apparatus	Methodology	Measure	Key Findings on Sustainable Food Consumption
Babakhani, N. et al. (2020) [31]	Australia	Menu: 6 burgers, 4 drinks, and 4 desserts	54 (17 control, 19 carbon label, and 18 local farmer group) 17–67 years, 32 years on average and 62% female	Local farmer and carbon footprint label	Desktop mounted eye-tracker Tobii TX-300 (300 Hz) [Tobii AB, Danderyd, Sweden]	Eye-tracking, interview, questionnaire	Dwell time, time to first fixation	Carbon and local farmer labels do not influence menu choices and capture little consumer attention.
Balcombe, K. et al. (2017) [32]	UK	Meat on pepperoni pizza	100 Wide range of ages (larger portion of young people than in the population as well as few participants over 55 years), 53 female and 47 male	Organic and country-of-origin label (farming system)	EyeLink II, SR Research (500 Hz) [SR Research Ltd., Ottawa, ON, Canada]	Eye-tracking, questionnaire	Dwell time, fixation count	Consumers who value sustainable characteristics of food (organic, country-of-origin) are more likely to pay attention to these characteristics.
Beattie, G. & McGuire, L. (2015) [33]	UK	Muesli, washing powder, ice lollies, and cake mix	32 University undergraduates	Carbon footprint label	ASL Model 504 remote eye tracker (120 Hz) [Applied Sciences Laboratory, Spokane, WA, USA] and mpeg2 video editing program	Eye-tracking, implicit association test, questionnaire	First fixation, number of intervals to first fixation	Consumers with a positive attitude toward carbon footprint do not spend significantly more time paying attention to the carbon footprint label, but they are more likely to pay attention to it first (than to other labels) than consumers with a more negative attitude. Carbon footprint labeling stands out for some consumers when the size of the label is matched with other labels.

Table 1. Cont.

Author (Year)	Sampling Country	Food	Sample Size after Eye-Tracking and Participant Information	Sustainable Stimuli	Apparatus	Methodology	Measure	Key Findings on Sustainable Food Consumption
Conoly, Y.K. and Lee, Y.M. (2023) [34]	USA	Menu choice	50 19–64 years, 30.76 years on average, 26 (52%) female and 24 (48%) male, 56% ( $n = 28$ ) Undergraduate or graduate students	Region-of-origin (local) label	Tobii X2-60 screen-based eye tracker [Tobii AB, Danderyd, Sweden], 17-inch monitor ( $1280 \times 1024$ pixel), and Tobii Studio Analysis 1.152 software	Eye-tracking, questionnaire	Fixation count, fixation duration	The extrinsic cue word local on menu choices relates to visual attention. Participants who choose the menu item with the word local appear to look at it more frequently before making their final menu selection.
Drexler, D. et al. (2018) [21]	Czech Republic	Cucumbers, peppers, apple juice, milk, mead, yogurt, and flour	147 (88 experimental group and 59 control group) 20–23 years, 64 female and 24 male experimental group, 41 female and 18 male control group Students	Local and organic label	SMI RED 250 (250 Hz) [SensoMotoric Instruments, Teltow, Germany]	Eye-tracking, interviews	Dwell time	Eco-labels (local or organic label) attract consumer attention and play a role in decision-making, but a third of the consumers pay no attention to them.
Dudinskaya, E. et al. (2020) [35]	Italy	Ruminants' meat	23 24 years average age, 8 female and 15 male Young participants (students) and meat consumers	Country-of-origin, organic, Halal, animal feeding, protected geographical indication, and carbon footprint label	Tobii X2-60 screen-based eye-tracker (60 Hz) [Tobii AB, Danderyd, Sweden] with iMotions software	Choice experiment, eye-tracking, questionnaire	Fixation count, fixation duration	Origin and organic labels have a significant positive effect on consumer choice, but a third of the consumers choose their meat without paying attention to its origin.

Table 1. Cont.

Author (Year)	Sampling Country	Food	Sample Size after Eye-Tracking and Participant Information	Sustainable Stimuli	Apparatus	Methodology	Measure	Key Findings on Sustainable Food Consumption
Fernández-Serrano, P. et al. (2022) [13]	Spain	Wine	64 (32 front-labels and 32 back-labels) 18–63 years front-labels and 18–61 years back-labels	Sustainable Irrigation label	Tobii Pro-Nano screen-based eye-tracker [Tobii AB, Danderyd, Sweden] with Tobii Pro Lab-Full Edition 1.152 software (60 Hz)	Choice experiment, eye-tracking, questionnaire	Fixation count, fixation duration, time to first fixation	Consumers prefer logo and picture labels over text labels. Consumer choice is directly related to the attention they pay to sustainable irrigation label. Consumers are willing to pay a premium for products (wine) with sustainable production characteristics.
Gidlöf, K. et al. (2021) [36]	Sweden	Pasta	Study 1:60, study 2:100 Study 1:24.25 years average age, 21 female and 39 male Study 2:25 years average age, 58 female and 42 male	Organic label	Study 1: Tobii Pro [Tobii AB, Danderyd, Sweden] Glasses 2 (50 Hz) Study 2: Tobii Pro Spectrum eye tracker (1200 Hz) [Tobii AB, Danderyd, Sweden]	Eye-tracking, questionnaire	Fixation duration	Visual attention and consumer choices to eco-labelled food options is relative equal among hungry or satiated consumers.
Giray, C. et al. (2022) [17]	Turkey	Banana, apple, strawberry, carrot, and tomato	60 (30 experiment group and 30 control group) 20–45 years, 60 woman all with children aged 0–18	Organic label (organic purchase decisions and consumption)	Tobii T120 (120 Hz) [Tobii AB, Danderyd, Sweden], 17-inch monitor (1280 × 1024 pixel), Adobe Flash software, and Attention Toll 5.2 software	Eye-tracking, questionnaire	Fixation count, fixation duration, time to first fixation, visit count, visit duration	The price of organic products has a significant negative impact on the purchase of organic products, but visual attention (longer gaze at the organic area) increases the likelihood of a purchase. The level of knowledge correlates with organic purchases.

Table 1. Cont.

Author (Year)	Sampling Country	Food	Sample Size after Eye-Tracking and Participant Information	Sustainable Stimuli	Apparatus	Methodology	Measure	Key Findings on Sustainable Food Consumption
Grebitus, C. et al. (2015) [37]	USA	Cheddar cheese	130 Higher share of younger participants, 65 female and 65 male, better educated and higher income on average than the general population, household size on average between 2 and 3	Hormone-free, country-of-origin, region-of-origin, and biodegradable packaging label	Tobii R T60 XL screen-based eye-tracker (60 Hz) [Tobii AB, Danderyd, Sweden] and Tobii Studio 2.2 software	Choice experiment, eye-tracking	Dwell time	Applying organic labels has a significant and positive effect on consumer decisions and choice. The probability of choosing an organic product decreases if consumers are not familiar with it. However, visual attention probably works against this behavior.
Grebitus, C. and van Loo, E.J. (2022) [38]	USA	Medjool dates	117 30 years average age, 56.4% female and 43.6% male, slightly higher than income of the population	Pesticide-free and genetically modified organisms-free (GMO-free) label	Tobii T60 XL screen-based eye-tracker (60 Hz) [Tobii AB, Danderyd, Sweden] and Tobii Studio 2.2 software	Choice experiment, eye-tracking, questionnaire	Visit duration	Consumers are willing to pay a premium for products with sustainable production characteristics. Higher visual attention to a particular production method label brings with it consumer concerns and consumer attachment to the region.
Guyader, H. et al. (2017) [39]	Sweden	Coffee and fabric softener	66 23 year average age Students	Organic and fair-trade label (colored price tags to signal eco-friendly products)	SMI eye-tracking glasses (60 Hz and 1280 × 960 pixel video resolution) [SensoMotoric Instruments, Teltow, Germany] with SMI BeGaze software	Eye-tracking	Dwell time	Participants paying attention to environmentally friendly food pay a premium. Priming can increase consumers' visual attention to sustainable labeling. The color green influences visual attention since it is associated with organic and natural characteristics.



Table 1. Cont.

Author (Year)	Sampling Country	Food	Sample Size after Eye-Tracking and Participant Information	Sustainable Stimuli	Apparatus	Methodology	Measure	Key Findings on Sustainable Food Consumption
Helmert, J.R. et al. (2017) [40]	Germany	Cucumber, banana, piece of butter, juice carton, carrot, apple, milk carton, and pile of cookies	30 40 years average age, 21 female	Visually suboptimal food	EyeLink 1000 eye-tracking system (1000 Hz) [SR Research Ltd., Ottawa, Ontario, CA] and 19-inch CRT monitor (Iiyama Vision Master 451; screen resolution 1024 × 768 pixels)	Eye-tracking, questionnaire	Fixation distribution, fixation duration, time to first fixation	Consumers prefer impeccable food compared to suboptimal food when shopping. When impeccable and suboptimal foods have differently designed price tags, a positive trend towards purchasing suboptimal food emerges.
Ismael, D. and Ploeger, A. (2020) [41]	Germany	Apple, orange juice (bottles), walnut, oregano, red bell pepper, coffee, and pear fruit	46 19–48 years, 65% female and 35% male, 96% moderate to very good level of knowledge on organic food, 75% students, 20% employees, and 5% neither students nor employees	Organic label (organic and conventional sample)	SMI RED-250 screen-based eye-tracker (60 Hz) [SensoMotoric Instruments, Teltow, Germany]	Choice experiment, eye-tracking, questionnaire	Dwell time	There are no significant differences in implicit food-elicited emotions between organic and conventional food items.
Katz, M. et al. (2019) [42]	USA	Apples, blueberries, and sweet corn	255 (88 apples, 81 blueberries, and 86 sweet corn) 37, 44, and 38 years average age (apple, blueberries, and sweet corn), 60%, 57%, and 69% female	Organic and country-of-origin label Sustainably (certified organic, local) grown logo labeled vs. text labeled produce	Tobii X1 Light screen-based eye-tracker (60 Hz) [Tobii AB, Danderyd, Sweden] and Tobii Studio 3.0.2.218 software	Choice experiment, eye-tracking	Fixation count, fixation duration, time to first fixation, visit duration	Local logo labels attract consumer attention quicker and have a longer eye-tracking time than text labels. Consumers prefer local and organic products to non-local and non-organic products. Consumers are also willing to pay a higher price for products with logo labels than for products with text or no labels.

Table 1. Cont.

Author (Year)	Sampling Country	Food	Sample Size after Eye-Tracking and Participant Information	Sustainable Stimuli	Apparatus	Methodology	Measure	Key Findings on Sustainable Food Consumption
Lamberz, J. et al. (2020) [22]	Germany	Juice	32	Organic label Sustainable and regional food (regionality)	Tobii Pro Glasses 2 (50 or 100 Hz) [Tobii AB, Danderyd, Sweden]	Eye-tracking, questionnaire	Fixation duration	Consumer with a positive attitude towards sustainable food fixate on sustainable packaging and sustainable display elements longer, deal more intensively with product information, and are more likely to remember sustainable product features and individual display elements. Sustainable information is more likely to be perceived by consumers if it is displayed at eye-level. A positive attitude towards sustainability tends to increase the willingness-to-pay for sustainable food.
Leon, F.A. et al. (2020) [24]	Brazil	Transgenic and organic products	30 18–30 years Study or work at the university campus	Organic label Organic and non-organic products	Tobii T120 screen-based eye-tracker (120 Hz) [Tobii AB, Danderyd, Sweden] and 17-inch monitor	Choice experiment, eye-tracking	Fixation duration, time to first fixation, return visits	Visual attention is influenced by self-esteem and image congruence in food decision-making. Women are more likely to buy food with sustainable logos than men because they are associated with high self-esteem behavior.
Maccioni, L. et al. (2019) [43]	Italy	Different products (not all foods)	43 20–45 years, 20 female and 23 male, various backgrounds Approx. half currently studying or have studied engineering while the other ones were mainly involved in humanistic studies	Green products (communicating sustainable features)	Tobii X2-60 Hz screen-based eye-tracker (60 Hz) [Tobii AB, Danderyd, Sweden], 23-inch LCD color monitor, TEA Captiv T-Sens GSR, and Tobii Pro Studio software	Eye-tracking, questionnaire	Fixation count, fixation duration, saccades count, saccades duration	Consumers' interest in sustainability issues is not reflected in their consumption decisions. Sustainable foods cause no increased emotional involvement among consumers than conventional foods. Price is a relevant issue and consumers may be discouraged from purchasing green products.

Table 1. Cont.

Author (Year)	Sampling Country	Food	Sample Size after Eye-Tracking and Participant Information	Sustainable Stimuli	Apparatus	Methodology	Measure	Key Findings on Sustainable Food Consumption
Meyerding, S.G.H. and Merz, N. (2018) [44]	Germany	Braeburn apples	73 34.86 years average age, 35 female and 38 male	Organic label	Tobii Pro Glasses 2 (50 Hz) [Tobii AB, Danderyd, Sweden], 27-inch flat screen monitor with a common resolution of 1280 × 1024 pixel, and Tobii Pro Lab 1.58 software	Choice experiment, eye-tracking, questionnaire	Fixation count, fixation duration, visit count, visit duration	Low-involvement products attract less visual attention than high-involvement products. Different organic labels play a less important role in decision-making processes than expected since visual attention influences purchase decision-making processes. Higher prices tend to reduce the purchase probability.
Meyerding, S.G.H. (2018) [45]	Germany	Tomatoes	17 27 years average age, 10 female and 7 male	Organic, country-of origin, fair-trade, and carbon footprint label	Tobii Pro Glasses 2 (50 or 100 Hz) [Tobii AB, Danderyd, Sweden], 42-inch screen, and Tobii Pro Lab 1.55.5126 (×64) software	Choice experiment, eye-tracking, questionnaire	Fixation count, fixation duration, visit count, visit duration	Unless it is a top-down situation, there is no significant relationship between visual attention and selection. Picture labels receive more visual attention than text labels. Higher and lower prices receive more visual attention than medium prices.
Orquin, J.L. et al. (2020) [14]	Denmark	Consumer products (packaged dairy product categories)	Study 1: 91 Study 2: no eye-tracking 21–59 years	Organic and Keyhole label	Tobii 2150 screen-based eye-tracker (50 Hz) [Tobii AB, Danderyd, Sweden], EyeLink 1000 (1000 Hz) [SR Research Ltd., Ottawa, Ontario, CA], and Tobii Studio Software	Choice experiment, eye-tracking	Fixation likelihood	Saliency, size, and distance (bottom-up factors) increase the likelihood that consumers fixate on food. The preference for brand-related elements leads to the neglect of sustainable elements.

Table 1. Cont.

Author (Year)	Sampling Country	Food	Sample Size after Eye-Tracking and Participant Information	Sustainable Stimuli	Apparatus	Methodology	Measure	Key Findings on Sustainable Food Consumption
Oselinsky, K. et al. (2021) [46]	USA	Different foods from food categories, including cookies, ice creams, crackers, nuts, chips, salty snacks (pretzels, cheese puffs, and rice cakes), yogurts, soups, cereals, meats, pizzas, canned fruit, canned vegetables, and frozen fruit and vegetables	434 (203 phase 1: 70 GMO free, 63 contains GMOs, and 70 control; 231 phase 2: 61 GMO free, 128 contains GMOs, and 42 control) 19 years average age (generation z), 62% female phase 1 and 61% female phase 2, Undergraduate students	GMO-free label	EyeLink 1000 (1000 Hz) [SR Research Ltd., Ottawa, Ontario, CA]	Choice experiment, eye-tracking, questionnaire	Fixation likelihood	Consumers who at least once fixate on sustainable labels spend some portion of time looking at them. Consumers pay attention to sustainable labels, but the labels have no significant impact on food choices.
Ozturk, E. et al. (2023) [47]	Italy	Two different shaped wine bottles	24 20–59 years (30.25 years average age), equal gender distribution Students and non-research staff from university	Organic label	Tobii X2-60 screen-based eye-tracker (60 Hz) [Tobii AB, Danderyd, Sweden], LCD monitor with a resolution of 1920 × 1080 pixel, and iMotions 7.1 software (60 Hz)	Eye-tracking	Dwell time, time to first fixation	Shoulder area and the top of a bottle are the best parts for drawing consumers' visual attention and interest to organic labels. The type of bottle determines the choice of the best place for the organic label.

Table 1. Cont.

Author (Year)	Sampling Country	Food	Sample Size after Eye-Tracking and Participant Information	Sustainable Stimuli	Apparatus	Methodology	Measure	Key Findings on Sustainable Food Consumption
Padilha, L.G. et al. (2021) [48]	Australia	Chicken meat products	30 Older than 18 years, 60% female and 40% male, 8% university degree	RSPC approved farming scheme, free-range, accredited free-range, and antibiotic-free label	Tobii Pro TX300 screen-based eye-tracker (300 Hz) [Tobii AB, Danderyd, Sweden] and Tobii Pro Lab 1.123 software	Choice experiment, eye-tracking, interview, questionnaire	Fixation count, fixation duration, visit count, visit duration	Consumers notice (fixate on) most sustainable labels.
Perkovic, S. and Orquin, J.L. (2018) [49]	Denmark	Choice sets of processed foods	71 18–74 years (45.73 years average age), 19 female and 52 male	Organic and Keyhole label	Tobii T60 XL screen-based eye-tracker (60 Hz) [Tobii AB, Danderyd, Sweden] and screen resolution of 1920 × 1200 pixel	Eye-tracking, questionnaire	Fixation likelihood	Consumers generally prefer products with two organic labels over products with either one label or no label. For non-label users, the choice is almost random for products with organic labels. When organic food and healthy food are positively correlated, consumers pay more attention to organic food when assessing the healthiness of food. In this case consumers are more likely to focus on the organic information and more likely to choose products with an organic label.
Peschel A.O. et al. (2019) [50]	Denmark	Tomatoes, chocolate, and yoghurt	127 75% in the 18–24 year age group, 57% female Students (57% undergraduate students)	Organic label	Tobii T60 XL screen-based eye-tracker (60 Hz) [Tobii AB, Danderyd, Sweden] and Tobii Studio software	Choice experiment, eye-tracking	Fixation likelihood	A larger and visually more eye-catching label significantly increases the fixation likelihood of that organic label. The consumers' fixation on the organic label decides whether they choose the product or not, same as the design of the organic label.

Table 1. Cont.

Author (Year)	Sampling Country	Food	Sample Size after Eye-Tracking and Participant Information	Sustainable Stimuli	Apparatus	Methodology	Measure	Key Findings on Sustainable Food Consumption
Proi, M. et al. (2023) [51]	Italy	Smoked salmon and smoked sea bass	61 18–64 years, 54% female and 46% male, students and workers, most participants were aged between 35 and 44 years, had a doctoral degree and were employed	Aquaculture Stewardship Council (ASC), Friend of the Sea, and GGN certified aquaculture label	Tobii X2-60 screen-based eye-tracker (60 Hz) [Tobii AB, Danderyd, Sweden], 22-inch monitor screen, and iMotions Attention Tool 8.0 software	Choice experiment, eye-tracking	Dwell time, fixation duration, time to first fixation	Size and salience of eco-labels influence visual attention. Larger organic labels, but not higher salience, help consumers cognitively process the organic label. Shape, symbols, and the language in which the organic label is written influence consumer preference.
Rihn, A.L. and Yue, C. (2016) [52]	USA	Apple juice and salad mix	93 51 years average age without young (<12 years old) children at home, 73% female	Organic, country-of-origin, and nutrient content claim label	Tobii X1 Light Eye Tracker (60 Hz) [Tobii AB, Danderyd, Sweden]	Experimental auction, eye-tracking, questionnaire	Fixation count	Consumers are willing to pay a premium for local produced food.
Samant, S.S. and Seo, H.S. (2016) [53]	USA	Chicken breast meat products	29 44 years average age, 18 female and 11 male	Organic label	RED, SMI eye-tracker (120 Hz) [SensoMotoric Instruments, Teltow, Germany], 22-inch monitor screen, stimulus presentation software (Experiment suite 360 TM), and BeGaze software	Eye-tracking	Fixation count, fixation duration	Consumers who are familiar with sustainable labels pay attention to them for longer than consumers who are not. When the meaning and purpose of organic labels are understood, visual attention and positive purchase intention are pronounced.

Table 1. Cont.

Author (Year)	Sampling Country	Food	Sample Size after Eye-Tracking and Participant Information	Sustainable Stimuli	Apparatus	Methodology	Measure	Key Findings on Sustainable Food Consumption
Sola, H.M. et al. (2022) [54]	Croatia	Mashed tomato and mix of spices	33 18–65 years	Organic and Bio label	Tobii Sticky online platform for webcam-based eye-tracking (15 Hz) [Tobii AB, Danderyd, Sweden], Tobii Sticky software, and G*Power	Eye-tracking, questionnaire	Dwell time, fixation count, time to first fixation	The color of the organic label matters. Organic labeling is essential for organic packaging and must be highlighted on the packaging.
Song, L. et al. (2019) [5]	USA	Product categories: bakery, beverage, canned/jarred/dried goods, cooking/baking goods and spices, dairy, frozen food, health, and seafood, kitchen/cleaning/bathroom supplies, meat and seafood, produce, snacks, and others	156	Organic, non-GMO, certified Humane, Program for the Endorsement of Forest Certification (PEFC), Sustainable Forestry Initiative, 100% recycled paperboard, Forest Stewardship Council, Dolphin Safe, Rainforest Alliance certified, Fair-trade certified, and transitional certified by QAI label	Tobii Pro Glasses 2 (50 or 100 Hz) [Tobii AB, Danderyd, Sweden] and Tobii Pro Lab software	Eye-tracking, observation, questionnaire	First fixation, visit duration	Organic labels are neither the first nor the longest fixated products in consumers' product evaluation process. Organic labels receive little attention in competition with other product information. Consumers are less price sensitive when purchasing eco-labelled products and expect better product quality. Consumers rely on habitual shopping (54% of consumers do not fixate on any product information for the items they buy).

Table 1. Cont.

Author (Year)	Sampling Country	Food	Sample Size after Eye-Tracking and Participant Information	Sustainable Stimuli	Apparatus	Methodology	Measure	Key Findings on Sustainable Food Consumption
Songa, G. et al. (2019) [55]	Belgium	Dairy products	89 20–25 years (22 years average age), 67% female Students	Recyclable label	SMI-RED250 eye-tracker (250 Hz) [SensoMotoric Instruments, Teltow, Germany], Dell 17.3-inch monitor, and face recoding software (Noldus FaceReader5)	Face reader, eye-tracking, implicit association test, questionnaire	Fixation duration, time to first fixation	The amount of time consumers view logos and the spontaneous emotional response dependents on consumers' implicit attitudes. A positive implicit attitude towards sustainability means that an organic label is recognized more quickly. The longer consumers fixate on an organic label, the stronger the connection between implicit attitudes and spontaneous emotional reaction.
Takahashi, R. et al. (2018) [56]	Japan	Coffee	246 (123 group with information and 123 group without information) 21 years average age, 47% female (41% female group with information and 53% female group without information) Students	Certified coffee	Tobii T60 screen-based eye-tracker (60 Hz) [Tobii AB, Danderyd, Sweden] and 17-inch single-screen	Choice experiment, eye-tracking, questionnaire	Fixation duration	Images of forests on certified forest coffee labels attract consumers' visual attention and further stimulate the actual purchase of certified forest coffee. Information about the certification program displayed on the certified coffee has no purchasing effect. Awareness and level of interest in sustainability issues of certified coffee and purchase experiences have no influence on consumer-purchasing behavior. Consumers' visual attention to the certification program logo, coffee product name, or a promotional statement does not influence choice.



Table 1. Cont.

Author (Year)	Sampling Country	Food	Sample Size after Eye-Tracking and Participant Information	Sustainable Stimuli	Apparatus	Methodology	Measure	Key Findings on Sustainable Food Consumption
van Loo, E.J. et al. (2015) [57]	USA	Roasted ground coffee	81 Each age and income category is represented, 53% female, sample slightly biased towards higher education	Organic, fair-trade, Rainforest Alliance, and carbon footprint label	RED, SMI screen-based eye-tracker (120 Hz) [SensoMotoric Instruments, Teltow, Germany], high-resolution computer screen (22-inch), Experiment Suite 360°, and BeGaze software 3.0	Choice experiment, eye-tracking, questionnaire	Fixation count, fixation duration	Sustainability criterions are more valued by consumers who spend more time attending to and fixating on them. Consumer preference increases when an organic label is on the coffee package. Consumers who place more value on sustainability aspects and/or price will also pay more attention to this information when making food choices. Sustainability aspects therefore attract a high degree of visual attention. Consumers who value sustainability aspects and visually pay more attention to sustainability information are also willing to pay more for sustainable products.
van Loo, E.J. et al. (2018) [58]	USA	Roasted ground coffee	81 Each age and income category is represented, 53% female, sample slightly biased towards higher education	Organic, fair-trade, Rainforest Alliance, and carbon footprint label	RED, SMI screen-based eye-tracker (120 Hz) [SensoMotoric Instruments, Teltow, Germany], 56 cm computer screen (screen resolution 1680 × 1050 pixel), Experiment Suite 360°, and BeGaze software 3.0	Choice experiment, eye-tracking	Fixation count	Consumers who don't visually pay attention to sustainability logos are actually ignoring organic labels. Consumer preference increases when an organic logo is present on coffee packaging.

Table 1. Cont.

Author (Year)	Sampling Country	Food	Sample Size after Eye-Tracking and Participant Information	Sustainable Stimuli	Apparatus	Methodology	Measure	Key Findings on Sustainable Food Consumption
van Loo, E.J. et al. (2019) [59]	USA	Cheddar cheese	103 At least 18 years of age, equal share of female and male, higher share of young and of higher educated participants, compared to general population, cheese consumer	Country-of-origin, region-of-origin, hormone-free, and biodegradable packaging label	Tobii X2-60 (60 Hz) [Tobii AB, Danderyd, Sweden], high-resolution computer screen, and Tobii Studio 2.2 software	Choice experiment, eye-tracking	Visit duration	Consumers pay attention to various attributes when selecting food. However, the country-of-origin label is the most attended label when choosing foods.
van Loo, E.J. et al. (2021) [60]	USA	Granola bar	115	Rainforest Alliance, fair-trade, non-GMO, and not genetically engineered label	Tobii X2-60 (60 Hz) [Tobii AB, Danderyd, Sweden], high-resolution computer screen, and Tobii Studio 3.4.5 software	Choice experiment, eye-tracking, questionnaire	Visit duration	Visual attention to sustainable claims influences product choice. Higher visual attention is associated with a higher likelihood of food choice. The higher the price, the less likely the consumer is to choose the sustainable food. When consumers focus (fixate) on an attribute for longer, this leads to a higher preference for that attribute.
Zhang, M.J. et al. (2023) [61]	China	Recycled water	94 43 female and 51 male	Recyclable label	Tobii Pro Fusion (250 Hz) [Tobii AB, Danderyd, Sweden]	Eye-tracking, questionnaire	Fixation duration	The perceived benefit and quality of recycled water has a positive effect on the population's willingness-to-purchase, while the perceived risk of recycled water influences the willingness-to-purchase negatively. The higher the visual attention to user comments, the more likely it is to stimulate and promote the public's perceived usefulness of recycled water.

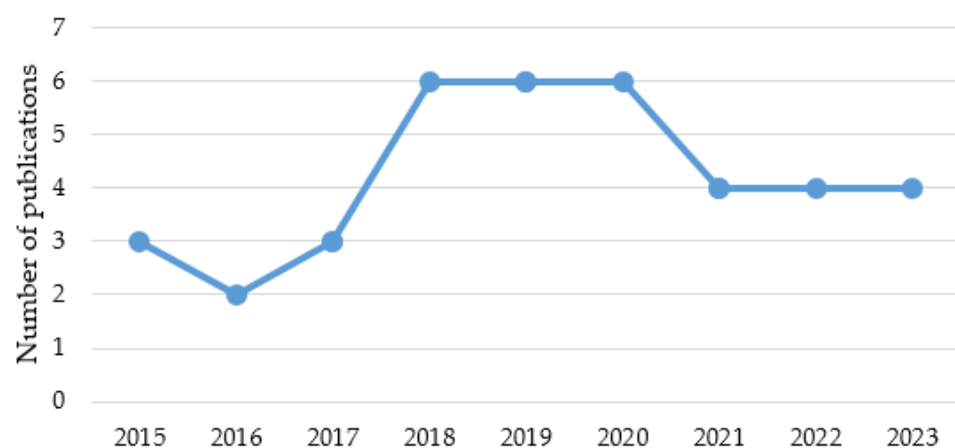
The sample size reported in this review is the number of participants whose data were analyzed after the eye-tracking and is therefore smaller than the original sample size. If more than one study was reported in an article, only the number of participants in those studies in which eye-tracking was applied were reported. The sample size of eye-tracking participants varied from 17 to 434 participants.

The age-range of the eye-tracking participants was reported in 20 studies and was grouped as follows: 18–30 years (three studies), 19–48 years (three studies), 18–59 years (three studies), and 18–65 years (eleven studies). The average age of the participants was reported in 17 studies and was 32 years. Twelve articles focused on young people and nine of these recruited participants (students) from the university environment. The gender distribution was not the same across all studies (female 57% and male 43%). In nineteen studies, the proportion of women was higher, while in seven studies, the proportion of men was higher, and in three studies, there was an even gender distribution. Nine studies did not report on the gender distribution of their participants (see Table 2).

**Table 2.** Categories analyzed in the reviewed studies.

Categories	Frequency	Percentage (%)
Age ranges		
18–30 years	3	7.9
19–48 years	3	7.9
18–59 years	3	7.9
18–65 years	11	28.9
Not specified	18	47.3
University students	9	23.7
Gender		
Female	1.575	57.0
Male	1.193	43.0

Six articles were published in *Food Quality and Preference*, four articles in *Sustainability*, and two articles each in *Ecological Economics*, *Journal of Business Research*, *Journal of Cleaner Production*, and *Journal of Retailing & Consumer Studies*. All the other 20 articles were published in various journals (see Appendix A). The systematic literature search according to the defined criteria in the two databases shows that previous use of eye-tracking studies on sustainable food consumption was found from 2015 onwards with three publications. By 2018, this increased to six releases per year. After three years with a constant publication count of six (2018–2020), the number of publications declined and has since then remained stable at four publications per year (see Figure 4). Although eye-tracking was conducted long before 2015 [6], research interest in eye-tracking related to sustainable food consumption seems to have emerged only in the last decade (since 2015).



**Figure 4.** Number of publications per year.

The most frequently examined single food in the studies reviewed were coffee and meat (both with four studies) (see Figure 5). The term “multiple” includes at least 3 foods and ranges up to 64 foods studied. Food causes different ecological footprints. Coffee, meat, cheese, and combinations of foods (“multiple”) are among the most resource-intensive foods [62]. Reducing their consumption is one of the best ways to reduce food-related greenhouse gases [62].

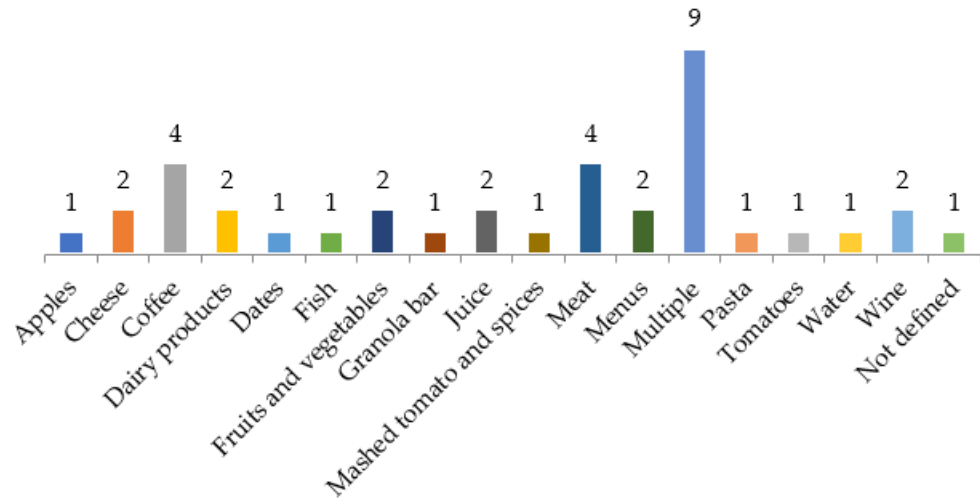


Figure 5. Overview of the foods investigated in the studies (n = 38).

### 3. Results and Discussion

#### 3.1. Application of Eye-Tracking

The majority of eye-tracking was carried out in laboratory settings (89%). Only four eye-tracking studies were conducted in the field, i.e., directly in the supermarket. A total of 32 screen-based eye-trackers, 7 head-mounted eye-trackers, and 1 web-based eye-tracker were used (see Figure 6). Two studies used two eye-trackers; specifically, Gidlöf et al. [36] used one screen-based and one head-mounted eye-tracker and Orquin et al. [14] used two screen-based eye-trackers.

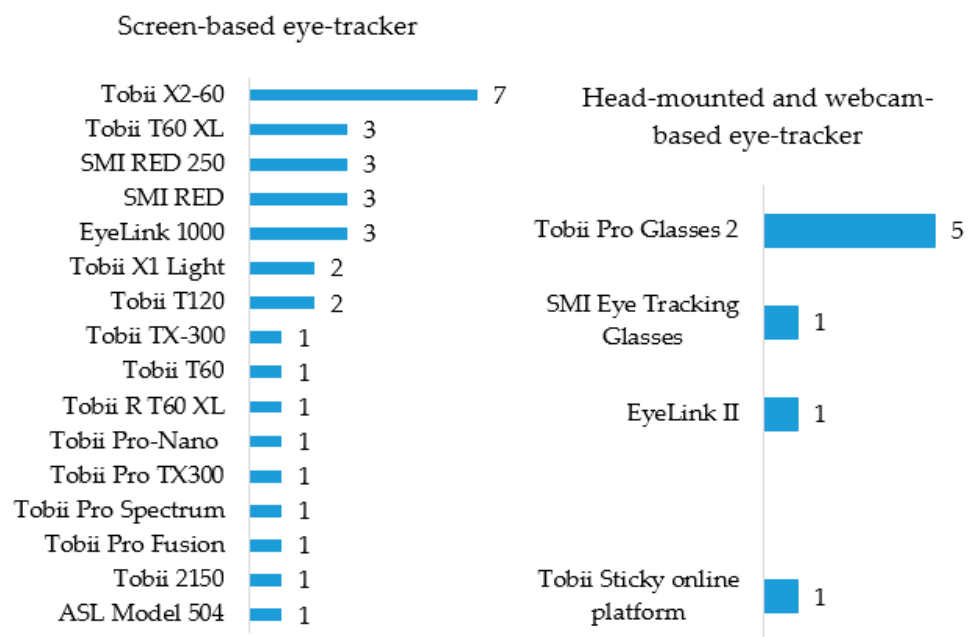
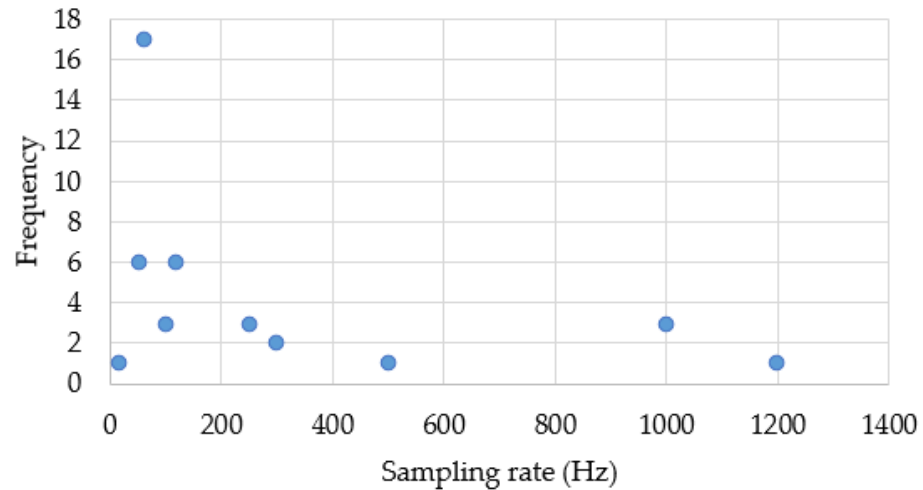


Figure 6. Eye-trackers used in the reviewed studies.

Depend on the eye-tracker, different gaze sampling frequencies (in Hz) were used in the studies (see Figure 7). Head-mounted and web-based eye-trackers usually have a lower sampling rates, while screen-based eye-trackers have a higher sampling rate [63,64].



**Figure 7.** Frequency and sampling rates (Hz) of the eye-trackers in all 38 studies.

Different eye-tracking measures were applied in the studies (see Figure 8). Accordingly, there is no uniform framework for eye-tracking. This finding is consistent with Borgianni et al. [11], who recommended that AOIs in eye-tracking studies require the same approaches and developed a framework for evaluating AOIs for sustainable products and designs. In addition, different terms are used in the reviewed studies for same measures, such as fixation duration and fixation time. To achieve a consistent understanding in eye-tracking research, a uniform definition and application of terms is advisable in the future. In this study, the measures were transferred and are reported in a uniform system (see Appendix B) and can be used as a recommendation for future eye-tracking studies.



**Figure 8.** Frequencies of the measures applied in the eye-tracking studies.

In total, 85 sustainability labels were investigated in the eye-tracking studies. Organic labels were the most frequently examined labels, followed by country-of-origin, carbon footprint, fair-trade, non-GMO/GMO-free, Rainforest Alliance, and region-of-origin labels (see Table 3).

**Table 3.** Sustainability labels examined in the studies using eye-tracking.

Sustainability Labels	%	Sustainability Labels	%
Organic	23.5	Forest Stewardship Council	1.2
Country-of-origin	8.2	Free-range	1.2
Carbon footprint	7.1	Free-range (accredited)	1.2
Fair-trade	7.1	Friend of the Sea	1.2
Non-GMO, GMO-free	4.7	GGN certified aquaculture	1.2
Rainforest Alliance	4.7	Green products	1.2
Region-of-origin	3.5	Halal	1.2
Biodegradable packaging	2.4	Local	1.2
Hormone-free	2.4	Local farmer	1.2
Keyhole	2.4	Not genetically engineered	1.2
Recyclable	2.4	Nutrient content claim	1.2
100% recycled paperboard	1.2	Pesticide-free	1.2
Animal feeding	1.2	PEFC	1.2
Antibiotic-free	1.2	Protected geographical indication	1.2
ASC	1.2	RSPC approved farming scheme	1.2
Bio	1.2	Sustainable Forestry Initiative	1.2
Certified coffee	1.2	Sustainable Irrigation	1.2
Certified Humane	1.2	Transitional certified by QAI	1.2
Dolphin Safe	1.2	Visually suboptimal food	1.2

### 3.2. Labeling

Consumers fixate on most sustainable labels [48]. Moreover, if consumers pay attention to a sustainable label at least once, they will also spend a certain amount of time looking at it [46]. While consumers pay attention to sustainable labels, according to Oselinsky et al. [46], labelling has no significant influence on food choices. Grebitus et al. [37], on the other hand, found that the labelling of food with organic labels has a significant and positive influence on consumer decisions. The majority of participants include sustainable labels in their assessment [49]. If this is the case, logo and picture labels are preferred over text labels and receive greater visual attention [13,45]. Sustainable labels should be designed with as little text as possible in order to achieve a high level of initial attention [22]. A larger and visually more eye-catching sustainable label significantly increases the fixation likelihood of that label and the impact on consumer attention [50]. Information, images, and slogans that are displayed at the consumer's eye-level are more likely to be fixated on by consumers. Consumers require less time and cognitive effort to view sustainable labels when they are large and highly visible [51]. Larger sustainable labels, but not higher saliency, help consumers cognitively process the label [51]. Increased saliency alone does not increase fixation likelihood, i.e., the combination of size and saliency is crucial [50].

Sustainable labels are hardly noticed by consumers in competition with other product information [5]. Food product appearance, price, and nutritional information are often fixated first and longest. Eco-labels are neither the first nor the longest viewed AOIs in the consumers' product evaluation process [5]. Consumers prefer products with two organic labels over products with one label or no label [49]. Accordingly, country-of-origin labels are an important factor in signaling sustainability [48]. Carbon footprint labeling stands out for some consumers, especially when the size of the sustainable label is matched with other labels (e.g., price or nutrition labels) and it is displayed on the front of the product [33]. When it comes to menu selection, carbon footprint and local farmer labels do not influence menu choices and capture little consumer attention [31]. To increase consumer interest in organic labels, visual elements need to be considered [51]. The design of organic labels can have a significant impact on consumer attention [50]. The most important task of an organic food label is to attract visual attention in order to increase product selection [50,51].

The visual ecology of product packaging has a predictable structure that favors brand-related elements [65]. Product logo and brand images are more concise, larger, and centrally positioned than sustainability-related elements. Therefore, organic labeling is essential

for organic packaging (longer dwell time and high number of fixations) and must be highlighted on the food packaging [54]. The type of bottle determines the choice of the best place for the organic label [47]. Since salience, size, and distance (bottom-up factors) increase the likelihood that consumers will fixate on a product [66], preference for brand-related elements leads to neglect of sustainable elements [14]. Changes in visual ecology and design could therefore lead to greater consumer awareness towards sustainability information.

### 3.3. Consumer Attention

Consumers pay attention to various attributes when choosing food [34,59]. They tend to quickly check all food alternatives, focus on a few food alternatives, and then compare key characteristics (e.g., price, animal feeding, and labels) [35]. Sustainable labels (country-of-origin or organic labels) attract consumers visual attention [21,34,57], but one-third of the consumers are not interested or do not pay attention to them [21,34]. Higher and lower prices receive more visual attention than medium prices [45]. Visual attention is related to extrinsic cue words such as local and menu choice [34]. Consumers who notice information displays at the point of sale spend more time looking at environmentally friendly products (e.g., certified coffee) than those who do not notice the information [22,39]. Sustainable criteria are more valued by consumers who spend more time attending to and fixating them [34,57]. Consumers who do not visually pay attention to sustainable logos are ignoring them [58]. Priming can significantly increase consumers' visual attention to an environmentally friendly food product [39].

Consumers who favor text labels direct their gaze stronger and longer at the text labels than those consumers who favor logo labels [13]. Country-of-origin logo labels tend to attract consumer attention quicker and have a longer eye-tracking time than text labels [42]. Regardless of a packaging design, consumers spent most time looking at the organic label section [54]. Since the color green is associated with organic and natural characteristics, green positively influences consumers' visual attention [39]. Thus, the color of the sustainable label matters [54].

When consumers' visual attention is focused on organic labels, this has a significant impact on the purchase of organic foods [17]. The longer consumers gaze on foods with organic labels (hormone-free and country-of-origin labels), the more likely they are to choose that product [37]. Low-involvement products appear to attract less visual attention than high-involvement products [44]. When consumers derive greater benefit from certain properties of a food product, they also pay more attention to them visually [44]. Although visual attention influences the purchase decision process, Meyerding and Merz [44] find that different organic labels play a less important role in food purchase decision processes than expected.

In the study by Grebitus et al. [38], the label pesticide-free attracts the most visual attention, followed by the GMO-free label, and the region-of-origin label attracts the least. Consumers pay more attention to the first two labels when they are concerned about these production methods. Attention to the region-of-origin label depends on how strongly consumers associate this product with a particular region [38]. The country-of-origin label is the label consumers most often look for when selecting food [59]. The level of consumer ethnocentrism influences visual attention directed to country-of-origin labels [59].

Visual attention to sustainable food options is relative equal among hungry or satiated consumers [36], while visual intention is influenced by self-esteem and image congruence in food decision making [24]. An increase in self-esteem can lead to better food choices [24,67]. Consumers pay greater visual attention to the criteria they value higher [57]. Unless it is a top-down situation, there is no significant relationship between visual attention and food choice [45]. However, visual attention to nutritional and sustainable claims impacts food choice [60].

User comments indirectly influence the public's willingness to purchase recycled water because they influence the perceived benefits of recycled water reuse. The higher

the visual attention to user comments, the more likely it is to stimulate and promote the public's perceived usefulness of recycled water [61].

### 3.4. Consumer Choice and Preference

Organic product labelling can play a role in decision making [21,51]. Country-of-origin and organic labels have a significant positive effect on consumer choice [35]. However, a third of consumers choose their meat without paying attention to its origin [35]. In a store-setting environment, hungry or satiated consumers do not make different choices when it comes to eco-labelled foods [36]. Cue words such as local seem not to be the main reason why consumers select menu items [34]. Consumers prefer impeccable foods over suboptimal foods when shopping [40]. However, when impeccable and suboptimal foods have differently designed price tags, there is a positive trend towards purchasing suboptimal foods [40].

Consumer choice is directly related to the attention consumers pay to sustainable irrigation labels [13]. Consumers who are more likely to pay attention to organic information are also more likely to choose products with organic labels [49]. Hormone-free and country-of-origin labels have statistically significant and positive effects on consumer choice [37]. Consumers prefer local and organic products over non-local and non-organic products [42]. Women are more likely to exhibit high self-esteem behavior and men are more likely to exhibit low self-esteem behavior, which means that women are more likely to buy foods with sustainable labels than men [24].

The attention capture effect, i.e., the fixation of an organic label, determines whether the product is chosen or not, as with the design of the organic label [50,51]. Price is the most important criteria that consumers consider when choosing food. Consumers who place more value on sustainability aspects and/or price also pay more attention to this information when making food choices [57]. Consumer preference increases when a food product has an organic label [57,58].

Consumers who include organic labels in their decision process are moderately likely to choose food with one organic label and highly likely to choose food that has two organic labels [49]. Consumers' visual attention to the certification program logo, coffee product name, or a promotional statement does not influence their food choice [56]. Higher visual attention is associated with a higher likelihood of food choice [60]. If the consumer spends more time on a particular attribute during the entire selection sequence, this leads to a higher evaluation of this attribute and, at the same time, to a preference for this attribute [60].

### 3.5. Consumer Attitude and Behavior

Consumers with a positive attitude towards sustainability spend more time searching for organic labels [33] and fixate on sustainable packaging and display elements longer [22]. They are more likely to remember sustainable product features and individual display elements than consumers with a negative attitude towards sustainability [22]. The amount of time consumers view logos and their spontaneous emotional response is dependent on consumers' implicit attitudes [55]. Consumers with positive implicit attitudes towards sustainability recognize the recycling logo quicker and spend more time processing the label, which in turn leads to better emotional response attitudes [55]. The longer consumers fixate an organic label, the stronger the connection between implicit attitudes and spontaneous emotional reaction [55]. Nevertheless, there is no significant relationship between consumer attitude and overall proportion of time spent looking at the label [33]. A positive attitude towards sustainability does not automatically lead to higher overall attention to the carbon footprint label. However, consumers with a positive implicit attitude to a low carbon footprint are more likely to fixate first on the carbon footprint label rather than other labels compared to consumers with a more negative implicit attitude towards carbon footprint [33].



If a consumer pays more attention to a sustainable attribute (e.g., organic, country-of-origin labels) of a food, it is because the consumer values this attribute more than other attributes [32]. However, designing specific and colorful price tags can increase consumer awareness of organic food [40]. This can overcome the barrier to sustainable purchasing behavior [68]. The likelihood of choosing an organic food product decreases if consumers are unfamiliar with it. Visual attention likely counteracts this behavior [37]. Consumers who have sustainable purchase intentions and generally look for environmentally friendly foods tend to take their environmental attitudes into account [39]. Knowledge about sustainability correlates significantly with the purchase of organic food [17].

There are no significant differences in food-elicited emotions between organic and non-organic samples [41]. Consumers tend to exaggerate their positive emotional attitudes towards organic over non-organic food and their negative emotional attitudes towards non-organic over organic food [41]. When consumers are presented with two samples, non-organic versus organic, they have the same emotional attitudes. This can change if consumers know they are testing a non-organic or organic sample [41].

The presence of environmentally friendly aspects in organic foods does not lead to increased emotional involvement of consumers, i.e., organic foods do not arouse more curiosity and excitement among consumers than conventional products [43]. The attitude-behavior gap shows that consumers' interest in sustainability issues does not reflect their consumption decisions [43]. Consumers who know and understand sustainable labels pay more attention to them than consumers who do not [53]. In addition, visual attention and positive purchase intention are stronger among consumers who understand the meaning or purpose of organic labels [53]. Awareness and level of interest in sustainability issues of certified coffee and purchase experiences have no influence on consumer purchasing behavior [56]. Since there is no statistical correlation between the duration of the logo fixation and the purchases, the logo does not appear to be a decisive factor in consumers' purchasing behavior [56]. Consumers do not need to focus on some visual attributes to the same extent as other attributes because they already know them [58].

A majority of participants (54%) do not evaluate the product information of the foods they purchase, suggesting habitual shopping [5]. This is also evident among consumers who prefer foods with organic labels. Organic labels are neither the first nor the longest observed attribute in the consumer product evaluation process [5]. Consumers do not actively look for environmentally friendly information during their decision process [5]. This means that consumers pay little attention to sustainable labels when buying food. To gain attention and influence consumer behavior, the visibility of sustainable labels should be improved.

### 3.6. Willingness-to-Pay (WTP)

Price is an important attribute for consumers and has a significant negative coefficient [35]. This means that the price of organic food has a significant negative impact on the purchase of organic food [17,43,44]. Sustainable labels (local or organic labels) cannot guarantee increases in sales [21], since they are commonly associated with higher prices [48]. The higher the price, the less likely consumers are to buy organic food [60]. However, when consumers look longer at the organic area, the likelihood of purchasing the organic food increases [17]. Compared to a control group, the vast majority of consumers are willing to pay 15% or more for wine labeled "sustainable irrigation" [13]. Other studies also show that consumers are willing to pay a premium after considering (viewing) sustainable production characteristics [13,38,39,52]. In addition, they are also willing to pay a higher price for products with a logo label than for products with text labels or without a label [42]. Images of forests on the labels of certified forest coffee attract the visual attention of consumers and additionally stimulate the actual purchase of certified forest coffee [56]. However, information about the certification program displayed on the certified coffee has no additional purchase effect [56]. Additionally, mood does not influence organic purchases significantly [22].

As consumer attention shifts from product claims and price to nutritional value and ingredients, consumers are less price sensitive and expect better product quality when purchasing eco-labeled food [5]. Consumers are therefore willing to pay a premium for organic food if they attach importance to sustainability aspects and pay more visual attention to sustainability information [57]. A positive attitude towards sustainability tends to increase the willingness-to-pay for organic food [22]. Also, the perceived benefit and quality of recycled water has a positive effect on the population's willingness to purchase the product, while the perceived risk of recycled water influences the willingness-to-purchase negatively [61].

#### 4. Conclusions

Following the search strategy (see Figure 1), studies investigating sustainable food consumption using eye-tracking were found from 2015 onwards, although the systematic literature search started from 2005. Accordingly, the research focus in this study is very current and needs to be pursued further to obtain relevant information on sustainable food consumption with eye-tracking. Eye-tracking plays an important role in food sustainability research [7], as evidenced by the number of publications found and analyzed in this systematic literature review. Since the review is limited to selected search terms and to two databases, the actual potential of the research area is not fully demonstrated.

The following should be taken into account in the future. As mentioned, the sample size varied from 17 to 434 participants. This represents a wide range of variation. In eye-tracking in particular, it appears that the number of participants is reduced because participants do not fulfill the prerequisite for eye-tracking or their eye-tracking data cannot be evaluated [69]. Because it is easier to recruit participants from university environments, nine studies (24% of the studies) did so. This recruitment then only includes certain consumer group (35% of participants in the studies are younger (<30 years)). In order to be able to investigate larger sample sizes in everyday shopping, scientific personnel and appropriate financial resources are required for research organization and implementation. Only four studies use eye-tracking directly in the supermarket. This points to limitations of the reviewed studies, since the focus is on a specific consumer group (younger) and environment (university setting). It can be assumed that the results of young consumers or undergraduate students cannot be generalized. Therefore, in the future, the sample size should be increased or focused on specific age groups or social milieus in order to uncover, with eye-tracking, specific consumption habits with regard to sustainable food consumption. Consumer groups need be recruited from various life situations and social milieus, not only from the university environment. Despite the organizational and financial effort, field studies with eye-tracking must be carried out in real shopping situations and not just in the laboratory [70].

The selection of food examined in the studies is broad. It can be assumed that coffee and meat are the most frequently examined foods in these studies because coffee and meat have high carbon dioxide emissions [71]. Future studies should specify why which foods are being examined or focus on foods that can make a significant contribution to sustainability. It might be helpful to focus on one food in each study to make the results comparable and also to provide a country comparison across different consumer groups. Food selection could be connected with the specific characteristics of consumers. Categories that arise from social milieus, such as age, gender, and income, could be taken into account in order to select foods specifically according to certain consumer behavior. As the socio-demographic characteristics of the eye-tracking participants were not specified in most of the studies, it was not possible to form meaningful categories regarding to this in this review. Future studies should specifically include the socio-demographic characteristics of participants after the eye-tracking is carried out so that it is possible to determine sustainable food consumption across different social milieus. Since different measures are used for eye-tracking, it is necessary to find in future a uniform application of the measurement

variables so that equivalent results can be obtained. The attempt to generalize eye-tracking scenarios by Borgianni et al. [11] can lead in this direction (see also Appendix B).

Saliency, size, and distance (so-called bottom-up factors), as well as the color of the organic label, increase the likelihood that consumers fixate on a food [16,54] and most likely influence the purchase decision [17,37]. Particular food marketers and policy makers could use this finding to adjust label size and saliency relative to other elements to increase consumer attention toward organic food [50]. Consumers who have a positive attitude towards sustainability [55] search for organic labels [33], fixate them long [22], and are more likely to buy organic food [57,58,60]. Nevertheless, organic food does not arouse more curiosity and excitement among consumers than conventional food [43]. To increase sustainable food consumption, consumers should be informed and educated about the importance of sustainable consumption and the meaning of organic labels [5,53,57]. Retailers could influence consumer intent to purchase sustainable food by displaying relevant information, orienting consumers in-store, and offering an environmentally friendly product assortment [39]. Since higher prices reduce the purchase probability of sustainable food [44], policy makers and managers have to think about how sustainable food can be made affordable. Even if the different design of price tags shows a positive trend towards buying sustainable food [40], this cannot be an option to increase sustainable food consumption in the long run.

**Supplementary Materials:** The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/su152316434/s1>, PRISMA Checklist from [72].

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**Conflicts of Interest:** The author declares no conflict of interest.

## Appendix A

**Table A1.** Number of publications by journal.

Journal	#
Agribusiness	1
Agricultural Economics	1
Agronomy	1
Appetite	1
Behavioral Sciences	1
Beverages	1
Business Systems Research	1
European Review of Agricultural Economics	1
Foods	1
Frontiers in Sustainable Food Systems	1
International Journal of Environmental Research and Public Health	1
Journal of Agricultural & Food Industrial Organization	1
Journal of Agricultural and Applied Economics	1
Journal of Choice Modelling	1
Journal of Economic Behaviour & Organization	1
Journal of Food Products Marketing	1
Journal of Neuroscience, Psychology, & Economics	1
Journal of Sustainable Tourism	1
Psychological Science	1
Semiotica	1
Ecological Economics	2
Journal of Business Research	2
Journal of Cleaner Production	2
Journal of Retailing & Consumer Services	2
Sustainability	4

**Table A2.** Number of publications by research areas.

Research Area	Count	%
Food Quality and Preference	6	
Business and Economics	14	25.000
Food Science and Technology	11	19.643
Environmental Sciences and Ecology	8	14.286
Science and Technology—Other Topics	7	12.500
Agriculture	4	7.143
Psychology	3	5.357
Engineering	2	3.571
Social Sciences—Other Topics	2	3.571
Arts and Humanities—Other Topics	1	1.786
Behavioural Sciences	1	1.786
Nutrition and Dietetics	1	1.786
Plant Sciences	1	1.786
Public, Environmental and Occupational Health	1	1.786

**Table A3.** Number of publications by Web of Science Categories.

Research Area	Count	%
Food Science and Technology	11	16.667
Environmental Sciences	9	13.636
Economics	8	12.121
Green and Sustainable Science and Technology	7	10.606
Business	6	9.091
Environmental Studies	6	9.091
Agricultural Economics and Policy	4	6.061
Psychology, Multidisciplinary	3	4.545
Ecology	2	3.030
Engineering, Environmental	2	3.030
Agronomy	1	1.515
Behavioral Sciences	1	1.515
Hospitality, Leisure, Sport and Tourism	1	1.515
Humanities, Multidisciplinary	1	1.515
Nutrition and Dietetics	1	1.515
Plant Sciences	1	1.515
Public, Environmental and Occupational Health	1	1.515
Social Sciences, Interdisciplinary	1	1.515

## Appendix B

**Table A4.** Corresponding eye-tracking measure.

Corresponding Measure	Measure in Reviewed Studies	Authors
Dwell time	<ul style="list-style-type: none"> <li>• Time spent;</li> <li>• How long looked at;</li> <li>• Amount of attention;</li> <li>• Time of attention focused on a particular point;</li> <li>• How long the attribute in question is attended to until the participant makes a choice;</li> <li>• Sum of fixations and saccades on objects of interest;</li> <li>• (Average amount of) time participants spent looking at a specific AOI.</li> </ul>	[21,31,32,37,39,41,47,51,54]

Table A4. Cont.

Corresponding Measure	Measure in Reviewed Studies	Authors
Fixation count	<ul style="list-style-type: none"> <li>• (Total) number of fixations (within each AOI);</li> <li>• Times looked at;</li> <li>• (Total) number of times a participant fixates (their gaze) on an AOI;</li> <li>• Total number of fixations that a participant makes on an AOI;</li> <li>• Number of fixations per attribute;</li> <li>• Number of fixations for each AOI.</li> </ul>	[13,17,32,34,35,42–45,48,52–54,57,58]
Fixation distribution	<ul style="list-style-type: none"> <li>• Attention distribution.</li> </ul>	[40]
Fixation duration	<ul style="list-style-type: none"> <li>• (Total) fixation time;</li> <li>• (Total) fixation duration;</li> <li>• Total duration of fixation;</li> <li>• Total durations participant fixates on an AOI;</li> <li>• Duration of all the fixations on an AOI;</li> <li>• Duration of all gaze points in the AOI;</li> <li>• Duration each participant visits each AOI;</li> <li>• Sum of all fixation durations within a given AOI;</li> <li>• Sum of fixation duration for each AOI;</li> <li>• Length of time a participant fixates within an AOI.</li> </ul>	[13,17,22,24,34–36,40,42–45,48,51,53,55–57,61]
First fixation	<ul style="list-style-type: none"> <li>• First evaluated AOI;</li> <li>• Information paid attention to first;</li> <li>• Where the first fixation occurs.</li> </ul>	[5,33]
Fixation likelihood	<ul style="list-style-type: none"> <li>• Likelihood of fixation;</li> <li>• Whether the label captures attention at all during the decision process;</li> <li>• Fixating on the label at least once.</li> </ul>	[14,46,49,50]
Number of intervals to first fixation	<ul style="list-style-type: none"> <li>• Number of gaze points before a fixation and what the focus of that first fixation is.</li> </ul>	[33]
Return visits	<ul style="list-style-type: none"> <li>• Number of times the individual returns to the product (with a fixation).</li> </ul>	[24]
Saccades count	<ul style="list-style-type: none"> <li>• Number of relevant saccades.</li> </ul>	[43]
Saccades duration	<ul style="list-style-type: none"> <li>• Total duration of the saccades.</li> </ul>	[43]
Time to first fixation	<ul style="list-style-type: none"> <li>• Starts when participant first sees the item and ends when she/he first look at the AOI;</li> <li>• Time from the start to the label display until the participant fixes her/his gaze on the AOI for the first time;</li> <li>• Time until the first fixation within the AOI is detected;</li> <li>• How many seconds it takes to first fixate on a particular AOI from the time the display appears;</li> <li>• Time a participant takes to fixate on a “product” for the first time;</li> <li>• Average amount of time in seconds participant needs to notice specific AOI from the stimulus onset;</li> <li>• Time in seconds from the stimulus onset until the start of the first fixation in the AOI.</li> </ul>	[13,17,24,31,40,42,47,51,54,55]

Table A4. Cont.

Corresponding Measure	Measure in Reviewed Studies	Authors
Visit count	<ul style="list-style-type: none"> <li>• Total number of visits a participant makes to an AOI;</li> <li>• Time span between the start of the first eye movement inside the AOI to the end of the last eye movement in the same AOI;</li> <li>• Number of visits within each AOI;</li> <li>• A visit includes both saccades and fixations during the time the eyes first fixate on an AOI until they move out of it.</li> </ul>	[17,44,45,48]
Visit duration	<ul style="list-style-type: none"> <li>• Total length of time a participant spends in the AOI;</li> <li>• Total number of seconds that a participant looks at a particular AOI over the total time she or he is observing the presented slide;</li> <li>• Total time each participant visits each AOI;</li> <li>• Duration of all visits within an AOI;</li> <li>• Sum of visit durations of an active AOI.</li> </ul>	[5,17,38,42,44,45,48,59,60]

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