Project
Opportunities for Improvement
Gmail, web browser version
CS6750 – Human Computer Interaction

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1. INTRODUCTION

This paper investigates the web browser version of Gmail, Google's email service, and identifies opportunities to improve this interface using a user-centered design process.

1.1 Background

Gmail is available via a web browser i.e. the webmail version, as well as through the Gmail mobile app on Android and Apple iOS. The retail version of Gmail is a free service, and there is a paid subscription version of Gmail available through Google Workspace. Google Workspace plans provide a customer email for businesses and include tools such as Gmail, Calendar, Meet, Chat, Drive, office applications, online survey forms and website hosting.

Gmail's core functionality is to send, receive, and store emails using an email address associated with a Google account. There are, however, other supporting functionalities include: contact/address list management, inbox search, spam filter, email group filtering and integration with other Google office tools, such as Calendar and Meet. The existing interface may be viewed in *Sections 3. Heuristic Evaluation* and *4. Interface Redesign*.

Gmail launched in 2004 and has undergone incremental changes since its inception, namely incorporating additional features and integration with other Google services, as well as the release of App versions with the advent of the smartphone. As of Jan 2020, Gmail has 1.8 billion concurrent users, of which approximately 60% (desktop plus browser modalities) utilize the web browser version (Gilbert 2022). Furthermore, as of May 2022, Gmail's global market share of email clients is estimated at 28.13% (Litmus 2022). Therefore, any identified

opportunities to improve this interface will likely benefit a significant number of users.

1.2 Reader familiarization

In order for you, the reader, to familiarize yourself with the interface that was investigated, I encourage you to experience it for yourself. In order to access and experience the webmail version of Gmail (the interface that was investigated), please follow the steps below:

- First, visit mail.google.com or google.com using a web browser and then log into your Google account or create a new account.
- If you have visited mail.google.com you will now have Gmail open in your web browser window.
- If you logged in via google.com, you will first need to click the Google apps button, the 3x3 dot icon ('the waffle') next to your profile picture (Google account) and then click on the Gmail icon. You should now have Gmail open in your web browser window.
- Next, try to view an email in the inbox by clicking on its associated row within. This row should pop-up slightly as you mouseover it before clicking down on it. If your account is new, there should be a welcome email from Google to view.
- Finally, try to send yourself an email by clicking the '+ Compose' button, entering your email address in the 'To' field, writing an email, and then clicking the 'Send' button.

Following these steps, should have enhanced your appreciation and exposure to the Gmail web browser interface.

2. INITIAL NEEDFINDING

Two types of initial needfinding were undertaken: Product Review Analysis, and Think-Alouds with a small Post-event Protocol.

2.1 Needfinding method

The Product Review Analysis involved collecting 1, 2 and 3 star reviews with overall negative comment sentiment from getApp product reviews about Gmail. getApp has a far more numerous review count for Gmail with 9106 reviews,

compared to 398 reviews on TrustPilot and 911 reviews on SiteJabber. The reviews were filtered down to 1, 2 and 3 star negative reviews, numbering 81 reviews in total. These may be viewed in Appendix *8.1 Product Review Analysis – Raw Results*.

Three think-alouds (with a small post-event protocol) were undertaken with work colleagues using the task list and questions shown in *Appendix 8.2*. Think-alouds took place with work colleagues, as our place of work utilizes Google Workplace for daily operations, as well as with family members who already use Gmail. Convenience sampling was leveraged in this circumstance. The Think-Aloud task scripts were also informed by the Product Review (specifically, the 'search for an email', 'email chain' and 'delete multiple emails' tasks).

2.2 Needfinding conclusions

Needfinding was undertaken with the intent to find features that the interface did not perform well and features that it lacked. At the same time, the think-alouds, as well as a brief analysis of positive sentiment product reviews, also provided an opportunity to identify features that worked well. It is also worth noting that the Gmail web browser version has benefitted from major updates in 2018 and early 2022, which may have addressed issues identified in earlier product reviews

2.2.1 Product review analysis conclusions

The following feature issues and suggested improvements that were identified by users in the product reviews are summarized below. They will be referred into in later *Sections* as **Issue Codes – PR1 to PR16**.

1. Email search has poor or inaccurate results.
2. Email search has poor filtering and limited search options.
3. Email threads (email chains or "conversations" in Google terminology) break-down quickly, becomes confusing, and is difficult to track the most recent part of the thread. It does not track these as well as MS Outlook.
4. Navigation and display emails/correspondence is not user friendly.
5. No preview attachment. It simply downloads it and opens it in another window.
6. Emails cannot be made into attachments, like in MS Outlook.

7. Spam filter works poorly. However, Gmail likely filters phishing emails well and user reviews are experiencing a negative experience from marketing or promotional advertising emails making it into their inbox.
8. Inbox sub-menu ordering is unintuitive and inferior to MS Outlook.
9. Settings customization too numerous and confusing.
10. Mass email deletion is complicated or unintuitive.
11. 2FA can take too long to login – one-step login would be ideal.
12. Major updates and interface overhauls without sufficient lead time before roll-out.
13. Overall, an inferior product to MS Outlook, especially for business. For example, system notification update emails often go directly to spam or non-primary mailboxes.
14. Poor user experience, but difficult to quantify. Not intuitive to use, or annoying to use. The flow between tasks is poor, resulting from a 'messy' interface.
15. User interface design is outdated i.e. the look and feel – text, layout, structure, colors and so on.
16. Implement email rules like MS Outlook.

2.2.2 Think-aloud conclusions

The following feature issues and suggested improvements that were identified by users in the think-alouds and small post-event protocols are summarized below. They will be referred into in later *Sections* as **Issue Codes – TA1 to TA5**.

1. Logging out forces the users to sign out of all linked Google accounts. Therefore, it would be ideal to allow users to sign out of individual Google accounts. However, this would not pose a problem with only one Google account, but would likely impact users who have a personal account and a work-related business account.
2. Deleting multiple emails is difficult and restrictive. It requires you to tick multiple boxes, or first tick a box then shift-click, and then click the trash icon below the search bar. You cannot use the delete button on the keyboard, and you cannot click-hold, drag and highlight multiple emails for selection.
3. The lack of a true dark mode. Colored themes, including dark mode, only change the inbox and side pane colors. Viewed emails, composed emails, the compose button and the settings are still white. A fully-dark mode should be implemented.

4. Searching using keywords often returns irrelevant emails or promotions. Promotions can be filtered out, but there are still many irrelevant emails. Searching by sender name and filtering by date is much more effective.
5. Inbox pages should be eliminated. Limiting the number of emails that can be scrolled through in the inbox to 50 or 100 seems outdated and restrictive.

Participants in the think-alouds and post-event protocols mentioned that basic functionality (viewing and sending emails) works well, and that there is consistency between the inbox and email composition. As stated above, searching by sender name and filtering by date is a very effective email search method. However, this requires the users to hold the answers to 'who sent the email?' and 'when was the email sent?' in their memories on a day-to-day basis. Also, two participants demonstrated it was possible to conveniently delete an entire page of emails by using the tickbox with a dropdown arrow that sits directly-beneath the search bar.

3. HEURISTIC EVALUATION

The user-centered design lifecycle is underpinned by a unification of 15 heuristic design principles from foremost leading HCI researchers, such as Nielsen (1990, 1994), Norman (2013), Constantine & Lockwood (1999) and Mace (1997). The 15 unified heuristic principle are Discoverability, Feedback, Constraints, Mapping, Consistency, Affordances, Structure, Simplicity, Tolerance, Equity, Flexibility, Perceptibility, Ease, Comfort and Documentation. These heuristic principles were used to assess the interface. At least 5 principles are covered for each perspective below, but more can be found in *Appendix 8.3*.

2.3 What the interface does well and why

2.3.1 Structure, mapping and consistency

When a user opens Gmail for the first time, a user will be greeted with a familiar Structure (or arrangement) of the interface (refer *Figure 1*), with a mailbox (and later discoverable email viewing window) comprising the center, user focal point and the majority of screen real estate. Additionally, the user will find elements that appear to be settings along the top of the interface, and navigation menus on the side. This Structure leverages the Mapping and Consistency of the most common forms of office-based software interfaces. One need only look as far as

Microsoft, Apple of Google-based office software interfaces such as word processors, spreadsheets and presentation slide applications, to find strong similarities in the interface Structure.

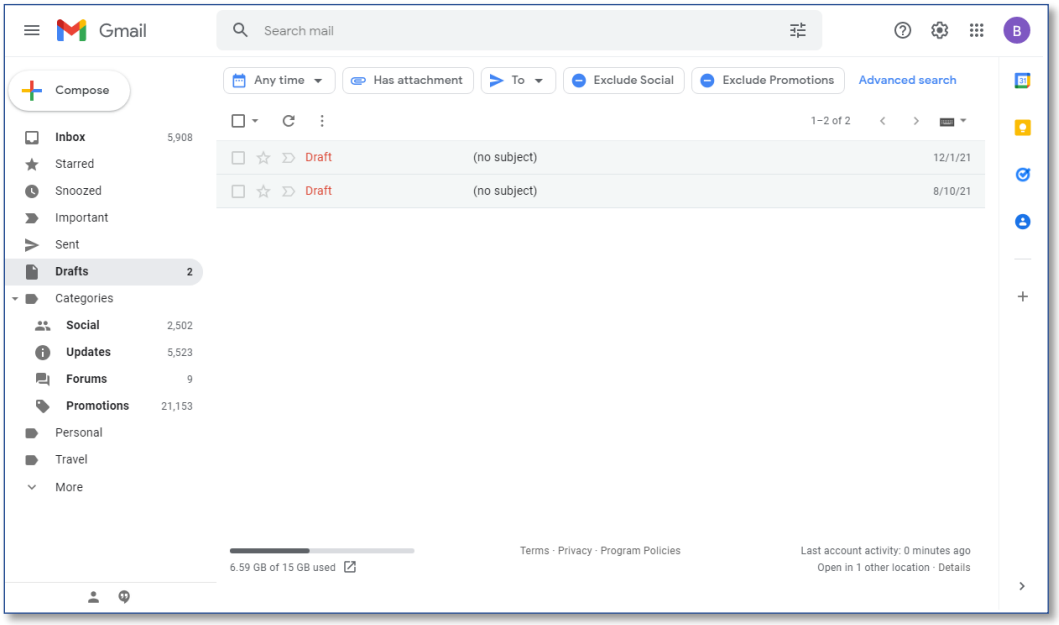

Figure 1 — Gmail Interface when opened and in Drafts inbox

Despite the Structure being familiar and reasonably intuitive, the user will also likely notice an assortment of buttons, labels, icons, check boxes and dropdowns within the different partitions and sections of the interface Structure. A majority of these elements are intuitive and familiar, but approximately one-third of button icons are likely unfamiliar to a first time user as they are proprietary icons and symbols developed by Google (likely as a differentiator from other platforms). The familiar elements (such as buttons, labels and icons) strongly leverage the principles of Mapping and Consistency. These include, but are not limited to: the 'Inbox' being the location where emails are found, a 'cog' symbol representing app settings, a bubble with the user's initials or nominated display picture representing user profile settings, a storage bar and capacity, a search bar being used to search for things (presumably emails if the user is within their inbox), a 'trash can' representing delete, 'starring' an email representing favoriting an email and the words 'sent', 'draft' and 'spam/promotions' evoking the exact same meanings as sent and draft letters, and spam/promotions mail (but in electronic form).

In particular, the consistent mapping and structure, as well as the use of consistent icon symbols, helps novice users bridge the gulfs of execution and evaluation, bringing them closer to interface invisibility through experience. The structure of the interface itself helps to bring important features and what actions are the most likely to bring the desired effect into the user's focus.

2.3.2 Discoverability and constraints

Discoverability is excellent in Gmail. Every clickable element of the interface can be subject to a mouseover to display a tooltip or basic textual label. Furthermore, some elements also feature three vertical dots (⋮) or a small down arrowhead to open a dropdown menu with yet more discoverable options. This aspect of Discoverability is favorable for a novice user to discover the most fundamental interface's features and capabilities. Next, when a user clicks on the 'cog' icon they are first presented with 'Quick settings' that displays simplified settings related to interface layout, theme, inbox type, reading/viewing pane location and email threading (conversation view a.k.a. email chains in Microsoft Outlook) – refer *Figure 2 (left)*. This 'Quick settings' pane is equipped with good structure, where setting categories are separated by bold lines, a scroll bar and diagrammatic representations of each setting option. Each setting category can only have one option selected via the use of radio buttons, which is great application of the Constraint principle and deters novice users from altering the settings in an adversely significant way.

This 'Quick settings' pane also features hyperlink text to further 'Customization' or a button that will take the user to the 'All settings menu'. Some 'Customization' options are presented in a manner friendly to novice users, such as the customization of the inbox type bringing up five check boxes, save or cancel buttons and a useful tooltip tutorial with animations – *refer Figure 2 (top-center)*.

However, many 'Customization' options will also take the user to the all (or full) settings menu. The 'All settings menu' is more appropriate for expert users – refer *Figure 2 (bottom-center)*. When the 'All settings menu' is opened, it takes overs the central pane and main focal point of the interface, replacing the inbox and any viewed email text. There are many settings, separated by different tabs vertically and bold lines horizontally. However, affordances such as radio buttons, checkboxes and dropdown scales are used in order to constrain user choice: a great application of the Constraints principle as it will significantly constrain

even expert users from modifying the interface setting in a critically detrimental manner.

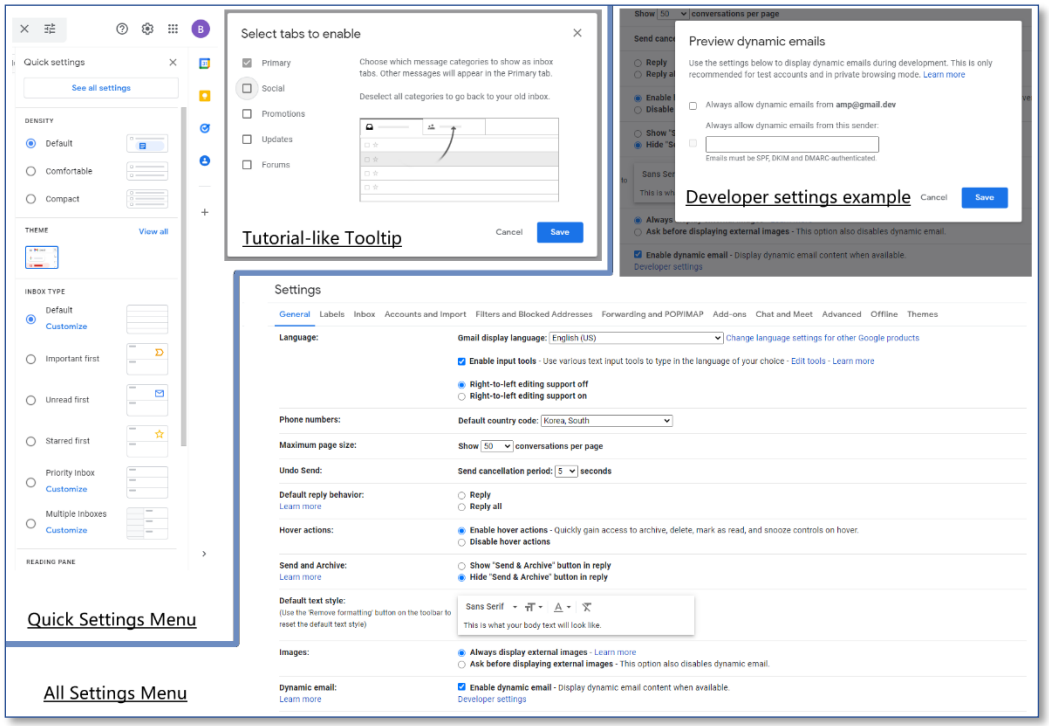

Figure 2 — Gmail Novice Settings (left), Expert Settings (right)

Furthermore, 'Developer settings' are available through hyperlinks underneath options and provide even further customization - refer Figure 2 *(top-right)*. The concept of nested options within submenus within a broader menu is a great application of the Structure principle because the structure of the menu itself follows a logical mental model and process: only those with the necessary expertise can dig deeper and deeper to find the settings and customization they seek. Furthermore, these options are Discoverable to any curious users seeking to enhance their level of expertise.

2.3.3 Ease and flexibility

The above heuristic-specific analyses have been fairly holistic so, it's worth discussing the commencement of two specific tasks: 'replying to an email' and 'using search filters', to demonstrate how the Ease and Flexibility principles are exemplified. Replying to an email is done by clicking on the reply button (represented by a curved backwards arrow) while viewing an email. This reply button

is in the top right corner of the email, the bottom left corner, and also available in via a small drop menu in the top right corner, accessible via 3 vertical dots (⋮) icon. There are three ways to commence this task and they are located around the borders of the viewed email, making the take easier to commence. Similarly, using search filters can be done in four ways. First, there are basic and common search filters available directly below the search bar. Second, there is an 'advanced search' option to the right of these commonly-used filters. Third, the amplifier level sliders icon on the right of the search bar also opens search filter options. Fourth, text-based search commands can be entered in the search bar by an advanced user, or someone who is curious enough to discover these in the help menu.

2.4 What the interface does poorly and why

As evident from the relatively in-depth heuristic evaluation and the positive sentiment captured in Needfinding, the Gmail interface performs very well from a heuristic evaluation perspective. The pain points and aspect features that contradict heuristic principles are mostly task-specific at a high granularity or the result of design choices by Google, such as certain icons. It's important to note that there is generally positive sentiment in the product reviews as only 81 of 9106 reviews are substantively negative, think-alouds identified that most tasks are easy and intuitive to perform and qualitative post-event protocol response indicate the interface layout is intuitive and logical. This heuristic evaluation of negative aspects of the interface will endeavor match issues to those identified in Needfinding.

2.4.1 Ease, flexibility and consistency

In the Gmail interface there are several quality of life (or Ease) issues resulting from interface design choices. Many of these were identified in Needfinding.

Issue TA5 states there are arbitrary pages in the inbox limiting the user to a default inbox page depth of 50 emails, and a maximum of 100. Refer to *Figure 1*. When a user reaches the bottom of the page of the inbox, they must click a left or right arrow to change inbox pages. It's important to note that a scroll bar already exists to navigate through the inbox vertically, so this raises the question as to why it is necessary to have another horizontal dimension of pages added to the inbox. This is contradictory to the Ease principle, and generally unintuitive and inconsistent with other applications. For example, Microsoft Outlook web

browser version has an infinitely scrollable inbox, and PDF readers typically allow readers to scroll through the entire document. This aspect of the interface is highly Discoverable and Affordances are used (email counter, left and right arrows), however from an HCI perspective, there are arbitrary extra steps added to searching for past emails. Additionally, *Issue TA1* states that the Gmail web browser version forces you to log out (sign out) of all linked Google accounts. It should be possible to log out of an individual account as this is possible on the Gmail iOS or Android App. This violates the *Ease* and *Consistency* principles. *Issues TA2* and *PR10* state that deletion of multiple emails requires more clicking than necessary. It requires the use of clicking tick-boxes and then a trash icon, which is also limited by the aforementioned page restriction. Ideally, email deletion could be performed more easily with drag-selecting and using the delete key. This violates the *Ease* and *Flexibility* principles. Finally, *Issue PR5* states there is no preview of attachment and the user is required to download the attachment and open it in the browser on another browser tab. This violates the Ease principle.

2.4.2 Affordances (and consistency)

As stated above and in *Appendix 8.3.2 Affordances*, approximately one-third of button would be unfamiliar to a first-time user even with extensive technological expertise. Many of these icons are proprietary icons developed by Google. They require the understanding of artifacts that often exist outside of a web browser, some artifacts being more familiar that others. A curious example and violation of the Affordances principle is one of the ways to open search filters are is represented by amplifier level sliders to the right of the search bar. The logical connection between amplifier level sliders, search filters, and the concept of 'filtering' being common to both, is onerously abstract for anyone without sound production experience. It is unlikely that most users could make this connection and form an appropriate mental model based on the icon. Another icon could suffice equally as the location of this icon within the search bar infers that it should be a search option of some kind, which again demonstrates the strong Structure and Mapping of the interface. Another confusing example of the violation of the Affordances principle is that the 'keyboard entry' and the 'join a meeting' buttons are both represented by a keyboard of slightly varying design. It is only on mouseover that a user discovers their different functions. Another violation of the Affordances principle is the similar icons used for text underline (U-

underline) and text color (A-underline with a dropdown arrow) in email composition – refer *Figure 3* below. As the use of proprietary icons and creative icon design is inconsistent with other platforms, this causes the gulf of execution to widen as it takes longer for users to formulate the correct mental models. They would likely do so using the strong Discoverability, Structure and Mapping of the interface. Application of the Consistency principle in a more significant manner would prove beneficial.

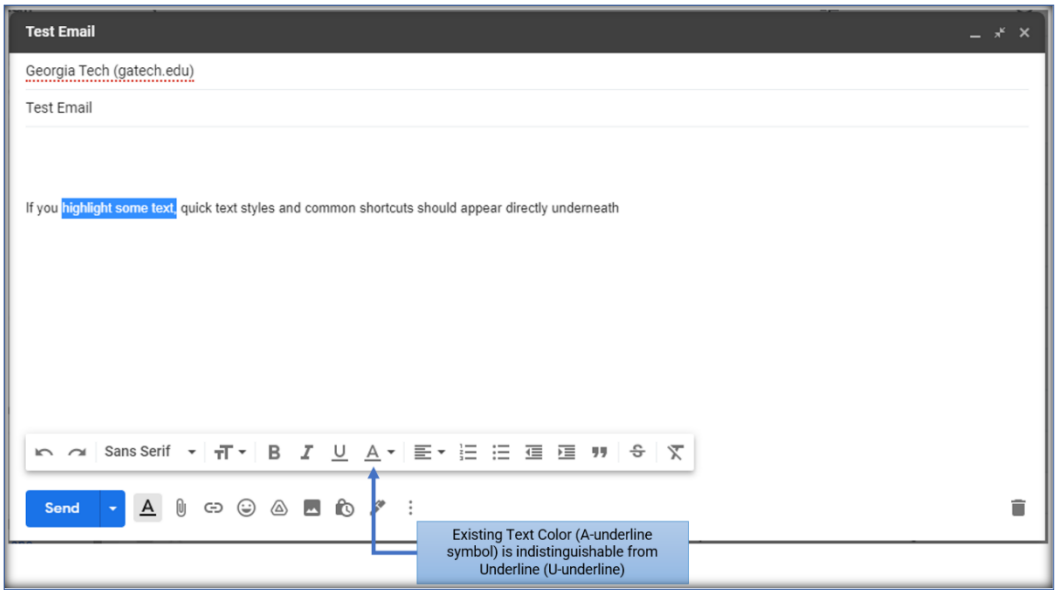

Figure 3 — Compose email – Underline text and Text color are too similar in appearance

2.4.3 Simplicity

Issue PR9 states that settings customization is too numerous and confusing in the interface. As stated by Constantine & Lockwood (1999), "the design should make simple, common tasks easy, communicating clearly and simply in the user's own language and providing good shortcuts." However, although Discoverability is strong, there is a big leap for user expertise requirements between the 'Quick settings' and 'All settings' as seen in *Figure 2*. The 'Quick settings' are fairly restrictive and highly graphical with visual examples, designed for the most inexperienced of users. In saying that, most users will likely find that they should enter into the 'All settings' menu due to the restrictiveness of the quick settings menu.

4. INTERFACE REDESIGN

A wireframe prototype was selected to redesign the Gmail web browser interface. The figures below detail the extent of the redesign. Existing interface artifacts have blue labels and new redesign features have yellow labels.

- **New redesign feature 1 & 2**: *Figure 4* depicts the existing interface, and *Figure 5* depicts Features 1 and 2, infinite inbox scroll and attachment preview, respectively.
- **New redesign feature 3 & 4**: *Figure 6* depicts Feature 3 and 4, quick cut/copy/paste and formatting on text highlight and new symbol for text color in compose email, respectively.
- **New redesign feature 5:** *Figure 7* depicts Feature 5: sign out of individual Google account on log out.
- **New redesign feature 6:** *Figure 8* depicts Feature 6: quick access to common interface color themes
- **New redesign feature 7:** *Figure 9* depicts Feature 7: true dark mode. The existing dark mode can be viewed in *Appendix 8.4*.

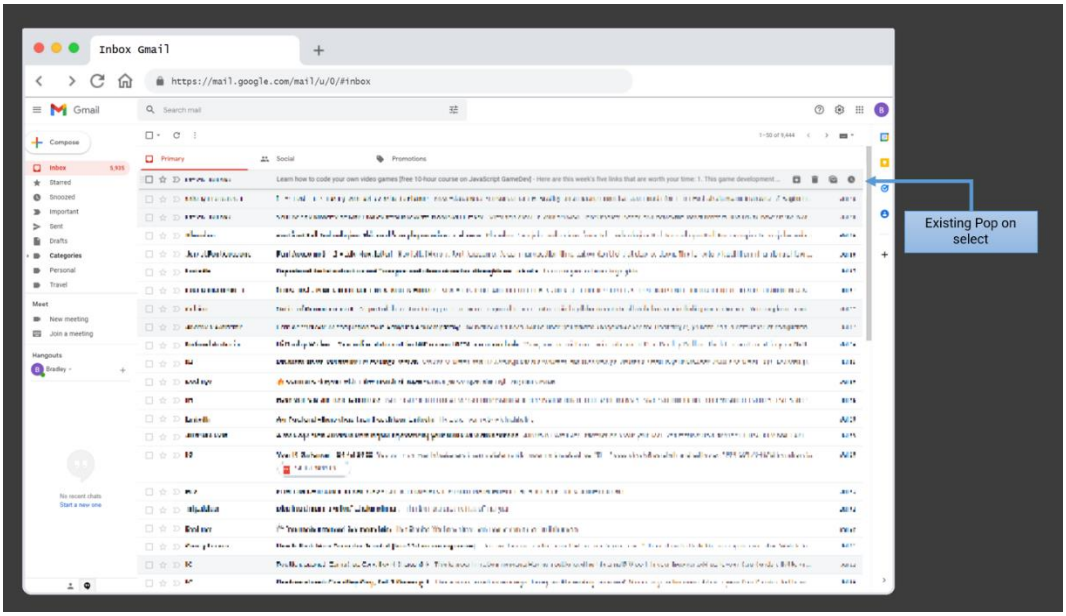

Figure 4 — Existing Gmail Interface, showing email row pop-up on select

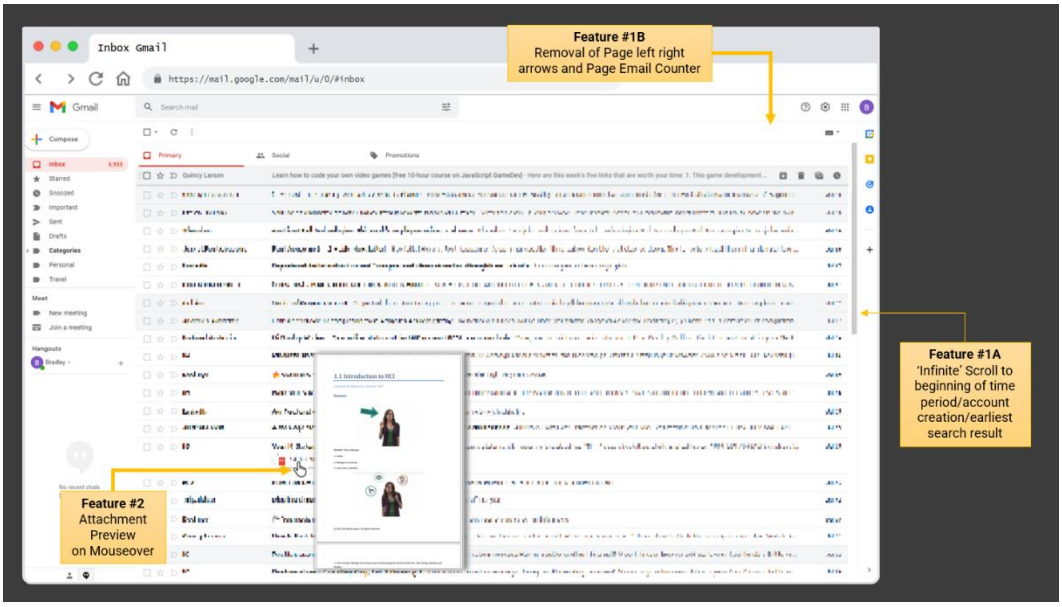

Figure 5 — Redesign features 1: infinite scroll and feature 2: attachment preview on mouseover

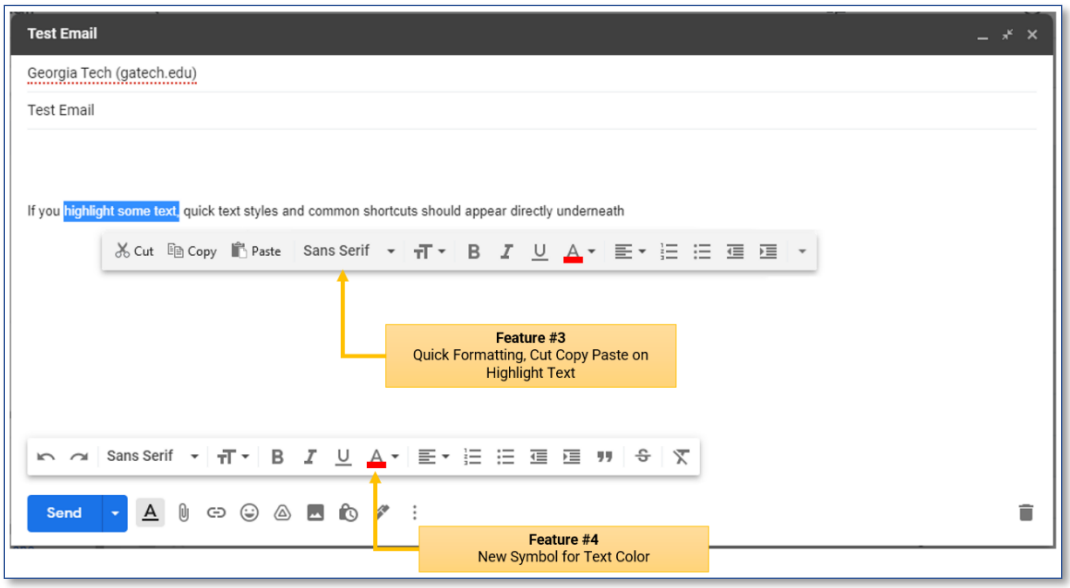

Figure 6 — Redesign features 3: quick text formatting and shortcut icons and feature 4: new symbol for text color

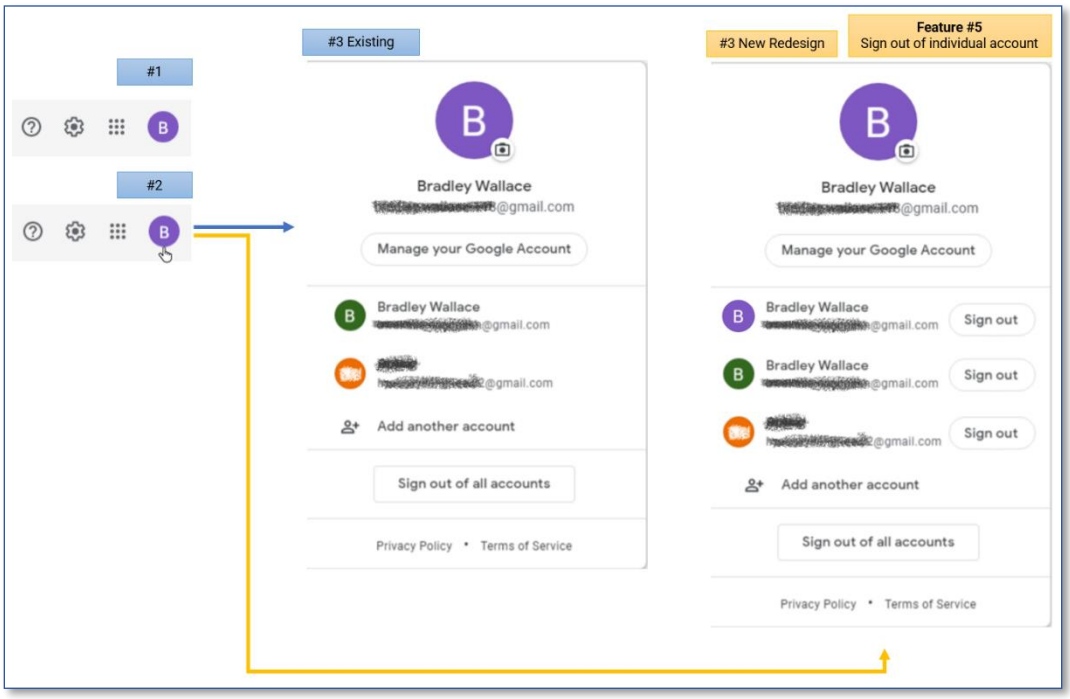

Figure 7—Redesign feature 5: sign out of individual account functionality

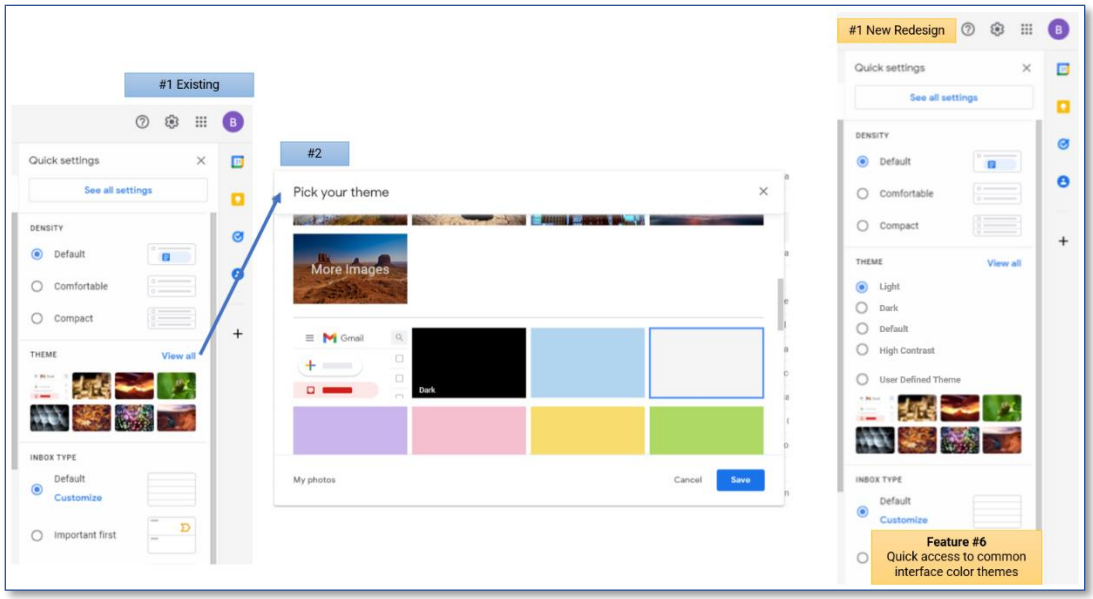

Figure 8—Redesign feature 6: quick access to common interface color themes

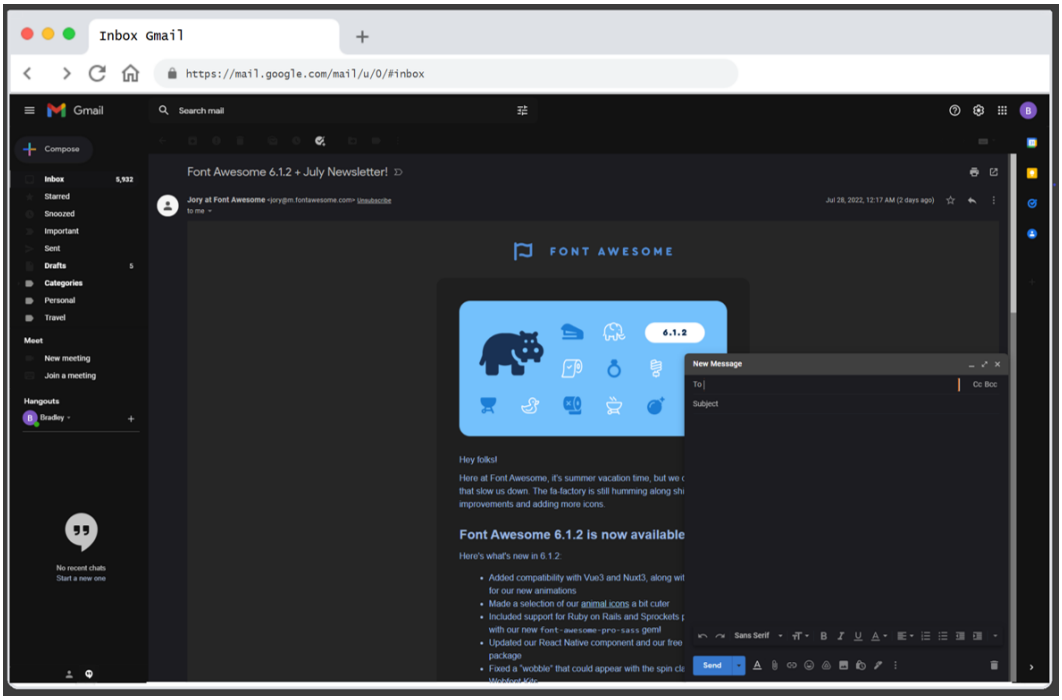

Figure 9 — Redesign feature 7: true dark mode

5. INTERFACE JUSTIFICATION

The interface redesign focuses on 7 features that address issues and criticisms discovered and through Needfinding and explored further through heuristic evaluation. Furthermore, strengths of the interface discovered in heuristic evaluation are preserved as much as practicable in the design of these 7 proposed features.

Of particular note, the proposed features aim to preserve the strong structure, mapping, consistency, discoverability, use of constraints, ease and flexibility of the existing interface. None of the proposed features call for a significant overhaul of the existing interface. Heuristic principles are leveraged further in the design of these proposed features in order to enhance many of these heuristic strengths of the existing interface.

The proposed redesign features are relatively standalone in nature. However, feature 4 complements feature 3 directly, and feature 8 complements feature 9.

4.1 Feature 1 Justification

Feature 1 proposes the implementation of an infinite scroll bar within the Gmail inbox, and the removal the inbox pages and related affordances (the email counter and page navigation buttons). The requirement for changing inbox pages and the limit on inbox email depth was identified as a usability issue (*Issue TA5*) in Needfinding. This usability issue was also explored and discussed further in *Section 3.2.1*. The feature of infinite scrolling is present in Gmail App, Microsoft Outlook web browser version, Microsoft Outlook, and Apple Mail. The implementation of infinite scroll provides users with a user experience that is Easier, more Comfortable and Consistent with existing competitor interfaces. This feature also significantly reduces the number of inbox interface states, thereby increasing the Perceptibility and Simplicity of the interface. Users no longer have to perceive which page of the inbox they are presently within and have the added horizontal dimension of inbox navigation: they can continue to scroll infinitely and Discover that the emails will continue to load. The design of this feature preserves the existing interface strengths and removes a weakness. There is no significant redesign of the existing interface and the strong Structure, Mapping, Discoverability and (internal) Consistency is preserved.

4.2 Feature 2 Justification

Feature 2 proposes the implementation of an attachment preview when the user mouseovers an attachment in the inbox or when viewing an email. This beneficial feature was identified in the product review analysis (*Issue PR5*) and explored further in *Section 3.2.1*, where it was discussed that the lack of this feature is a violation of the Ease and Consistency principles. As stated, the existing interface lacks and the feature of attachment previews and the user is forced to download an attachment in order to inspect it. If the user was in a situation where they were searching through emails attempting to find an attachment they don't know the exact name, date or size details of, the lack of this feature causes Ease violations. Attachment preview is a common feature in many email applications, so this is also a violation of Consistency principle. Therefore, implementing this feature will enhance the Ease and Consistency strengths of the interface. There is no significant redesign of the existing strong Structure, Mapping, Discoverability, Consistency of the interface. The coloration and style of attachment preview window is Consistent with the design of the existing interface.

4.3 Feature 3 Justification

Feature 3 proposes to implement text formatting and quick icon shortcuts for cut, copy and paste when text is highlighted in email composition. When undertaking the heuristic evaluation, it was discovered that text formatting in email composition requires users to highlight text and then select formatting at the bottom of the email composition window - refer *Section 3.2.1*. Furthermore, cut, copy and paste options are accessed through a right-click menu or the typical keyboard shortcuts. In Microsoft word, a concise quick text formatting toolbar appears above any highlighted text. Leveraging this interface idea, it was proposed to implement this feature, along with cut, copy and paste icon shortcuts to enhance user Ease and Comfort, as well as Consistency. The coloration and style of the toolbar is consistent with the design of the existing interface and does not detract from its existing strengths. Affordances are also utilized for the icons of cut, copy and paste.

4.4 Feature 4 Justification

Feature 4 proposes the change of the text color icon in text formatting within email composition. This was identified as a usability issue in the heuristic evaluation refer *Section 3.2.2*. The existing icons for text underline and text color are too similar and therefore it is proposed to distinguish them apart using a similar design to that present in Microsoft Word and Outlook. This leverages the Affordances and Consistency principles, removes an interface weakness and does not detract from the existing strengths of the interface.

4.5 Feature 5 Justification

Feature 5 proposes that the interface allow a user to sign out of an individual account. This lack of this feature was identified in the think-aloud needfinding (*Issue TA1*) and explored further in *Section 3.2.1*, where it was discussed that the lack of this feature is a violation of the Ease, Flexibility and Consistency principles. It is possible to sign out of individual accounts in the Gmail App but not on the web browser version. The feature proposes to extend the sign out box that appears when a user clicks on the user profile button in the top-right corner of the interface. The sign out box must be adjusted to accommodate the sign out of an individual account feature. The coloration and style of the toolbar is consistent with the design of the existing interface, leveraging existing strong applications

of the Structure, Mapping and Consistency principles. Further, the ability to sign out of all accounts is retained for Ease and Consistency.

4.6 Feature 6 Justification

Feature 6 proposes that a commonly used and required interface color schemes be included in the 'Quick settings' menu in a manner that does not require color to interpret, which enhances Equity, and leverages easy to understand Structures and Affordances of radio buttons, bounded areas for single option selection. *Issue PR9* states that settings customization is too numerous and confusing in the interface. Further, *Section 3.2.3* of the heuristic evaluation identifies those users may require an intermediate interface or more usable 'Quick settings'. The addition of this feature is simply one example addressing this very broad usability issue, but also seeks to complement Feature 7 (which is detailed below). The design of this feature allows users to quickly access commonly-demanded color themes (for example, dark mode as identified in *Issue TA3*). Particular care is also made to not marginalize and forget minority color-blind or those with degenerated visual acuity (such as the elderly) who require high contrast color settings. This feature enhances the Ease and Equity of the existing interface. The coloration and style of the 'Quick settings' submenu is consistent with the design of the existing interface, leveraging existing strong applications of the Structure, Mapping, Affordances (radio buttons and bounded areas) and (internal) Consistency principles.

4.7 Feature 7 Justification

Feature 7 proposes the implementation of a true dark mode since the existing interface currently lacks this feature. This usability issue was identified in *Issue TA3*. Furthermore, the Gmail App (and many other applications) feature a true dark mode and thus this is violation of the Consistency Principle. Those desiring this particular type of color contrast are unable to do so. The style of the toolbar is consistent with the design of the existing interface, leveraging existing strong applications of the Structure, Mapping and Consistency principles. The extent of the color scheme of the true dark mode is Consistent with other applications. There are arguments that true dark mode reduces blue light exposure and eye strain (claimed by some technology companies), but this has been yet to be scientifically confirmed. If true, this feature enhances the Ease and Comfort of the interface through the reduction in health effects of prolonged screen use.

6. EVALUATION PLAN

As the interface redesign proposes 7 new interface features, qualitative evaluation has been selected to evaluate the interface redesign. It is proposed to undertake an **Online Survey** using the **Wireframe Feature Prototypes** developed.

5.1 Online survey - procedure

An asynchronous online survey will be distributed online via Google Forms, along with the Wireframe Prototype for Qualitative Evaluation by participants. The Wireframe Prototype is of sufficient fidelity to acquire evaluation feedback from participants without researcher oversight during the evaluations. The goal is to gather user thoughts and opinions on the 7 proposed features. Distributing the online survey via Google Forms allows the survey to be distributed efficiently at scale and also allows for automatic data visualization. Furthermore, the survey will consist of 25 questions to make survey participation less time consuming and attractive to potential participants. Given that the survey covers 7 features, this is not an unreasonable length. Three survey questions are also repeated for each of the 7 proposed features for consistency.

Participants will be recruited via convenience sampling, plus snowballing, with colleagues, friends and family, and broader sampling will be undertaken by distributing invitations to the online survey via two online forums, namely Ed Discussion and Reddit. Given the ubiquity of Gmail, as discussed in *Section 1.1*, this recruitment process should capture a participant population representative of the true user base.

5.2 Online survey – script

This survey strictly relates to the web browser version of Gmail

1. How long have you been using Gmail in web browser? [ratio data]
2. On average, how often do you use Gmail in web browser? Pick the closest choice. [ratio data]

Please review the attached Wireframe feature prototypes. These cover 7 new proposed features and improvements to the existing Gmail web browser interface. The questions seek to gauge the perceived benefits of each proposed feature.

3. From 1-5 strongly disagree to strongly agree, compared to the existing interface, **Feature [Insert Number]** is beneficial. [nominal]

4. From 1-5 strongly disagree to strongly agree, **Feature [Insert Number]** is designed well in look and feel (easy to find, easy to use and stylistically consistent). [nominal]
5. What, if any, aspects of **Feature [Insert Number]** do you like -or- do you think work well (N/A if nothing)?
24. From 1-5 strongly disagree to strongly agree, I would like to see the proposed features implemented
25. What, if any, changes -or- improvements would you like to see made to the prototype?

5.3 Online survey – biases discussion

Reflecting on the online survey, sources of bias are: sampling bias, satisficing bias, speeder bias, question order bias, voluntary response bias and observer bias.

Sampling bias may arise due to oversampling particular demographics of the Gmail web browser version userbase, thus not having a representative participant population. Convenience and snowball sampling of colleagues, friends and family may introduce sampling bias as colleagues and friends (and their snowballed participants) are likely to be of a similar age group and, on average, a similar socio-economic and cultural background. Furthermore, participant recruitment taking place on Ed Discussion and Reddit will likely oversample the Millennial age groups. It may be possible to extend the survey through schools, universities or seniors' groups in an attempt to reduce sampling bias and capture younger and older age groups, respectively. Poor response rate may also introduce sampling bias and therefore it would ideal to use principles from Dillman et. al.'s (2014) Total Design Survey Method to follow-up non-respondents to achieve high response rates. The survey questionnaire is no longer than needed and contains quality questions that assist in reducing question order, satisficing and speeder bias. Observer bias is mitigated by avoiding leading questions and questions are grouped logically (i.e. there is a clear flow to the questions). Duplicate response bias can also be prevented by not allowing duplicate emails or disregarding duplicates during analysis. Voluntary response bias may be a risk given the use of many bi-polar scale questions when assessing feature sentiment, however these questions have been worded in-line with other high quality and polished user surveys to minimize this bias as much as practicable.

7. REFERENCES

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8. APPENDICES

8.1 Product Review Analysis – Raw Results

Gmail Product Review - Raw Results

8.2 Think-Aloud Script

Complete the followings tasks:

1. Login
2. Compose an email
3. Send an email
4. Reply to an email
5. Search for an email
6. Search for an email chain
7. Reply to an email chain
8. Delete an email
9. Delete multiple emails
10. Logout

Post-Event Protocol brief questions:

- Please provide your thoughts on features that you think work well
- Please provide your thoughts on features that require improvement or features that do not work well

8.3 Heuristic Evaluation Expanded

8.3.1 Tolerance – positive applications

Further to above, one final principle the Gmail exemplifies and demonstrates well is the Tolerance principle. Within the interface is high recoverability, mistake reduction, mistake fixing and deterrents to adverse setting changes by curious novice users.

Looking at the most fundamental task in Gmail of composing an email, a user's grammatical and spelling mistakes are automatically corrected and improvements are suggested. These options are on by default, by can be turned off in the 'All settings' menu. Next, when composing an email, the user can undo (ctrl+z) and redo (ctrl+y) any text they input within the email message. Further, if an email is not sent immediately after composing, or is stopped mid-way or closed abruptly, Gmail saves this email as a Draft for later continuation. The interface will also warn the user of attempting to send emails without a recipient address, an email subject, or a missing attachment (if AI within the interface can detect

text indicating an attachment) when the user clicks 'Send'. Further to this, there is a 5-second window (by default) to undo a sent email. It is possible to increase this time window in the 'All settings' menu.

Also, if an email is deleted, it is not yet permanently deleted. It first sits in the 'Trash' bin for permanent deletion by default in 30 days or user-defined permanent deletion. In other words, the user may recover an accidentally deleted email or an email that was deleted prior, but was realized to be useful at a later time.

Finally, the settings menus are particularly well-designed to deter users from making any fatal changes to the interface. The 'Quick settings' are easy to use, and are quick to toggle between. The 'Quick settings' do not take up the majority of the interface, and so a novice user making any adverse changes can rapidly switch between settings to restore the intended look and feel of the interface. Within the 'All settings' menu, many settings are very constrained to only two to three different options that control interface 'flavor'. In saying that, there are some tabs within the 'All settings' menu, specifically: multiple account options, filters and block addresses, and forward options, that if changed haphazardly will result in fatal problems with the interface that impede tasks significantly. However, these particular tabs require the user to enter additional information. These requirements for additional user input act as deterrent for users to make fatal errors, much like other advanced options.

8.3.2 Affordances – positive applications

As touched upon above, there are many types of typical software interface Affordances built into the interface. These include: radio buttons, to select one from a group; checkboxes, to tick one or multiple items to perform a further action; a search bar for typing in text and searching, indicated by a magnifying glass and empty search field; an assortment of buttons, for clicking and whose function is indicated by the corresponding icon; a progress bar that indicates storage requirements and total storage capacity; horizontal arrows, for flipping pages of a menu or inbox; and vertical down arrows, for dropdown menus. Further to this, mouseovers on certain bars and icons make them pop out in a darker shade, indicating they can be depressed or clicked on (Refer *Figure 3*). Then, when clicked on, some icons and bars become a slightly darker shade (than on mouseover) to indicate an active selection. Many of these affordances are familiar such as a star for favorites, a question mark in a bubble for a help menu, a cog for settings and

a printer for printing, however there are still lingering proprietary icons developed by Google. Some of these are intuitive in a sense, but require the user to understand some artifacts outside of a computer, looking at *Figure 1*, the calendar is represented by a button with a box with a 31 inside (which symbolizes a date), contacts are represented by one person in a bubble, the social media notification inbox is represented by two people in a bubble, meeting is represented by a TV-station style large recording camera, Google apps is represented by the 3x3 dot waffle icon resembles the app menu of a smart device, the inbox is represented by a traditional paper in-tray, and the task list is represented by a single tick in a circle.

8.3.3 Feedback – negative applications

Feedback within the system is fairly limited and does not do a particularly strong job of helping users to bridge the gulf of evaluation. If the user makes an error beyond spelling or grammatical errors such as changing a setting, sending an email prematurely or deleting an email, they can only determine this by evaluating the state of the system themselves. This often requires proofreading an entire email, manually checking the sent, trash or draft sections of the inbox, or evaluating the entire interface to attempt to detect any anomalies. While the interface is strong in its applications of the principles of Tolerance and Constraints (allowing users to undo mistakes and limiting their potential range of mistakes), users are left on their own to identify if mistakes have occurred, why they occurred and to use other Tolerance features in order resolve them. Furthermore, the interface does not tend to provide any guidance on how to avoid such mistakes or errors in the future.

8.4 Existing Gmail dark mode

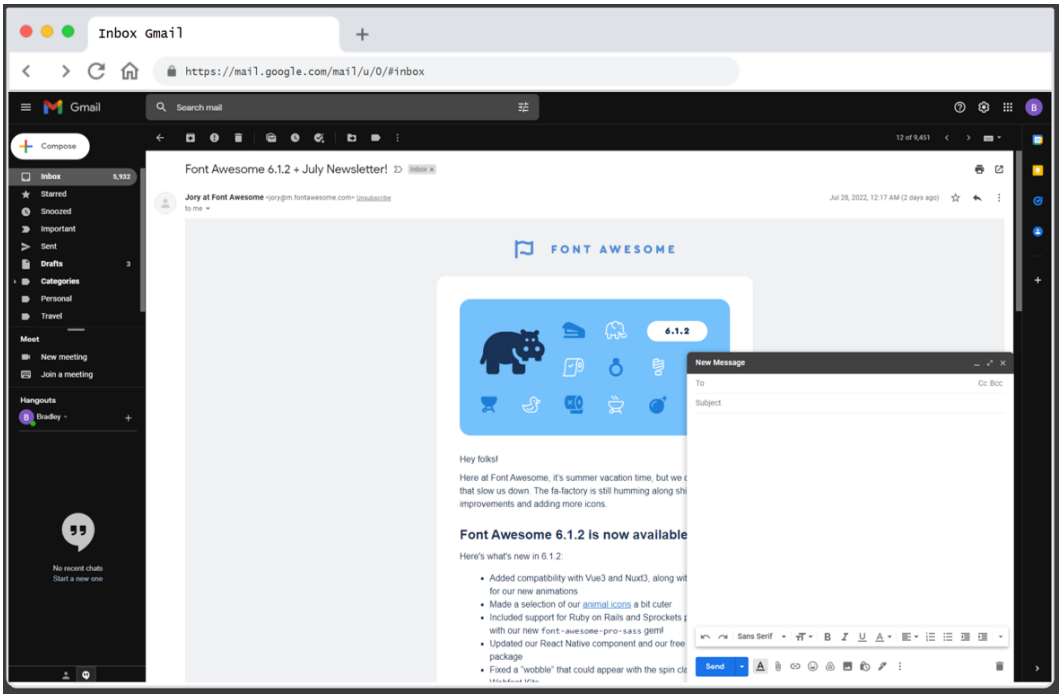

Figure 10—Existing dark mode in Gmail