

Assignment P2 (Summer 2021)

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1 DIRECTNESS AND INVISIBILITY

Table 1—Sample morning tasks, goals, interfaces, and objects

Task	Goal	Interface	Object
Toggle the on/off switch	Turn on the lights	Alexa iPhone app	Bedroom lights
Turn on the water	Take a shower	Shower faucet	Water
Inquire about local weather updates	Know what to wear	Alexa Echo	Knowledge of daily temperatures
Flip to the next page	Read the A.M. news	News iPad app	Various news articles
Adjust the timer dial	Make breakfast	Toaster oven dial	English muffin

1.1 Toggle the on/off switch

The level of directness and invisibility is high. This interaction, which occurs within the Amazon Alexa application for iPhone, requires minimal cognitive effort to manipulate (toggle the on/off switch with a single tap) and evaluate the system (observe the resultant increase in room brightness). The interaction is straightforward and thus, easily bears a resemblance to the physical action of flipping a wall-mounted light switch; the perception of direct engagement could only be improved if the toggle were oriented vertically to mirror the up/down nature of a light switch, and maybe if the user had to drag or swipe the toggle upwards/downwards rather than just needing to tap the control. From a design perspective, I suppose the on/off toggle could be a miniature representation of a light switch, but that seems unnecessary. Invisibility is tricky because the task is so elementary and requires such little thought. Because of this, the amount of thought dedicated to the interface (i.e., the need to find/open the app, click on the "Devices" view, scroll through the list of Groups, and select the right button to click) is relatively higher, at least for novice users, than one may initially suspect. I know exactly where the app is on my phone and how far down "Bedroom" falls on the list, so the interface has become more and more invisible over time (though, I think good design also plays a role).

1.2 Turn on the water

The level of directness and invisibility is low. The exposed thermostatic valve is the most complicated interface I have encountered in years. If "the feeling of directness is inversely proportional to the amount of cognitive effort it takes to manipulate and evaluate the system" (Hutchins et al., 1985), our faucet fails to inspire feelings of directness. The gulf of execution, i.e., semantic/articulatory distance, is significant. Even with the simplest of shower faucets, users do not directly manipulate anything that resembles water; clockwise/counterclockwise motions do not intuitively correspond to increasingly hot or cold temperatures, so the interaction is already far from the object. Then, if you add four different controls of different shapes and sizes on different planes of rotation, the task becomes really difficult when all you want is hot (but not scalding) water. The interface is 99% the focus, unfortunately, and that is due to bad design (even worse because of the shocking price tag on the item). The process of learning makes the interface more invisible, but when the interaction is so challenging in the first place, there is no way to completely achieve invisibility.

1.3 Flip to the next page

The level of directness and invisibility is high. The activity of swiping to the left as a means to turn the page and view another news article closely resembles the action required to turn the page in a hardcover book or printed newspaper. Graphically, the user can also see the object move off the screen (to the left) similar to how an actual page would move. While a user is engaged with the Apple News app, the goal (of reading the morning news in my case) is the sole focus. This level of invisibility can be attributed to great design, as both novice and expert users can achieve their goals quite easily.

1.4 Adjust the timer dial

The level of directness is high, but invisibility is slightly lower. This interaction requires minimal cognitive effort to manipulate (turn the timer dial clockwise, following the time stamp labels) and evaluate the system (the pointer lands somewhere next to a number, representing the number of minutes, and the user begins to hear a ticking noise as the dial slowly moves back towards 0). Notably, no other actions are possible, like pressing a button or flipping a switch. Further, the activity does not deviate from user expectations/preconceived notions based

on prior experiences with clocks and timers. Like the digital light switch, this task is simple, so the user is able to dedicate more thought to manipulating the interface. Unlike the digital light switch, however, some additional attention is required to make sure the dial is not turned too much (burnt toast!) or not enough (soggy waffle!). This need to focus on the interface has persisted over the years, so even for expert users, invisibility remains a goal rather than a reality.

2 LEARNING PROCESS

I have used Tableau Desktop, a robust self-service business intelligence tool, on a daily basis for nearly two years. It is widely known in the Tableau community that new or relatively inexperienced users will face a steep learning curve in the efficient and effective navigation of the interface (Figure 1), which is packed with functionality and allows for a high degree of flexibility.

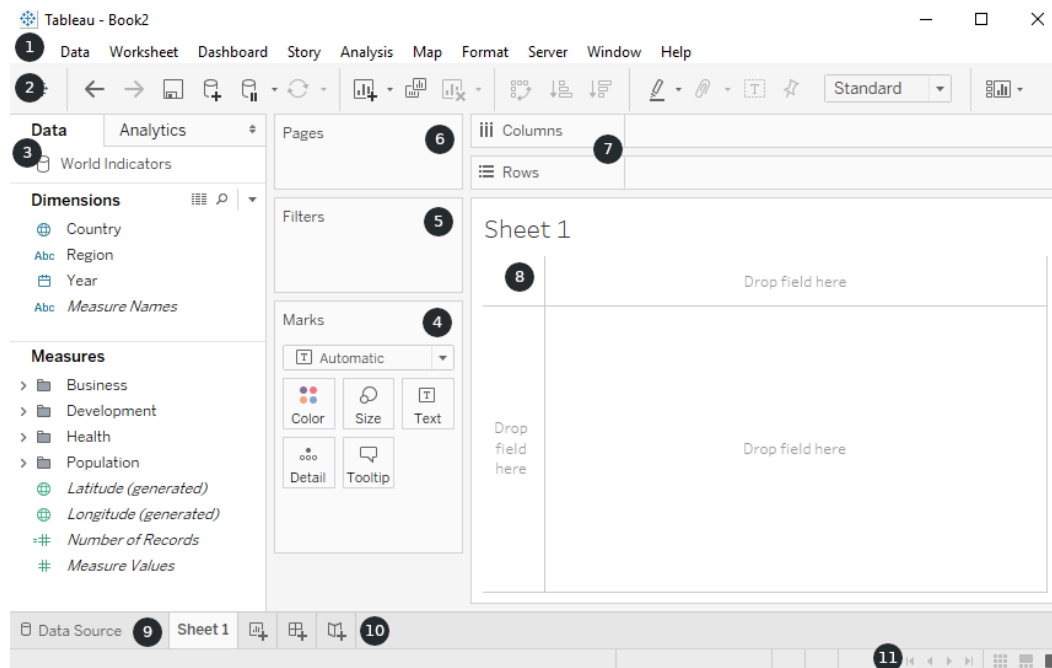


Figure 1—Tableau Desktop 2018.2.2 Interface (Worksheet View)

This particular client tends to prefer intricate, nuanced dashboards with more complicated graphics that draw on multiple data sources, so I needed to become familiar with its entire suite of features rather than just the basics. For me, the hardest part was to determine (and then subsequently remember) where the different functionalities are located within the interface; there are menus within

menus, and each interacts with the others in unique (and sometimes unexpected) ways. In the beginning, I spent as much time on Google as I did within Tableau Desktop! Consider, for example, the task of formatting text. Under the "Marks" card, users see some controls for basic text properties, like alignment and font size. The "Format" pane, accessed via the toolbar, includes similar options. The reality is that a novice user may try to change the font size in one of these menus and become frustrated when the worksheet does not appear to have recognized their input(s). For whatever reason, the specifications within the other menu may override those that the user is actively manipulating. A similar problem exists between the "Analytics" card and the "Analysis" pane, accessed via the toolbar. Only a small bit of overlap exists between the two, so the appropriate action sequence based on a desired analytical outcome is not intuitive enough and almost always requires novice users to backtrack or simply look around (somewhat blindly) until they locate the correct command. As such, too much time and effort is required of novice users for the actual execution of a task, even for basic operations.

My current process is entirely different because, over time, I have learned to quickly navigate the Tableau Desktop interface in support of my intended goals. I do not necessarily consider my knowledge, skills, and abilities to be "advanced" but believe my thought process is much more strategic now. To continue with the example of formatting text, I use a consistent plan of attack: (1) manipulate the "Text" controls under the "Marks" card; (2) if the text format deviates from expectations at any point in the development process, apply the same changes within the "Format" pane; and (3) if inconsistencies persist, copy the worksheet and wipe the formatting to create a clean slate. I no longer have to dedicate as much time focusing on the interface because I have memorized where the relevant commands are located and, through trial and error, have learned what troubleshooting steps are most likely to be effective. In a sense, my process is automatic now, despite the fact that the same, odd behavior may initially occur.

The Tableau Desktop interface will sometimes display error messages – many of which are ambiguous or poorly explained in layman's terms – but never warnings or hints to help the user make sense of these nuances. For example, if Menu A eclipses Menu B and the user completes an operation within Menu B, then a warning message could appear to inform the user as to why the expected result did not occur and direct the user to where else that same operation should

be performed. As for the "Analytics" vs. "Analysis" conundrum, consolidated or more distinctly labeled menus would also improve usability. Further, each Tableau Desktop license is issued to a specific person, so an opportunity exists for better memory-like functionalities to be directly incorporated into the user interface. For example, Tableau Desktop does not offer an out-of-the-box donut chart, yet this is a visualization I custom create on a semi-regular basis. That being said, I frequently have to look up the instructions (a fairly involved action sequence), so it would be helpful if the donut chart could be saved as a reusable protocol/template that appears with my other standard visualization templates.

3 TYPES OF HUMAN PERCEPTION

Task Domain: A fancy treadmill, cross-trainer, or stationary bike with advanced functionalities like heart monitoring, calorie-counting, rate variation, etc.

3.1 Current Feedback Mechanisms

3.1.1 VISUAL

High-end workout machines include LED displays that help users track progress and key metrics, including (but not limited to) speed, incline, distance covered, time elapsed/remaining, active workout program, total/avg calorie expenditure, current/avg heart rate, and upcoming changes dictated by the pre-set program. Some modern day machines also create a travel-inspired experience; due to the advanced graphics displays, users can feel like they are running circles around the Eiffel Tower or biking on a trail to Machu Picchu.

3.1.2 AUDITORY

Exercise machines have and always will beep a lot — when a button is pressed, the incline or speed changes, the cooldown period begins, etc. Some machines offer programs (or connectivity to programs) with live or pre-recorded fitness coaches, who provide verbal feedback/encouragement throughout the workout. Furthermore, there are also (potentially unintended) auditory outputs, like the motor working to adjust the incline of a treadmill.

3.1.3 HAPTIC

The most apparent example that comes to mind is the feedback that semi-raised/squishy buttons on the console give a user when pressed (the little bit of extra

give alerts the user that the button has indeed been pressed successfully). The sides of a treadmill provide some level of haptic feedback, simply due to their existence, because users will sense if they stray too far from the middle of the track and brush up against (or nearly against) the cold metal/plastic arms.

3.2 Potential Feedback Mechanisms

3.2.1 VISUAL

A current limitation of the graphic displays is the constant/universal rate at which the user passes stationary objects, regardless of their current speed. An upgrade in the visual feedback would be video or scenery that passes by faster when the user accelerates and similarly matches a slower pace. Motivational pop-up messages and/or warnings about over-exercise in extreme cases (both of which could be turned off by the user) could also be beneficial additions.

3.2.2 AUDITORY

Similarly, music could also change with the pace of exercise. Many modern day machines connect to the user's iPhone and even specific apps, like Spotify and Apple Music. In this case, different music could be chosen (based on beats per minute) to match a faster or slower run. The volume could increase/decrease accordingly (within a safe range), as well. If applicable, an audible beep — different from the standard beep for button controls — could be used to alert a user if their heart rate climbs too high.

3.2.3 HAPTIC

Research on haptic feedback mechanisms is an active field, currently. Interesting additions include (A) an automatic fan (pointed at the face, typically) that turns on/up when the user's heart rate increases, (B) a functionality to automatically lean as a simulation of left/right turns in the path, and (C) a vibrating heart rate monitor to help users ensure the intensity of exercise continues to be safe.

3.2.4 SMELL (*NEW*)

Imagine a travel-inspired workout machine that produces specific, faint scents depending on the environment/scenario that you choose to explore (e.g., the smell of ocean breeze when biking along the coast, the sweet smell of pine when running through the forest). A potentially useful...but also very ridiculous and undesirable...feature could be the release of a semi-foul odor if the user begins to

abuse the machine and push themselves too far (e.g., as evidenced by sustained activity in the "danger" heart rate zone).

4 REDUCED COGNITIVE LOAD

4.1 Emphasizing Essential Content While Minimizing Clutter

I recently started to use Microsoft Power Automate for one of my client projects. Each trigger/action must be introduced into the flow one at a time, so the "Add New Step" menu (Figure 2) is a heavily utilized interface.

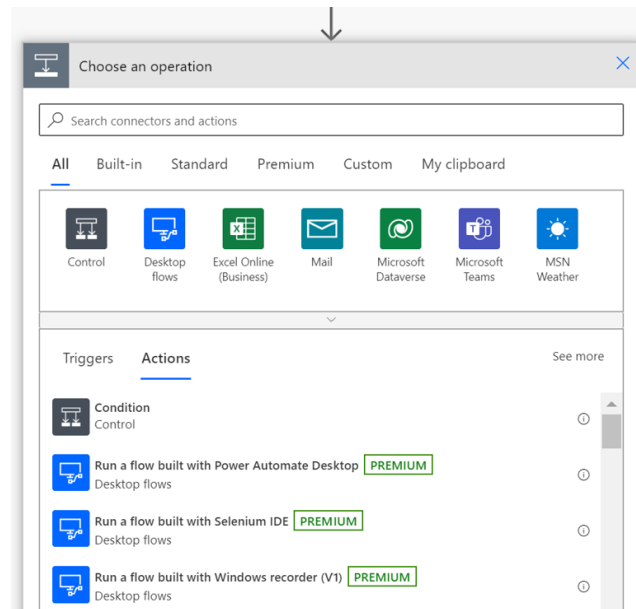


Figure 2—Microsoft Power Automate ("Add New Step" Menu)

Content appears to be arranged well at first glance, but users quickly come to realize the extent to which extraneous and poorly organized information clutter the interface and subtract from the user experience. This proves to be a source of frustration, but more importantly, when essential content gets lost amid the clutter, users are more likely to make wrong choices, which ultimately creates inefficiencies due to the need to backtrack.

Specifically, the default menu includes options only available to those users with a premium license. Since our client has not yet chosen to upgrade from the basic license and there is a "Premium" view, accessible via the textual ribbon, it does not make sense for these options to fill such a high proportion of the immediate view. Further, nearly 50% of the options in the graphical ribbon (i.e., Desktop

Flows, Mail, and Microsoft Dataverse) either cannot be used without a premium license or have not been enabled for the entire organization. These have been awarded prime real estate over critical (and more frequently engaged) connectors, like SharePoint, Outlook, Planner, OneNote, and Microsoft Forms, yet I cannot customize this interface at all to better suit my needs. To that end, there is also no "My Favorites" or "Most Frequently Used" view, so I am constantly performing the same searches over and over again.

To fix these issues, I would reconfigure the interface to reflect individual needs and preferences. Empower users to choose the icons they want to appear in their unique graphical ribbon, or at least allow users to remove icons from the default selection that are not relevant to their work (similar to how web browsers let users delete quick links from the default welcome page). I would also segment the list of actions, which would exclude premium-only options unless the user has the upgraded license, into two sections: "Favorites" and "Recommended for You." Then, to make the marketing/business development folks happy, I would make the "Premium" option stand out from the other options in the textual menu (maybe as a colorful button) to encourage exploration if of interest to users.

4.2 Giving the User Control of the Pace

The RealReal is my favorite place to shop for luxury consignment, but their app has room for improvement. Upon adding an item to the cart, a bright red countdown clock appears at the top of the interface and begins to count down from 20 minutes. If the customer does not check out in time (even if in the middle of the checkout process), the cart is emptied — to include items added within the 20 minute window — and the customer is forced to go search for those items again. Ultimately, the user experience ends up feeling stressful and chaotic, and that impacts their bottom line.

The aggressive countdown clock should be eliminated. Instead, when customers click "ADD TO BAG" and are routed to the "YOUR BAG" interface, they can be presented with a warning that items in carts are not reserved and may become unavailable if another customer completes their purchase first. The RealReal could notify customers if items in their carts become unavailable, or customers could opt out and request that all unavailable items be immediately removed from their carts. This approach conveys the same sense of urgency but delivers a less disruptive (more enjoyable!) user experience.

5 REFERENCES

Hutchins, E. L., Hollan, J. D., & Norman, D. A. (1985). Direct Manipulation Interfaces. *Human-Computer Interaction*, 1(4), 311–338. https://doi.org/10.1207/s15327051hcio104_2