Usability Assignment

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The site I picked to assess and improve upon is:
https://www.online-calculator.com/simple-calculator/

I chose to revamp the calculator, which is the only relevant content on my page. Everything else is just there to show that it's meant to be a mock-up of a revamped version of the previously linked page. Only the calculator is relevant to the redesign.

The calculator redesign is here:
https://cs1.ucc.ie/~jb35/usability/index.html

N.B: I wasn't sure if copy-pasting the original page's code to edit my calculator revamp into would count as plagiarism or not, and I didn't want to leave links to other sections of their site because you said to not leave in unnecessary/useless features. So what I did was I created a mock-up of the original page from the ground up, that looks and feels mostly like the original page but just with the hyperlinks edited to lead nowhere and of course with the revamped calculator. Apologies if this was the wrong way of going about it.

Redesign Description

The feature I chose to redesign and implement a prototype of was the calculator, which I built from the ground up, with none of the original's code reused whatsoever, to improve its general usability and accessibility. The main changes were:

1. In the original, you could only see the number you most recently input. For example, if you entered "3+2+1+5", you would only see 5 on the calculator. This places quite a large user's short-term memory as they may forget what they entered. I fixed this by showing all the figures entered so far in an equation, as well as showing the full equation above the answer when you hit equals.

2. I recreated the calculator using HTML buttons and other elements to represent the screen and buttons on the calculator, rather than the canvas system it was using before. This means that the redesigned calculator is now keyboard navigable; the original was not.

3. As a result of the former, the redesigned calculator is recognised and read out by screen-readers. With all the screen-readers I tested, the original calculator was completely ignored. This massively improves accessibility for the visually impared.

4. I split the C/CE button into A/C and DEL, allowing a user to quickly delete all figures at once should they choose, saving time if they entered many. In addition, tooltips were added to explain the meaning of these buttons in case the user is unaware.

5. As a result of the redesigned calculator showing all the figures in an equation, the user gets visual feedback(and aural if using a screen reader) feedback as to what figures were removed and which still remain. In the original it would just show "0" after you deleted one figure, and the user would be totally unaware as to what remained.

6. My redesigned calculator does not suffer from a bug in the original calculator whereby the division button wasn't highlighted when selected. This was very confusing for the user.

Analysis of the Original Calculator Vs How My Redesign Improved It

- Who the site is aimed at, and how successfully you think it appeals to and meets the needs of the target audience

The site was just aimed at people needing quick access to a simple calculator to perform basic arithmetic. It's not designed or intended for scientific equations, but it's sufficient for most day to day sums a person would need to do. So it's aimed at a very broad audience consisting of every different kind of person, although the site says it's specifically targeted towards younger users.

However, I think it was largely unsuccessfully in meeting the needs of its audience. One common use for an online calculator, for example, would be to add together a long list of figures that would be difficult for a person to do in their head. But this calculator doesn't show you the previous figures you typed, only the most recent one. This makes it very easy to forget what you've already entered, and may cause you to enter the same number twice, etc.

Furthermore, if you delete a figure you entered with the C button, it still doesn't even show you the figure you entered before that(instead it shows "0"). In the best case scenario, this is simply very unhelpful, but it could also lead to people thinking they've wiped the equation entirely, and then getting the wrong answer as they re-enter the equation with some of the old figures accidentally still included.

The lack of a "paper trail", so to speak, in calculations makes this calculator unnecessarily difficult to use. Additionally, the lack of keyboard controls or screen-reader compatibility for the calculator renders it totally inaccessible for certain kinds of users. So I think it fails to meet every user's needs entirely, and it entirely fails to meet some users' needs.

In my redesign, I addressed these issues. My redesigned calculator shows all the operands and operators entered so far, and not just the most recent one, allowing users to easily keep track of which figures they've already input. This also lets them see what they're actually deleting, and are left with, when they use the delete button, helping them there too. This makes the calculator far more user-friendly for every user. The added keyboard and screen-reader compatibility also

lets the visually impaired, and users who are without or unable to use a mouse, access it too. Therefore I think it meets the needs of its target audience far better.

- How much demand it places on short-term memory

As I outlined above, the original calculator only displaying the most recently input figure places quite a large demand on short-term memory, as the user must remember which figures they entered prior to that, which could be quite difficult if they entered a long string of numbers. The C button poses a similar problem, when you delete a figure using it, it doesn't then show the figure you enter before that. Instead you just see "0", and you have to rely purely on memory to know what other figures you're deleting.

In my redesign, I show all the figures entered in the current operation, as well as in the previous operation, allowing the user to keep track much more easily and removing the demand on short-term memory.

- What interaction styles are used? Are they appropriate?

In the original site, the only way one can interact with the site is using their mouse for input and a screen for visual feedback. While these are the most obvious and commonly used interaction styles for a calculator, and therefore they're appropriate in a sense, they're inappropriate in that they render it inaccessible to a large number of people.

Because the site is graphical(rather than using real buttons) and not actually part of the webpage its embedded into, users cannot navigate or access the calculator at all with their keyboard. In my testing screen-readers also seemed unable to interact with the calculator and simply skipped over it. This renders the web page useless to the blind, or even just those without access to a mouse.

In my redesign, I remade the calculator using actual HTML buttons and elements, thereby making the calculator fully keyboard-navigable and also allowing screen-readers to read it. This allows the visually impaired to use the site, makes it usable for users without a mouse, and it also gives users more ways to interact with the site(as some users may prefer to use keyboard over mouse, etc.)

- How easy is it to navigate around the page and find information/features?

The original site is quite easy to navigate. It's very plainly and simply laid out. Nothing is hidden or obscured, and it's all-in-all a very basic and easily understood design.

However, as I outlined above, navigability was impaired by the inability to interact with the calculator itself using the keyboard.

In my redesign, I simply made it possible to use the calculator and all its features using just the keyboard, and thereby improved navigability.

- Is the site easy to learn to use, and once learned, to remember?

The original is very easy to learn and remember how to use. All there is to it is clicking whichever numeral or operand you wish to input into the calculator. Most people are familiar with calculators from childhood, so it's very unlikely that any user would struggle to understand how to use the site.

However, one thing I believe did make the site unnecessarily difficult to use is the inability to see previously entered figures. This added strain on short-term memory would be frustrating for new users and could cause them to make errors as they forget what they've already entered. Further compounding this is the strange functionality of the delete button, which I elaborated on above. These things make it a little bit difficult to learn how to use proficiently.

In the redesign, I made it so that all figures previously entered in the current operation, as well as in the previous operation, are clearly visible. The lowered demand on short-term memory, along with the better visual feedback from the fixed delete button, makes the site easier to use and also makes it more like a real calculator, meaning it takes less getting used to initially as well.

- Are all the interaction widgets clearly labelled? Are they appropriate for their purposes?

I believe so. All the numbers are clearly labelled, and all the operators would be easily recognised by any users. The only button a user may not be sure of is the C/CE button, which deletes the most recently input figure. The buttons are all appropriate for their purpose as calculator buttons.

In my redesign I split the C button into two A/C and DEL buttons, with their meanings explained by tooltips. I also believe the addition of keyboard navigability made the buttons more appropriate for their purpose, but other than that I saw nothing else about them that needed changing.

- How accessible is the site? Could it be used by someone who is (e.g.) blind?

Simply put, no. By the nature of the calculator's implementation, where it's imported drawn onto a canvas, without any real HTML elements representing its buttons or screen, screen readers seem to completely ignore it(at least every one I tested it with did). Additionally, buttons can't be navigated to using the keyboard, meaning one requires a mouse(which of course requires a lot of visual feedback). I don't see how a blind person could possibly use it.

In my redesign, I worked towards making it more accessible by making it compatible with screen readers(which now recognise both the output on the screen and the buttons) and by letting users use the calculator solely through their keyboard(using tab, shift+tab and enter).

- How good is the site in terms of:
    - consistency

There's an inconsistency with the operator buttons on the original. When they're pressed, instead of appearing on the screen, they light up orange. However, this does not happen with the divide button. There are only 4 operator buttons, so this is quite a severe and bothersome inconsistency in my view, and so I would say the site is not very consistent.

In my redesign, no such bug exists.

    - tolerance of errors

As I outlined a few times above, the awkward functionality of the C button makes the original calculator intolerant of human error. If you entered an incorrect figure or simply made a typo a few figures ago, you can't see this on the screen, so you may not notice. And if you remember that you typed it incorrectly, it's difficult to go back and delete the incorrect figure/typo, as once you delete the most recent figure, the calculator will only show you "0" rather than any previous figures. So the design is quite intolerant of human error and makes it very hard to fix them.

In my redesign, the fact that the screen shows the entire operation you've entered so far means such errors are easy to fix, so I would assert my redesign is more tolerant of error.

    - feedback and visibility

In terms of visibility: According to the Wave Report of the original website, the poor contrast of the links down at the bottom could make them difficult to see for some users. Overall this is a minor issue and the site's visibility is quite good. However, while not strictly related to the calculator redesign, I improved the contrast in my redesign and my Wave Report fares much better.

In terms of feedback: As I said above, there is a bug in the original calculator whereby the divide button doesn't get lit up like the other operator buttons when it's clicked. There is no feedback of any kind at all when the user hits the divide button. This is quite a significant and annoying bug in my view, and I'd rate the site's feedback poorly because of it.

In my redesign, there's no such issue, and there's visual(and aural if a screen reader is used) feedback that the button has been pressed.
