I. Evaluation of prototype UI

As a principle component of the iterative design and evaluation methodology, an exercise in usability analysis allows for the discovery of issues which may later be addressed in subsequent user interface design iterations. This practice is common within an industry which increasingly sees the importance of developing engaging and interactive user experiences as primary product differentiators, as it has been demonstrated to consistently produce successful results [9], [7].

The task at hand saw the evaluation and analysis of the eVeg commerce site with respect to a general set of usability principles and guidelines. In this manner, a non-user based evaluation methodology was necessary. In order to conduct the activity, a working set of usability guidelines was first consolidated from a wide variety of sources. These included lectures, online articles and textbooks (such as Human-Computer Interaction: Concepts And Design (ICS) by Rogers et al & Benyon), as well as practical knowledge.

Forming part of a group activity, coordinating an appropriate distribution of labour for the evaluation task was the first measure. While various approaches were considered, the following figure from Jacob Nielson's Finding usability problems through Heuristic Evaluation paper [8] highlighted the particular value that collaboration may bring forth for such a task. In particular, it would reveal that using 5 "Regular Specialist" evaluators, which the group members consider themselves to be, enabled the discovery of 85% of usability problems.

This distribution of work, as opposed to one that involves team members working independently, likely yielded improved results over more independent approaches, as the party was able to combine their ideas in collaborative work sessions, leading to the discovery of issues that would have otherwise gone unnoticed.

The four-stage cognitive walk through model was deemed to be the most appropriate evaluation methodology for the forthcoming task. Despite seeing its primary effectiveness in the analysis of "walk up and use" interfaces, it is

Average proportion of usability problems found as a function of number of evaluators in a group performing the heuristic evaluation.
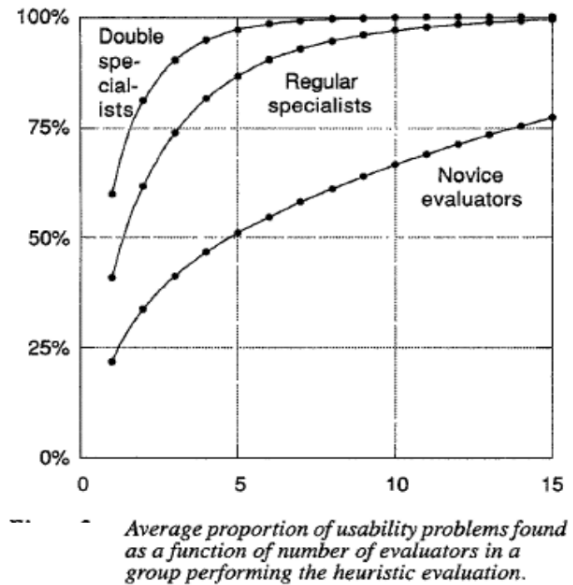
Fig. 1: Illustration of the benefits of affording multiple evaluators to a single usability analysis task.

believed that the framework provided an encompassing means of evaluating the interface across dialogues and pages, due the consideration of specific user goals and intentions. The four goal, search, select and perform stages informed, rather than dictated, the evaluation. Goals were identified in fairly unstructured means, through collaborative brainstorming and a reliance on intuitions which leaned on familiar experience with e-commerce platforms, as it was felt that a formal specification would hinder the discovery process. Where the consideration of a particular goal violated a particular component of the model, the consolidated guideline list was then consulted to identify the most appropriate principle violation.

As such, evaluation mimicked the expected user interaction flow, while also considering uncommon behaviours (e.g. manually entering the URL of a page other than the landing page). Using this approach, rather than evaluating each page as an isolated unit, helped identify the most likely issues users would encounter, as well as highlighting faults with the website that spanned over numerous pages. These "cross-site issues" pertained to both design (e.g. small buttons, poor spacing) and functionality (e.g. erroneous tab behaviour), with a particular emphasis on issues related to the site's poor navigation.

In addition, the system's ability to cope with erroneous and unintentional behaviour, such as unintended or empty field inputs and clicks, was examined. Mimicking non-deterministic user behaviour allowed for the examination of the level of feedback (the basket doesn't dynamically update when items are added), validation (users can enter negative product quantities) and recoverability (instant and unrecoverable basket emptying) that the system was capable of providing. This revealed the extent to which the system would present errors, and how it would allow users to recover from them.

II. REDESIGNING THE UI

A. Design

In order to eliminate the previously identified problems, the team performed a ground-up redesign of the system. The key functionality of eVeg was determined, and several team members thought about how an interface might best deliver this to the user.

The page structure of the prototype UI was revised to create a more natural flow through the site. For example, the redesigned system excluded the unnecessary welcome page (which created separation of information), thus shortening the ordering process.

Wireframes were created for each of the new pages to visualise the structure of the essential elements. By looking purely at the required functionality for each page, the team was able to devise which components were needed. The wireframes were constructed by sequentially including these components, using best practices, guidelines and industry standards to determine their design and positioning.

To influence the wireframe designs, and ensure that we designed a system that users would be familiar with, the team studied and used other e-commerce platforms that offer similar services (e.g. Amazon & Ocado). This helped us to understand the typical user-journey so that we knew what our users might expect to experience on eVeg.

Through this method of creating new designs rather than simply 'upgrading' the existing design, the vast majority of the original issues were

(a) Original Buttons

(b) New Buttons

Fig. 2: Button Comparison

fixed without needing to be directly addressed. By using wireframes, the team were able to look objectively at the page layouts and assess their usability.

An example of this is shown in the comparison of the buttons from in the 'View basket summary' stage in both sites (see Fig. 2). The original buttons (2a) were too small and tightly packed together. All three buttons had greatly contrasting functionality, yet they were also very similarly styled; this increased the risk of user error. This, compounded by the fact that the original eVeg site had little to no confirmation/recoverability capabilities, meant that users could easily be frustrated by a small mistake setting them far back in the ordering process.

In the redesigned UI, the design of the equivalent buttons solves the the aforementioned issues. As well as being substantially larger, they are now more generously spaced, employ a familiar colouring scheme and have far clearer labels. When designing these buttons, we considered Fitts' law and followed guidelines to prevent user slips [2]. The 'Clear Basket' functionality was relocated, to reduce the likelihood that the user would accidentally clear the basket.

By following the guideline stating to use natural language syntax to meet the 'Familiarity' principle, the pricing breakdown was re-created in a much simpler form than on the original site (see Fig. 11). The price is rounded down to two decimal places, pound symbols are used to provide clarity, and unnecessary information (the actual amount of VAT) is removed. The information which is most important ('Total') is emphasised to draw the user's attention to it.

The original UI violated many 'Observability' principles. To meet the principles of synthesiz-

Total ex VAT: 39.0127659574468 includes VAT: 6.827234042553194 Total inc. VAT: 45.839999999999996

(a) Original Pricing

	Cost
Total excluding VAT	£2.00
Total	**£3.27**

(b) New Pricing

Fig. 3: Pricing Breakdown Comparison

Fig. 4: New Breadcrumb Trail

(a) Original Basket

(b) New Basket

Fig. 5: Basket Comparison

Fig. 6: Remove Item Confirmation
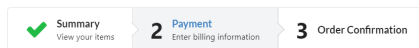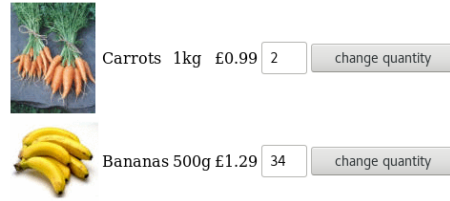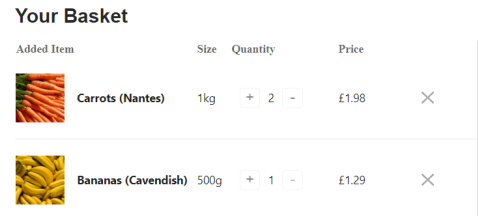
ability, operation visibility, predictability and immediate honesty, a breadcrumb trail was created to guide the user through the ordering process, aiming to answer the following questions from the users perspective: *"Where am I?"* , *"How did I get here?"* and *"Where can I go from here?"* (see Fig. 4).

The original basket (Fig. 5a) did not allow for Direct Manipulation (DM), since changing the quantities did not automatically reflect in the price totals at the bottom of the page. Furthermore, there where no shortcuts provided to completely remove an item, and users had to move their hands to the keyboard to type a new number when changing quantities of items. The new basket (see Fig. 5b) provides buttons to incrementally adjust the quantities with the mouse rather than the keyboard, and to completely remove an item from the basket. In contrast to the old basket, which has a very dense layout and unlabelled text, elements in the new basket are arranged into labelled columns with a suitable amount of spacing between them. To further conform with the synthesizability principle, users are given immediate honesty in the form of acknowledgement popups when they add or remove an item (see Fig. 6). These popups appear at the top of the page to ensure they do not obstruct important content, and they automatically disappear after three seconds so that the user is not forced to manually close them.
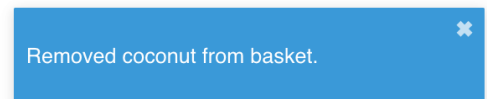
B. Implementation

The implementation of the new UI was performed with the goal of recreating the design outlined in the wireframes.

Implementation of the new UI was performed with constant reference to the wireframes. To streamline the development process and increase the visual appeal of the final product, we chose to use a more performant tool set than what was previously employed. As such, we chose to use the React.js UI library, which provides additional core JS functionality (i.e. streamlines the process of developing JavaScript based features) and introduces a number of third-party components that can be imported to handle various basic (and yet critical) tasks. For instance, we utilised the Router and Switch package from react-router-dom to help us easily implement cross-page navigation, handling default paths and visit history. Similarly we used Toast, from react-toastify, to build confirmation messages and help us handle stage changes. Lastly, we utilised the Select package from react-select to streamline the creation process of dynamic modifiable dropdowns.

During each development iteration, the interface was compared to the initial list of issues to ensure that they were no longer present.

III. EVALUATION OF THE REDESIGNED UI

A. Overview of Testing Methods

In order to assess the redesigned UI and ensure that the previously identified issues had been resolved, the team evaluated the new system using four different approaches, each of which is explained in this section.

1) Four-Stage Cognitive Walkthrough Model: This is a method for evaluating the site without users. Analysts step through the system, looking at how the interface would be used and considering each different user goals. At each stage, problems are identified and ranked based on how many users it is expected to affect. This method allows the team to define the users goals and assumptions, and identify potential errors that users may experience. It is important to note that this method is limited by the creativity of the designers, who are less likely to find fault with their own work than real users.

2) Concurrent Think Aloud: The team decided to use a Cooperative Evaluation procedure known as Concurrent Think Aloud (CTA), in which users complete pre-specified tasks whilst speaking about their thoughts and actions [5]. This method allows the team to gain a deep intuitive understanding of the users behaviour that would not necessarily be evident from plain observation. This method requires less time and fewer resources to deliver meaningful results than other more quantitative approaches.

An issue that is often raised about the CTA method is that speaking concurrently may influence the user's performance, distract them and alter the way in which they go about solving the task. The team considered using a Retrospective Think Aloud (RTA) protocol, in which the users only talk about their experience once they have completed the task, but this is covered through the interview [6]. Provided that the experiment facilitators do not direcly implant bias into the

user's opinions, it is likely that honest and meaningful feedback will be obtained. The flexibility of the approach allows it to be conducted at any stage of the development process (or even more than once), meaning that it can be utilised to review numerous iterations of the project.

3) Interview: A user interview is a session during which the evaluator asks an interviewee (who has previously used the system) various questions relating to their perception and experience of the system [4]. The primary goal of a user interview is to provide insight into what users think about the system's design and functionality. Additionally, user interviews can help assessors determine which features users consider to be essential and memorable, with the ultimate goal of identifying areas in which the system can be improved [4].

Interviews can be *structured*, *semi-structured* or *unstructured*, depending on how much they are guided by a pre-determined script. Unstructured interviews allow the user to explore their ideas and the system as they see fit, however it is difficult to replicate. Structured interviews are easily replicated because the questions are all pre-determined, but they are very restrictive with regards to what the user can talk about, and often don't explore the user's responses in depth.

4) Questionnaire: Questionnaires consist of various questions that respondents answer by filling out a form. They are a valuable method for gaining feedback from large populations easily and efficiently. Questionnaires are inexpensive and quick to distribute, responses are received quickly, and the data is collected in a format that allows for straightforward processing. Response formats may typically be 'yes'/'no' checkboxes, multiple-option checkboxes, rating & likert scales, semantic scales, or open ended responses.

There are some disadvantages relating to this approach, notably that questionnaires are prone to respondent fatigue where respondents lose enthusiasm and willingness to participate and produce erroneous and superficial responses [3]. Furthermore, they are often inflexible and unable to explore issues deeply, and may be open to misinterpretation.

B. eVeg Evaluation Methodology & Approach

To evaluate the redesigned eVeg interface, the team used the testing methods described in section III-A. The CTA (see III-A2), interview (see III-A3) and questionnaire (see III-A4) were used with a group of anonymous users. Each user was asked to use the website to perform pre-determined tasks (outlined in figure 7). A group of users was asked to perform these tasks in a laboratory setting, so they could perform CTA and be observed by the team, while the remaining users performed the tasks in a completely natural setting. After all users had performed the tasks, a selection of users were interviewed, and all users were asked to complete a questionnaire. The CTA and interview methods were not performed on all users due to time constraints.

1. Add 5 apples
2. Add 7 bananas
3. Remove all the apples
4. Add 3 cherries
5. Go to checkout page
6. Go back
7. Add 7 of the most popular item
8. Add 1 of the cheapest item
9. Change the view to vertical and sort on a-z reversed
10. Add another banana
11. Remove 2 cherries
12. Go to checkout page
13. On the checkout page, change the quantity of cherries to 10
14. Go to order
15. Fill out form
16. Order
17. Tell the assessor when the order should be collected

Fig. 7: List of tasks that the interviewees were asked to perform

During the CTA evaluation method, the users were asked to verbalise their thoughts and actions as they completed the tasks. The responses were noted.

Once all the users completed the given tasks, a subset were invited to a user interview. The interview designed by the team was semi-structured so that it provided a rich mixture of open and closed questions. The interview was partially scripted, allowing the team to focus on aspects of the UI for which evaluation was critical, however interviewees were provided with the opportunity to explore their own perceptions and thoughts in depth. Figure 8 outlines a few example questions that have been addressed to the users. During

the interviews with the users who had also completed the CTA, the interviews were also used as an opportunity to ask the users elaborate on what they said during the CTA.

A. Were there any of these steps that you found particularly difficult?
B. Which features do you think you would be most likely to use when shopping?
C. Were features / tools located where you expected them?
D. Did each feature behave as expected?

Fig. 8: List of questions that have been addressed to the group of users

The use of a questionnaire in addition to the previously mentioned methods was decided upon because it allows for the extraction of the user's reaction to the site in such a way that affirms our own. By asking the user unequivocal questions that are focused on attributes of the site that the team has identified as being important, and offering a discrete set of unambiguous responses (often 'yes'/'no', or a Likert scale for the agreement or disagreement of a statement), the responses can be used to verify that common issues are not present, and to glean a high level overview of the users experience.

The majority of the questions used a Likert scale and asked the users whether they agreed or disagreed with a given statement. The statements used throughout the questionnaire had a mixture of positive and negative tones in order to force the user to think carefully about their responses, and to also reduce the influence that the tone of the questions had on the user's opinions. The team decided to withhold a 'neutral' option from the scales in order to coerce users into making a concrete choice. The user was able to choose from either 'Strongly Disagree', 'Disagree', 'Agree' and 'Strongly Agree'. Using a larger scale could have lead to inconsistent results that were difficult to interpret.

Questions were also repeated with different wording and contrasting tones to highlight various response biases. For example, if a user responded 'Strongly Agree' to one statement, and 'Strongly Agree' to a directly conflicting statement, then we can assume that this is a case of extreme response bias [1] and that this particular user's responses are of a lower quality

than a respondent who was more consistent. The full list of questions that the questionnaire is comprised of can be observed in the appendix.

The questionnaire provided the means to supplement our findings with feedback pertaining to our initial list of usability issues. This method allowed us to verify that the initial list of issues that we identified in the original system had in fact been addressed by the redesigned UI.

The team also performed a four-stage cognitive walk through of the site without users. This is the same method that was initially used to evaluate the prototype UI. This was performed so that the team could compile a new list of usability issues, and compare it with the original list to ultimately decide whether the original issues had been resolved or not.

C. Testing Results

The tests mentioned in section III-A were performed with 10 subjects. All of these users completed the given tasks and were then asked to experiment and use the system normally. Following this, all testers completed a questionnaire. Due to time constraints, we only invited 5 test subjects to participate in an interview. Of these 5, 2 completed the tasks in laboratory settings and performed CTA.

During the CTA procedure, it was noted that both users used the back and forward buttons provided by the web browser instead of using the built-in navigation elements (such as the breadcrumb - see fig 4, the buttons - see fig 2b, and the eVeg logo button - which is a cross-site anchor to the homepage). When asked about this in the interview, the users suggested that they did not think to look for the built in navigation when they needed to go back a page, and it was second nature for them to use the browser button. The prototype UI did not facilitate use of the browser back button; the redesigned UI is therefore successful in supporting this functionality. This measure ensures the system is robust and flexible.

The CTA procedure was also useful for observing how users interacted with the order form. Testers reported that they were confused about whether to provide their area code for their phone number or not. This indicates that the form was not intuitive or self-explanatory. Additionally, one of our users used an international phone number, which was of a different length to the expected UK format. This caused the form validation to reject their input, even though they provided a valid phone number. The team noted the dangers of form validation which doesn't account for all possible inputs. The site must either inform the user to enter only UK numbers, or accept all valid numbers. Furthermore, both testers initially attempted to shorten the expiry date of their payment card, for example by typing '21' rather than '2021', which was rejected by the system. The users were also confused by the underscores in numerical input fields, and questioned what they were for. As shown in figure 9, in input fields with fixed input lengths (such as card number and expiry date), underscores are used as a clue to users to indicate that there are remaining characters to be typed in, and the underscores are overwritten by the user.
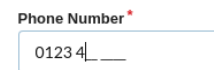

Fig. 9: Phone number input field partially completed

To remove an item from the basket, a user must first click on the cross next to the product they wish to remove. After this click, the cross is replaced with a confirmation message, which the users must again click. This is shown in figure 10. Some subjects observed during the CTA procedure deemed this procedure cumbersome and unexpected. When asked to elaborate on this during the interviews, these users felt that a more natural approach to mitigate accidental basket removals would be to have an undo button on the acknowledgement popups (as shown in fig. 6). Users felt that adding an additional click to the removal process was annoying, and risked them thinking they had removed an item when in fact they had not. On the other hand, two users reported that having to confirm when removing an item from the basket did prevent them from accidentally removing the wrong items, and they
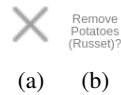
(a)   (b)

Fig. 10: The two buttons users must click on to remove an item from their basket

realised their mistake when asked to confirm their actions.

Additionally, one candidate reported that when clicking out of the focus of the basket, the corresponding pop-up doesn't close, thus contributing to an unfamiliar user experience.

All of our subjects used the provided ordering methods (e.g. by popularity or price) when asked to perform operations reliant on sorting, such as selecting the cheapest or most popular item. It was clear to users that the products were initially sorted by popularity, and that they could adjust the sorting.

All 10 subjects completed the questionnaire after they had completed the given tasks, and had time to experiment with the system. Figure 11 shows a selection of processed results from the questionnaire. The green slices in the pie charts are highlighting the expected results.

It was noted that most users did not deduce and use any shortcuts while navigating the site. It could be the case that if they used the site more frequently, then these alternatives would be discovered. For this reason, it is presumptuous to suggest that the redesigned UI does not provide any shortcut for power users. The site was designed such that the URLs are clear and intuitive, allowing users to skip from the products straight to the payment page by directly manipulating the URL (*eveg/payment*) , without having to:

- Open the basket
- Click 'Proceed to checkout'
- Click 'Proceed to payment' (from the Order Summary page)

Results from figures 11a, 11d and 11e suggest that the site was designed in an intuitive manner which users were familiar with and could navigate easily.

"It was easy to find the product I was looking for"

Agree
10.0%

Strongly Agree
90.0%

(a)

"Text was appropriately sized"

Agree
20.0%

Strongly Agree
80.0%

(b)

"Buttons are too small and should be larger"

Agree
10.0%
Disagree
10.0%

Strongly Disagree
80.0%

(c)

"It was immediately apparent how I should advance to the next stage of the ordering process"

Agree
30.0%

Strongly Agree
70.0%

(d)

Fig. 11: A Selection of Results from the Questionnaire

"I was always aware of my current location in the system"

(e)

"I found the system unnecessarily complex"

(f)

"I deduced and used shortcuts while navigating the site (e.g. directly typing out URLs)"
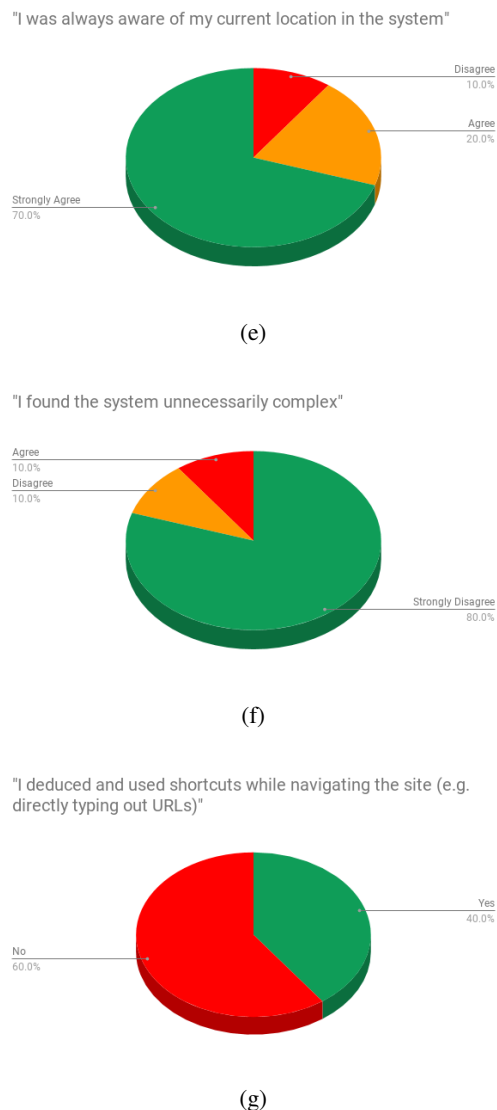

(g)

Fig. 11: A Selection of Results from the Questionnaire (cont.)

The results of the Four-Stage Cognitive Walkthrough (see III-A1) were positive, and the team did not identify any of the problems that existed in the list generated from performing this method on the original site. The results from the questionnaire are also positive, and confirm that the site is enjoyable to use, user friendly and has a familiar and intuitive design.

D. Conclusion

The questionnaire feedback, coupled with the results of the Four-Stage Cognitive Walkthrough, indicated that the errors identified in the prototype UI were solved. The CTA and interviews further affirmed the usability of the system, and bought to light new issues and suggestions to improve the usability.

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Issue	Violation Descriptions	Violated Guideline	Severity	Pages
	Navigation Issues			
Inconsistent & Non-deterministic Navigation	Mitigates use of back button. When a user closes a tab, clicking exit does not return the user back to the shop page they originally came from	Navigation, Farmiliarity, Inconsistency, Predictability	4	All
	Continue Shopping button just closes tab and forgets about any changes made on basket page		2	Basket.html
	Cancel button closes the tab on order.html, and takes you back to the Shop page skipping the basket page which was the previous page		2	Order.html
	Basket opens in new tab, others close current tab	Navigation	3	All
Navigation is not gated	User can proceed to the invoice page wtihout entering card details or any information	Navigation, Error checking, Recoverability, Synthesizability	4	Order.html
	User can proceed to the Order page from just the URL (without going through Basket page)		3	Order.html
	User is not identified to have visited the welcome page in current session already		1	Eveg.html
	Navigating to the invoice page by accident, or for future reference after making an order and closing the store produces confusing output with various undescriptive, uninformative errors ('for undefined undefined undefined', 'Total NaN, NaN', and the presence of closing </body> and </html> tags at the bottom of the page which may confuse users.		3	Invoice.html
No anchor to homepage	No heading / logo / navigation to homepage on any page	Navigation, Farmiliarity	2	All
No navigation crumbs / nav-bar		Synthesizability	3	All
Enter button behaviour	Typing in new quantity and pressing enter does nothing. have to manually click button	Farmiliarity, Providing Shortcuts, Migratability, Flexibility	3	Shop.html
Unnecessary navigation controls	Exit' button unnecessary, clutters UI	Minimal UI	1	Shop.html
Redundant URL Information	Unnecessary addition to the URL when clicking continue (params...)	Navigation	1	Eveg.html
System State Management	Clicking 'Proceed' doesn't clear the basket or the input data on the shopping page	System status, Predictability	2	Order.html
	Layout & Design Issues			
Inconsistent Layout	Homepage centered, others left	Consistency	1	All
Inconsistent Design	Text: Varying fonts, sizes, colours	Consistency	3	All
	Varying product description capitalisation			Shop.html
	Background Colours			All
	Button Capitalisation			
	Unresponsive design			
Button Design & Layout	Inappropriate button sizing, close proximity. Inconsistent capitalisation. Buttons located outside the user's line of sight (breaks Fitt's law).	Visibility, Accessibility	4	All
	Contradictory buttons are similarly styled and in close proximity	Error mitigation	4	All
	Button text "click here to continue", "add to basket" too verbose	Minimal UI	1	Eveg.html.
	Purpose of various buttons is unclear. E.g. Order could be checkout or advance and Proceed could be Pay	Predictability, Farmiliarity	3	Shop.html, Basket.html
	Varvious buttons have ambiguous meanings (e.g. does 'Cancel' take me back to the basket, does it empty the basket?)	Visibility of system status / feedback, Predictability	2	All
Dialogue Design	Separation of information into extra dialogue (entrance page) is unnecessary	Minimal UI	2	Eveg.html
	Lack of sematic separation	Minimise user memory load	4	Order.html
	Copyright overly emphasised suggests that it is as important as the other text	Minimal UI	3	Eveg.html
	Copyright should be at bottom of page	Farmiliarity	2	Basket.html, Order.html
	No confiramtion dialogue preceeding critical actions (e.g. clearing basket or proceeding to payment) - user should be able to review delivery & billing information before confirming	Recoverability	3	Basket.html, Order.html
Use of Colours	Buttons with different purposes should have different colour coding (green for continue, red for cancel etc)	Predictability, Farmiliarity	3	All
	Text colour coding inconsistent with standard (should be red for alerts, green for proceed etc)		4	All
	Colour choices are dull and may invoke boredom	Yerkes-Dodson	4	All
	Insufficient colour contrast according to AA & AAA standards	Accessibility	1	Eveg.html
	Disadvantages a specific group of users (colour blind, poor vision)	Accessibility	2	Eveg.html
	Text may be hard to read due to choice of colour against background (Lack of contrast)	Readability	3	Order.html
Images	Inconsistent image sizes and shapes	Consistency	2	Shop.html, Basket.html
	Inappropriate image sizes. Images too small and may disatvantage users with visual impairments	Visibility. Accessibility	2	Shop.html, Basket.html
	Clicking on a product image does not expand image or show details	Familiarity, Observability	1	
	No "alt" tags (issue screen readers)	Accessibility	2	All
Text Layout	Information too close together and doesn't make good use of screen real estate	Aesthetic and minimalistic design	2	All
	No use of borders to clearly separate information	Aesthetic design, Visibility	2	Shop.html, Basket.html, Order.html
	Price should be in the user's FOV and have flexible location	Observability, Visibility	3	Shop.html, Basket.html

ISSUES IDENTIFIED ON THE ORIGINAL SITE

Issue	Violation Descriptions	Violated Guideline	Severity	Pages
Layout & Design Issues				
Text Layout	Too much granularity on numerical values	Aesthetic and minimalistic design	4	Basket.html, Invoice.html
	Ambiguous text (e.g. unnecessary use of 'paid') ('incoice' rather than 'receipt')	Minimise scope for error through design	2	All
Price Formatting	Final total should be emphasised	Visibility	4	Basket.html, Invoice.html
	Confusing & inconsistent terminology regarding VAT. Use of 'inc.' and 'includes' and 'ex'. Is it price or percentage?	Predictability, Familiarity	3	
	The order of various price categories is unintuitive (e.g. ordering of VAT totals)	Reducing scope for errors	1	Bakset.html, Invoice.html
Product Display	No obvious logic to the ordering of products on this page - they are not in the order that they were added to the basket	Predictability, Familiarity	3	Basket.html
	No product filtering	Familiarity	2	Basket.html, Shop.html
	Lack of column headings	Accuracy	1	Shop.html, Basket.html
Grouping	Input fields should be semantically grouped; lack thereof overloads working memory and is visually overwhelming	Minimise user memory load	1	Order.html
In/Out Interface				
Inconsistent Units	Measurements displayed in grams, kilograms and qunatities.	Consistentcy	4	Shop.html, Basket.html
Product Descriptions	No product details supplied (expiry date)	Familiarity, Perceptible Information	2	Shop.html
	No prices supplied	Recognition rather recall, Familiarity	4	Shop.html
	Missing currency symbol	Predictability	3	Shop.html
Input form issues	Form values are not validated. Users can insert non-numerical characters and negative qunatities	Roboustness	4	Shop.html, Basket.html, Order.html
	Lack of specific input type for corresponding input categories. Drop-downs or arrows for item quantity selection. Drop-downs for country selection.	Roboustness, Substitutability	4	Shop.html, Basket.html, Order.html
	Address input mechanism should be free form input to account for varying address formats	Customizability, Equitable Use	2	Order.html
	Inadequate / missing semantic labels detailng what the information is being used for (e.g. delivery or billing address?)	Simple, Intuitive use	2	Order.html, Invoice.html
System status	Have to refresh page after every change. Users are not given immediate feedback when they make a change (e.g. change quantity, or add new product). Price is not updated when the users make a change	Familiarity, Observability, Predictability	4	Shop.html, Basket.html, Order.html
	Can't see basket status	Observability	2	Shop.html, Order.html
	Invoice can be modified by user	Reducing error & recoverability, System status	4	Invoice.html
Undo Button	Various actions not accompanied by a corresponding undo button. For instance: clearing the basket or adding a new item to the basket	Recoverability	3	Shop.html, Basket.html
Emphasis on important information	Lack of emphasis of important information	Visiblity	2	All
Deafult values	Default quantities for add to basket would reduce need for input	Shortcuts	1	Shop.html
General				
Missing Information	Missing delivery/collection information, such as: address and P+P costs	Predictability, Familiarity, User Support	4	Order.html
	Legal/privacy/T+C/Security info should be in a footer		1	All
	No supporting documentation, help page or contact information		2	All
	Missing cookie, GDPR compliance notification		2	All
	Quantities of each item is not displayed	Promoting recognition over recall	2	Shop.html, Basket.html, Invoice.html
	Date / time information	Visibility of system status, Farmiliarity	1	Invoice.html
Unnecessary Information	Exact unit amount of each product is unnecessary			Invoice.html
Language and Currency	Possibility to extend the UI to support multiple languages and currencies	Customisablity, Familiarity	1	All
	Can be detected based on location	Task migrability	1	All
Account System	An account could speed up some routine tasks, facilitate express checkout	Customisablity, Familiarity	3	All
System Outputs / Saving Data	No built in way to save invoice - have to manually copy-paste	Shortcuts	2	Invoice.html

APPENDIX B
QUESTIONNAIRE FOR EVALUATION OF THE
REDESIGNED UI

Questionnaire

General

1. **I found the system unnecessarily complex**
   Mark only one oval.

	1	2	3	4	
Strongly Disagree	⬭	⬭	⬭	⬭	Strongly Agree

2. **In general, I enjoyed my experience using the site**
   Mark only one oval.

	1	2	3	4	
Strongly Disagree	⬭	⬭	⬭	⬭	Strongly Agree

3. **I would rather go to a shop than use eVeg**
   Mark only one oval.

	1	2	3	4	
Strongly Disagree	⬭	⬭	⬭	⬭	Strongly Agree

4. **How likely are you to visit the site again?**
   Mark only one oval.

	1	2	3	4	
Very Unlikely	⬭	⬭	⬭	⬭	Very Likely

5. **How do you rate the overall experience of this site against other similar sites you have used?**
   Mark only one oval.

	1	2	3	4	
Much Worse	⬭	⬭	⬭	⬭	Much Better

6. **How much did you spend on this site compared to other similar sites you have used?**
   Mark only one oval.

	1	2	3	4	
Spent Much Less	⬭	⬭	⬭	⬭	Spent Much More

Navigation Questions
How much do you agree with these statements?

7. **I was able to navigate to the desired page easily**
Mark only one oval.

	1	2	3	4	
Strongly Disagree	◯	◯	◯	◯	Strongly Agree

8. **I was always aware of my current location in the system**
Mark only one oval.

	1	2	3	4	
Strongly Disagree	◯	◯	◯	◯	Strongly Agree

9. **Navigating the site felt unnatural and unfamiliar**
Mark only one oval.

	1	2	3	4	
Strongly Disagree	◯	◯	◯	◯	Strongly Agree

10. **It was immediately apparent how I should advance to the next stage of the ordering process**
Mark only one oval.

	1	2	3	4	
Strongly Disagree	◯	◯	◯	◯	Strongly Agree

11. **The function of navigation buttons matched their descriptions**
Mark only one oval.

	1	2	3	4	
Strongly Disagree	◯	◯	◯	◯	Strongly Agree

12. **I deduced and used shortcuts while navigating the site (e.g. directly typing out URLs)**
Mark only one oval.

◯ Yes

◯ No

13. **Is persistent information consistent through page changes?**
Mark only one oval.

◯ Yes

◯ No

14. **Please provide any additional feedback related to the above questions**

_____

_____

_____

_____

_____

Layout & Design Questions

How much do you agree with these statements?

15. **The website was aesthetically unpleasant**
    Mark only one oval.

	1	2	3	4	
Strongly Disagree	◯	◯	◯	◯	Strongly Agree

16. **If I was designing the site, I would have chosen a similar colour scheme**
    Mark only one oval.

	1	2	3	4	
Strongly Disagree	◯	◯	◯	◯	Strongly Agree

17. **It was easy to find the product I was looking for**
    Mark only one oval.

	1	2	3	4	
Strongly Disagree	◯	◯	◯	◯	Strongly Agree

18. **The logo is memorable**
    Mark only one oval.

	1	2	3	4	
Strongly Disagree	◯	◯	◯	◯	Strongly Agree

19. **Buttons are too small and should be larger**
    Mark only one oval.

	1	2	3	4	
Strongly Disagree	◯	◯	◯	◯	Strongly Agree

20. **The colours of the buttons didn't match their functionality**
    Mark only one oval.

	1	2	3	4	
Strongly Disagree	◯	◯	◯	◯	Strongly Agree

21. **Text was appropriately sized**
Mark only one oval.

	1	2	3	4	
Strongly Disagree	◯	◯	◯	◯	Strongly Agree