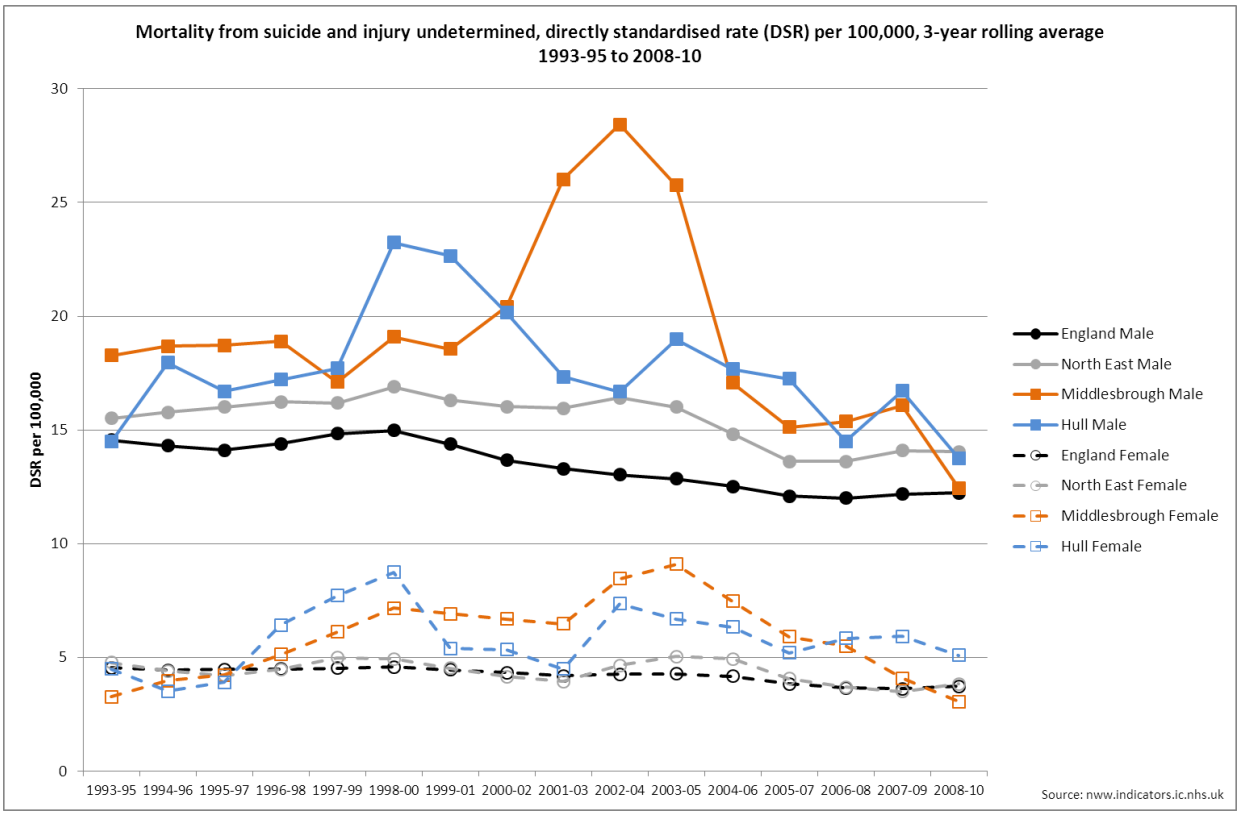
Eos Mental Health Support Project

Version 1 (released 2018-01-01; deprecated 2018-05-01)

Initial Brief



The graph displayed above shows one of our most critical issues faced by modern society - suicidal mortality rates - and the trend in numbers over time, showing clear relative consistency with regards to suicides and undetermined injury rates (which, for this project, we shall normalise to also be suicide - though, naturally, many of these may not be, but the NHS provides limited statistics on **only** suicide rates).

Shown clearly is an obvious imbalance between male and female suicides, with the male suicide rates tending to float around 15 DSR per 100,000; to the contrary, the female rates average at roughly 7.5 DSR per 100,000 (approximately half of those displayed to occur within males).

Further supporting this interpretation, studies conducted by the United States' Centre for Biotechnical Information suggested an average 6:1 ratio for male:female suicides (except for China)[1], in some cases rising to an extreme 9:1 ratio.

In addition to this, in 2015 the Campaign Against Living Miserably (CALM) noted that **75% of all suicides were male**[2].

[1] Suicide in the World. Retrieved 2017-11-21.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3367275/
[2] Suicide – Campaign Against Living Miserably. Retrieved 2017-11-21.
https://www.thecalmzone.net/help/get-help/suicide/

Evidently, whilst depression is a critical issue, we should handle this problem systematically; beginning with male issues (specifically, issues preventing existing mental health support techniques from working) to reduce mortality numbers drastically.

Mental health in males

Statistically, the mental state of males is disadvantaged to that of females: males are more likely to be neurodivergent, having conditions such as ADHD and autism (ASD); and males are more likely to develop conditions such as obsessive-compulsive disorder (OCD) and depression.
Despite this, discussion regarding male mental health is frequently stifled, usually due to societal ideals regarding supposed male superiority, and the male social role, which opposes and shuns men who worry their friends and/or peers. Particularly, this mindset can be seen clearly through the common idiom, "man up", used regarding someone uncontrollably sobbing, for example.
Considering this fact, it is therefore likely that men simply do not feel comfortable with disclosing their feelings with other people, for fear of judgment or other negative reactions, and thus are likely similarly worried to rely on helplines, such as that of the Samaritans or the NHS.

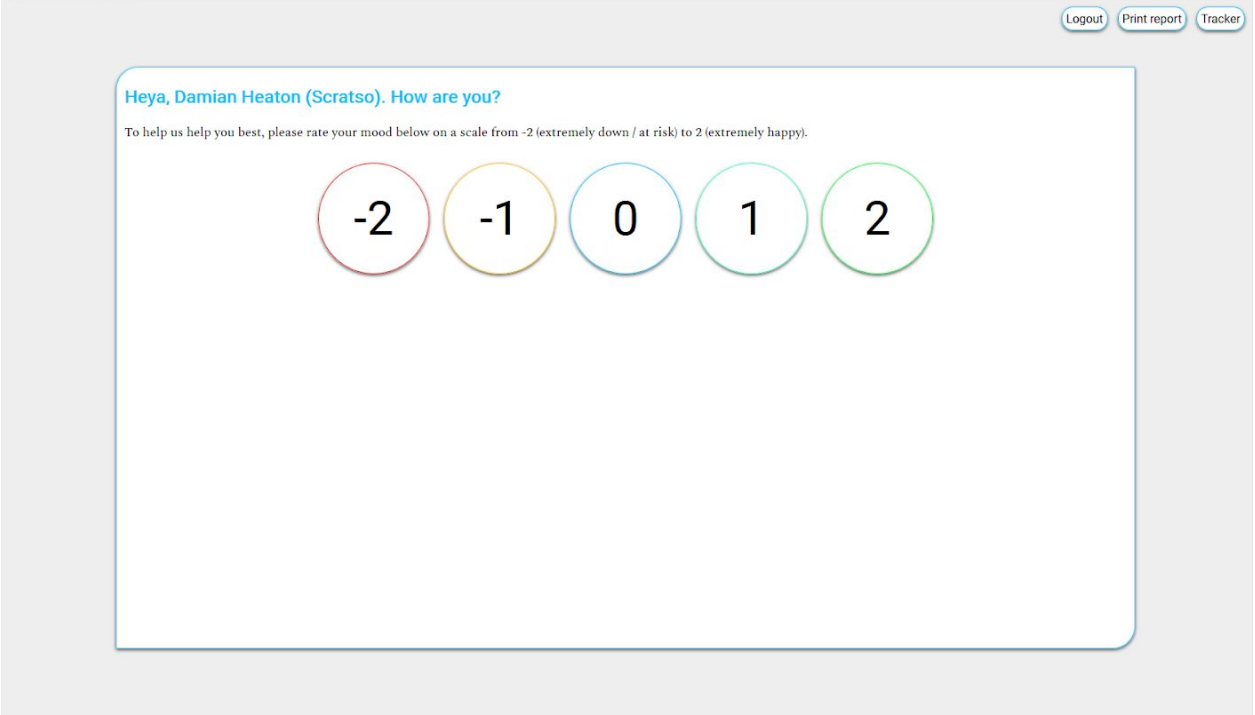
A solution

Anonymity seems like an appropriate solution, as the worries of someone whom the patient does not know are less likely to concern them. However, men are often worried about potential oral recognition, that the person on the helpline **may** be someone that they know and may recognise them. Sadly, there is little avoiding this with traditional helpline means.
Focusing more on depression particularly, even whilst in care it can be difficult for some patients to identify different emotions or to work out if there are any particularly bad days (such as, for example, if a patient consistently felt down on Sundays) or if they suffer from a seasonally affective disorder (SAD) (such as if a patient felt significantly worse during the Winter or Summer months, for example).
This issue can be solved with technology, however, via the use of mood tracking applications. Unfortunately, existing solutions to this particular problem are not quite fit-for-purpose (likely due to little input from potential users during development), frequently using mood rating scales from 1 to 10 or predefined emotions to select from. The issues with such implementations are, respectively, as follows:

1. Scales frequently fail to accurately assess moods due to the qualitative nature of emotional stimulus, and therefore scales from 1 to 10 are simply too precise (and thus likely incorrectly answered by users) for the average user to accurately discern the answer to. Additionally, the positioning of such scales as purely positive numbers can be disconcerting for users who may be in the middle of a depressive episode, and thus unlikely to see their mood as anything even remotely positive. As Till Kottman (deletescape.ch), a sufferer of both Asperger's Syndrome and depression relates, he will "usually select the middle option if the scale is too precise", ergo defeating the purpose of the scale at all. Conversely, a scale from negative two to positive two, from 'at risk' to 'ecstatic', respectively, allows the user to clearly tell which number they should pick at any one time with more reasonable perceptive abilities.
2. Predefined emotions are similarly flawed as too-precise scales are, as the target market can often not identify differences between specific emotions such as lethargy

and anxiety, rather only knowing realistically if they are feeling positively or negatively, with little precision.

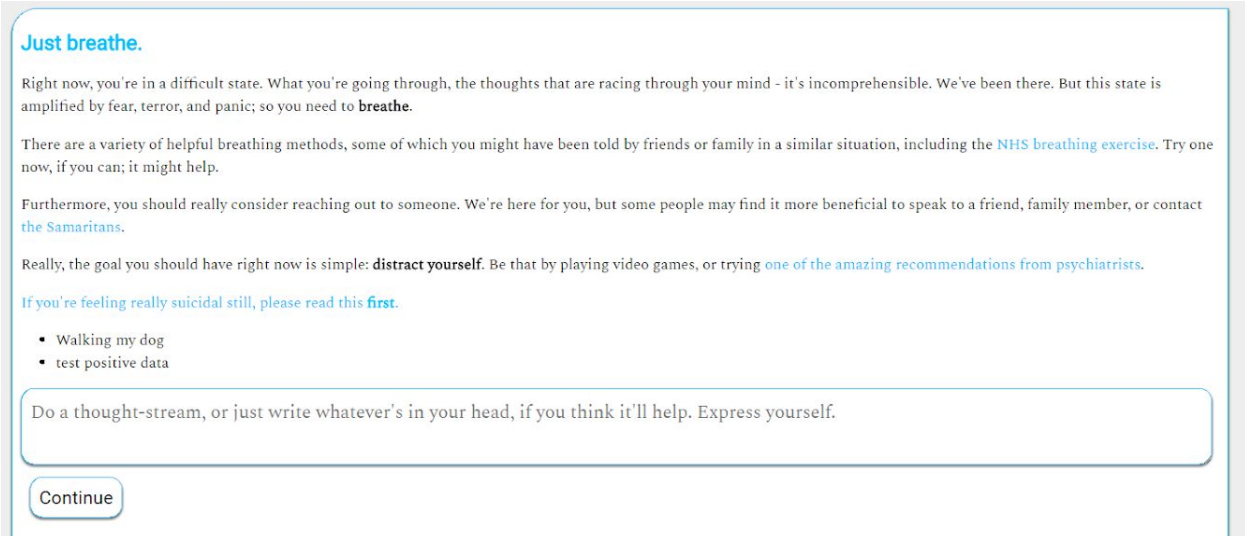
Considering this, I have decided to develop a new mental health application, which will allow for more reliable mood tracking capabilities using a small scale from -2 to 2, shown below:



This approach acknowledges consistent difficulties in the specific target market of this application, particularly those resulting from the correlation between autistic individuals making up the majority of suicides annually; to which a common trait of autism includes a difficulty interpreting, reading, or otherwise quantifying emotion beyond “positive” or “negative”.
However, this solution disregards two key factors with regards to mental health, particularly that of depression; namely:

1. This approach does not work to improve an already-negative mood, rather only tracking this; and
2. Whilst the benefits of this feature cannot be disregarded, common advice from psychiatrists include discussing one’s feelings with another individual.

In order to address the former point, Eos is designed with the concept of data-storage, in which thoughts and feelings for each different mood score are logged securely. Based on this, if someone is happy (1 or 2), we believe that they are more likely to log positive thoughts or comments, such as a nice thing someone has said about them that day to make them feel good. Acknowledging this, all happy comments are reported back to the user should they declare that they are “extremely low” (-2):



Data shown in the above screengrab is mock test data, and not indicative of any live account data.

Technical details

Version one of Eos was created quickly, in order to have something available to those who need it as soon as possible in a robust, secure, and working state. However, in order to consider time, Eos was created initially as solely a progressive web app, ensuring access from any device regardless of operating system, whilst using Google's Firebase as the primary back-end provider in order to make development faster, and easier, in order to meet the January 1st deadline.

The reliance on Firebase paired with a progressive web app (PWA), however, posed two issues:

- Firebase has many external circular dependencies in packages. Consequently, we cannot realistically cache the entirety of the Firebase JavaScript libraries on the user's device, particularly if mobile, but these libraries are crucial to the application's operation. Thus, Eos version one does not work **at all** without internet connection. This is considered a small issue acknowledging that much of the app is online-focused anyway, but could be problematic for users on intermittent connections if they cannot cache data transmissions.
- Using Firebase as a storage service poses privacy concerns for some users, as Firebase is owned by Google, whom aren't trusted by some groups (for example, the Free Software Community).
- Using Firebase makes open-sourcing the application difficult, and somewhat useless, as the backend would need to be duplicated by anyone testing the code themselves, and thus the project could not be open-sourced or made free (libre).

Colour schemes

Eos' position as a mental health application places its colour scheme in a position of great import, as it is crucial to consider the psychological effects and impressions left by specific colours. Therefore, the decision to use a light theme with a light blue primary colour was done due to numerous factors, namely:

- Light colours are more conducive to positive thought processes, by waking the mind up somewhat due to stronger visual stimulus, and thus aiding with recovery through methods such as cognitive behavioural techniques.
- Large amounts of white have been found to create impressions of cleanliness and purity, which may eventually turn inwards as the user improves, aiding their self-impression.

- Blue has been found to create impressions of age, reliability, and trust, which will make users more likely to use Eos honestly, thus helping themselves better. The low use of blue highlights dilutes it, however, helping to prevent the blue light itself from being strong enough to potentially disrupt sleep should the app be used at night (albeit ill-advised regardless without a blue light filter).

Response

Overall, response to the first iteration of Eos has been positive thus far, however much feedback has been private and thus not subject to publication:

- "Good idea. […] well thought out […]" – jakeM on Twitter (https://twitter.com/jakemdotexe/status/947668878888439809)

Notable issues

Since launch, only one issue of any significance has been identified and/or reported, the details of which are duplicated from internal issue tracking for the purposes of transparency:

- [BUG] "'I'm uncomfortable' report button unable to be clicked on / used"
    - This issue was caused by a minor CSS flaw in which the report button was beneath (in terms of z-index) the rest of the UI, leading to the chat system's report functionality to be blocked by the overlays therein.
    - This issue was identified at source approximately 2 days following release. A patch was prepared the following day, and underwent additional testing to ensure robustness of the report and abuse systems.
    - A patch correcting the issue was released three days following launch, when confidence was strong enough to trust working state of the patch.
    - **REMEDIAL**: Estimated effect of this issue: MINIMAL. The initial low number of users greatly decrease the chances of this feature being necessary, and thus less likely to impact users. Additionally, server bandwidth usage suggested approximately **one** use of the chat system prior to the release of the patch.

Future considerations

Following the official launch of the progressive web app on January 1st, 2018, further development should be considered now. Acknowledging the points posed in the technical details section of this review, Eos version two has entered the development phase, and is planned to launch on January 1st, 2019. This iteration of Eos should:

- Simplify the Eos back-end, by consolidating the two servers (Firebase + websocket chat) into one websocket server handling both. This will make maintenance easier in the long term.
- Migrate all Firebase functionality into Eos' own server, and migrate all existing data with it. This completely removes the dependency on Firebase, allowing for better trust, open-sourcing of code, and allowing offline caching of the app.

Although not planned for version two, it is also worth considering native listings on the Google Play, Microsoft, and potentially Apple stores, either in the form of native applications for each platform or web wrappers for the PWA version. This may expand Eos' publicity and reach, allowing for a larger audience and potentially helping more individuals.

Deprecation

Eos version 1 has been officially deprecated as of March 1st 2018, at which time the online chat servers were taken offline permanently. User data was then erased from the servers as of

25th May 2018, in order to comply with the GDPR. No support is provided anymore for Eos, with the base infrastructure pending destruction.

Rationale for the deprecation is as follows:

- This build was prototypical in nature, and did not comply with the GDPR's stipulations. It was decided that the work to comply with the GDPR using the original codebase was infeasible and excessive.
- This build had the server written in Node.JS and ran on Google's Firebase infrastructure. The resources used by Node.JS alone made running the servers on a budget less feasible in the long term, risking maxing out resources should the project expand. Furthermore, the use of Google Firebase does not coincide with the project's goals, as it could lead to distrust of the project: Google's privacy history is relatively sketchy.
- The build suffered limited growth, and therefore maintaining the build given the other points seemed wasteful, as efforts could be directed towards rebuilding the project to rectify these.

Version 2 (to be released 2019-01-01)

Changes to be introduced

In version 2 of Eos, the concerns described in version 1 **must** be addressed. Furthermore, it is imperative to maintain a simplified server architecture – both to reduce costs and to ensure ease of development.

Further to the above, however, the current interface is both non-performant on lower-end devices, and limited from an extensibility perspective, as we are likely to struggle adding new screens to the app as necessary (example being, we don't have a settings page). Pursuant to the performance concerns, I find it likely that these issues are caused by an unoptimized CSS / JavaScript setup: in order to make animations work, all hidden elements remain rendered outside of the browser window. By breaking this mechanism into sections, so that non-related content is not animated, we can make use of `display: none;` to prevent rendering entirely – improving performance.

To summarise, the following changes are planned for Eos version 2:

1. Removal of dependency on Google Firebase;
2. Simplification of both backend service endpoints into one server software for streamlined development;
3. Reconsideration and modification to existing design interface to optimize for performance and enable extensibility.

Back-end Architecture

Changes 1 and 2 are intrinsically linked in forming the back-end architecture of Eos, and thus can be handled at the same time. In order to remove the dependency on Firebase, the existing custom server software used to handle the Eos chat functionality would need to be extended to incorporate the Firebase functionality on its own, allowing us to merge the two backend functionalities into a single server software.

The end server software will achieve the following functionality:

- A simple web server supporting TLS in production environment, serving the frontend web app;
- A websocket server supporting TLS in production environment, addressing:
    - Account management (user creation, login, and data modifications)
    - Mood tracking (logging moods AND providing mood data upon login)
    - Online chat functionality between accounts

This server must be performant and optimised to cope with the increased load provided by the additional functions. Considering this, Node.JS is no longer suitable for this purpose given its high system use at idle, but concurrency is still a necessity. Therefore, the new server is to be a rewritten form of the original built in **Go**. Based on standard use, Node.JS averages at (tested on a Civo Small plan) 20% memory usage and 10+% CPU usage while the server is idle; comparatively, on the same plan the Go rewritten server operates at 0.1-0.5% CPU usage at idle, with similar figures for memory usage.

Design Theory

Eos' homepage has undergone a drastic shift from that of Eos v1, with a more image-heavy style to it with a shorter, more concise description of the app. Links to the project's design specification, Patreon financial support page, and official Discord community have been added to allow for clearer understanding of the project and contact to the project's team. This maintains the original colour scheme consisting of a light blue background colour (#0099ff), a white element background colour (#fff), with black text (#000), along with continuing use of the Spectral font family for text and Roboto for headers.

The Eos application itself, however, has undergone a significantly greater change:

- A material-design sidebar has been added, with a 'hamburger' icon button to toggle visibility of this sidebar. On landscape screens, this sidebar is set to always display, with the button disabled, so as to make better use of screen real-estate.
- Components of the project (mood tracking, chat, and print reports) have been consolidated into a single page setup, along with the app flow no longer being a required process as users may access specific components from the sidebar (eg, a user may load the app and choose to go straight to chatting, rather than the old process of logging a mood and then chatting).
- Background colour has been changed from white to light blue (#0099ff), while block elements remain unchanged.
- Block elements have been shrunk to use less of the screen on desktops.
- Mobile (portrait) devices now use full-screen block elements, acknowledging the lack of real estate available.

Styling is a customisation of the Google Material Design style specification, focusing on shadows to provide depth and strong use of vibrant colours to assist with cognitive therapies.

Colour scheme

Primary colour: This should remain a vibrant, distinctive colour. Depression has been found to lead to bleakness of perceived colour[3], so a large block of vibrant colour is likely to alleviate this. For the flagship Eos instance, the light blue colour with hex value *#0099ff* was chosen as, following colour psychology[4], blue has been found to trigger connotations of trust, truth, and loyalty (which can also suggest reliability), which is felt to work well with Eos' goals and should be conducive to mental health difficulties. However, by no means is this colour perfect: the connotations with coldness and lack of emotion is not ideal; thus, experimentation with style and different vibrant colours is advised for other instances.
Secondary colour: Comprising the rest of the non-textual page, the secondary colour should be neutral. Either white, grey, or black is preferred. For the flagship instance, white was chosen due to the psychological effects of white to suggest purity, cleanliness, and neutrality,

[3] https://www.nicabm.com/depression-the-connection-between-color-perception-and-mood/
[4] http://www.arttherapyblog.com/online/color-psychology-psychologica-effects-of-colors/

which we also feel to be conducive to the goals of Eos. The bright nature of white is a further bonus, as light colours are more conducive to a lighter mental state.