

HCIN 630

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Autodesk Fusion 360  
Heuristic Evaluation Report

**Autodesk Team 1 (Group 3)**

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# Executive Summary

The Autodesk Fusion 360 is a cloud-based CAD/CAM/CAE tool for collaborative product development. Autodesk Fusion 360 combines fast and easy organic modeling with precise, solid modeling, allowing users to make their design manufacturable.

To gain more knowledge on how to improve the user interface while browsing Autodesk Fusion 360, the client of the software requested a usability evaluation and part of that includes the heuristic evaluation. Students in the Human-Computer Interaction Usability Testing course at the Rochester Institute of Technology conducted a Heuristic Evaluation and competitive analysis.

This report details our findings and proposes some adjustments to the interface of the software to enable users to interact with less confusion.

Each team member independently evaluated Autodesk Fusion 360 against a set of predefined usability and accessibility heuristics, recorded usability issues, and identified which heuristic violations occurred. Team members later consolidated and prioritized usability issues according to the criticality of the usability issues.

This evaluation identified 10 usability issues in Autodesk Fusion 360. The team recommends further evaluation on specific areas of focus toward improving the user interface. The next stages of the usability evaluation will do comparative analysis of competing products with Autodesk Fusion 360.

## Team Members' Backgrounds

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<b>Master's Degree</b>	Human-Computer Interaction	Human-Computer Interaction	Human-Computer Interaction	Human-Computer Interaction
<b>Bachelor's Degree</b>	Mechanical Engineering	Industrial Design	Computer Engineering	Information Technology
<b>Qualifications</b>	1-5 years of experience of using mechanical software, such as AutoCAD, PorE, SolidWorks, 1 years of working experience	4 years of using 3D model software, such as Rania, Creo	Have used AutoCad for a semester during Under-graduation. Conducted contextual inquiry, Affinity Mapping and Personas. Experience in Heuristic Evaluation and Web Accessibility evaluation on an educational website.	Experience conducting contextual inquiry, such as observation and interviews, creating personas, and affinity diagramming.

Table 1: Team Members' backgrounds

# Product Description

**Product's name:** Autodesk Fusion 360

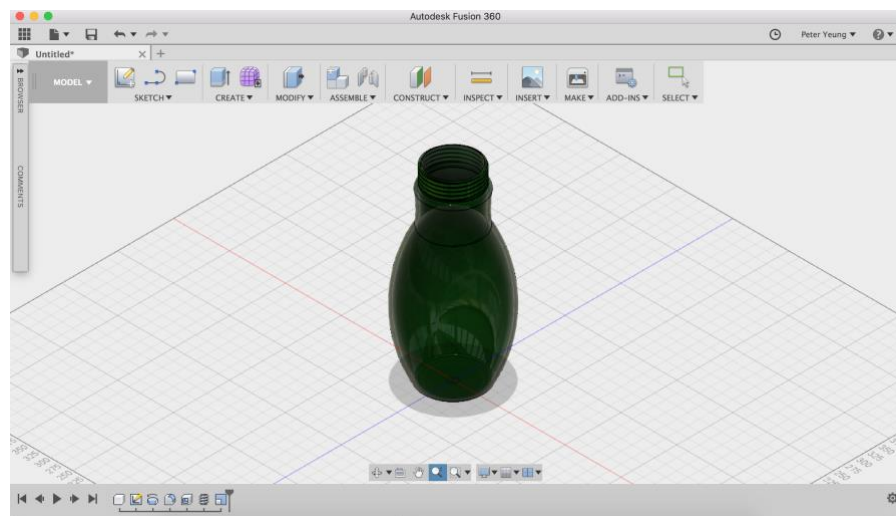
2.0.3803 on Mac, Active Plan: Fusion 360 Ultimate, Student available on both Windows and Mac.

The Autodesk Fusion 360 service is a cloud-based 3D CAD/CAM tool for product development that combines industrial and mechanical design, collaborating, and machining in a single package. It connects the entire product development process in a single cloud-based platform that works on both Mac and PC.

The target user audience are those who are interested in product design using CAD, including industrial designer and mechanical engineers as well as secondary students interested in design and technology.

Competitors of Fusion 360 includes Industrial Software, Mechanical Software, 3D Painting Software, such as Creo and Solidworks.

## *Overview of the Product and the User Interfaces*



*Figure 1: Autodesk Fusion 360 User Interface*

When opening the Autodesk Fusion 360, there is a menu bar that allows the user to create 3D models that can be modified and assembled, and it allows users to construct them. The menu bar has an option to inspect the model, options to create the 3D objects, assemble existing objects, add scripts to the model through the Add-Ins option, and select the model. Next to the sketch group, there is a drop-down menu listing render, animation, simulation, and drawing. On the bottom of the screen, there is a central bar that navigates (zoom and moves) the object. On the bottom-left of the screen, there are

buttons from the left to right: fast backward, backward, play, forward, and fast forward. When the user creates something, the software logs the history at the bottom panel beside these buttons. These buttons play the logged history in motion or by scrutinizing each step.

## *Context of Use*

The expected environments of use are indoor and quiet environments, such as office, classroom, lab, or home, with computers with at least two monitors. Each indoor environment has proper lighting and comfortable room temperature. The mechanical engineering students work on their homework or projects using the mechanical software at home. Users with the mechanical engineering background usually work as a group in the lab. After graduation, they become more familiar with designing the 3D objects using the various mechanical software.

Since Autodesk Fusion 360 is a single cloud-based platform, it works both on Mac and Windows that requires processing power. Input devices such as mouse and keyboard are typically used with Autodesk Fusion 360.

## *User Profiles*

There are three characteristics: novice, casual, and expert users. They have been segmented using the mechanical software. Users are also grouped by their expertise and motivational characteristics (Table 2 below).

<b>Characteristics</b>	<b>Novice User</b>	<b>Casual User</b>	<b>Expert User</b>
<b>Gender</b>	Male and Female		
<b>Culture</b>	May originate from different countries and cultures		
<b>Education</b>	Undergraduate, Graduate, and PhD		
<b>CAD Expertise</b>	Have little experience and knowledge of CAD	Have some experience and knowledge of CAD	Have professional experience or knowledge of CAD
<b>Use Frequency</b>	May use software every week but not consistently	May use software every day but not consistently	May use software every day consistently

<b>Motivation</b>	Motivation may vary but can include, creating the basic objects and learning simultaneously	Motivation may vary but can include, creating the objects for the projects and portfolio	Motivation may vary but can include, producing the advanced objects for the projects, and using it for the portfolio
<b>Attitudes</b>	Learning how to use the various software and gain the experience creating 3D objects.	Committed to learn how to use software for the projects and portfolio and gain sufficient experience creating 3D objects.	Ambitious working some various projects for the portfolio and work with the team to prepare projects.

*Table 2: User Profiles*

## *Stakeholders*

We identified direct stakeholders as an individual or a party that uses or buys the product or services of a company directly, such as users who design machines either for education or business (see Table 3). We also identified indirect stakeholders as an individual or a party who may not use Fusion 360 directly but is affected by the use of the system, such as shareholders of Autodesk. The direct stakeholders, such as professors, students, and enthusiasts, decide if they purchase Autodesk Fusion 360. If they use Autodesk Fusion 360 often, the income of Autodesk Fusion 360 increases, which would also increase the share price of Autodesk Fusion 360 that associate with the profit of shareholders. Because of growth of value for shareholders, shareholders would also invest more in this company, which would help the company to build better services for direct stakeholders.

Direct stakeholders of Autodesk Fusion 360, such as professor, student, engineer, and enthusiast, use Fusion 360 frequently. Usability of Fusion 360 closely affects these direct stakeholders because it affects their learning and academic performance. Their creation skills would improve their accuracy, precision, and speed of operation when using the software to build 3D objects.



Direct Stakeholders		Objectives
User	<b>Professor: (Expert User)</b>	To use Fusion 360 to teach students job-specific technology-based skills. To use Fusion 360 to research efficiently.
	<b>Student (Novice User, Casual User)</b>	To use Fusion 360 to enhance their skill set that is desired on the job market. Students need to be able to use software which are used in companies. As a result, if companies use Autodesk Fusion 360, students are motivated to learn and use this software.
	<b>Engineer (Casual User, Novice User)</b>	To work efficiently.
	<b>Enthusiast (Novice User, Casual User)</b>	To use and explore efficiently and creatively.
Customer	<b>Enthusiast or Engineer in small company</b>	Buy Fusion 360 for using and hope it is easy to use and cheap.
	<b>Education Institute</b>	Institutions want a cost-effective tool that gives students experience in a skill they can use to get a job.
	<b>Company</b>	Buy Fusion 360 for their employees to finish work duty.

*Table 3: Direct Stakeholders*

One of indirect stakeholder of the Autodesk Fusion 360 are shareholders of Autodesk company. Shareholders will want to increase dividends and make more money, and an indirect goal of theirs is to increase market share because that it one way they make money.

# Methodology

We used the 2.0.3803 version, on both Mac and Windows, version of the Autodesk Fusion 360 to evaluate the heuristic principles. The evaluation was conducted on Thursday, February 8, 2018, through Sunday, February 18, 2018.

During the evaluation process, the group defined the context of use for the Autodesk Fusion 360 by observing users interacting with various mechanical software in the environment of use, such as classroom, lab, and office. Each environment has proper lighting and comfortable room temperature. During our observation, mechanical engineering students used Solidworks because they were required to make a report template in advance.

In the 10-day evaluation, individual team members evaluated Autodesk Fusion 360 against predefined heuristics (Table 4 below). After individual evaluations, the group came together to consolidate findings by creating affinity diagram. We discussed and consolidated our findings in this report.

## Heuristics Evaluation Terms

The heuristic evaluation is when a group of experts reviews the product's or website's interface and compares it against accepted principles. The analysis results in a list of potential usability issues. There are 15 usability heuristics in this evaluation (Table 4):

Heuristic Term	Definition
<b>1. External Consistency</b>	The system uses interactions and design patterns that are consistent with the platform and analogous systems.
<b>2. Internal Consistency</b>	Words, phrases, signifiers and design patterns are used in a consistent manner throughout the system.
<b>3. Widgets and Labels near Targets</b>	Place widgets (controls) adjacent to their respective targets of operation and labels on, or directly adjacent to, their associated controls.
<b>4. Group like widgets/functions</b>	Use the gestalt principles of proximity, similarity, and closure to group widgets with similar functionality
<b>5. Frequently used functions optimized</b>	The system minimizes the user's cognitive load by keeping only the most salient information and signifiers visible
<b>6. Speak the User's</b>	The system "speaks" to the user in their native language

<b>Language</b>	using signifiers that are contextually relevant.
<b>7. Perceptibility of Feedback</b>	User interaction with the system must result in immediate, perceptible, and interpretable feedback.
<b>8. Perceptibility of System State</b>	The user must have the ability to perceive the state of the system at any given moment.
<b>9. Appropriate Selection of Design Patterns</b>	Are the optimal design patterns used within the system?
<b>10. Minimize Knowledge in the Head</b>	The system should display appropriate information for the user based on the context of use.
<b>11. User Control and Freedom</b>	Is the user in control of the application or does the application force the user adapt to the system?
<b>12. Error Prevention</b>	A system should prevent the user from making an error.
<b>13. Error Recovery</b>	Where error prevention is not feasible or desired, the system should provide graceful mechanisms to help the user recover from either system or user errors.
<b>14. Novel Interaction easily learned and recalled</b>	A system should support novel interactions that are easily learned and remembered.
<b>15. Help and Documentation</b>	Help should be easily accessible and may take the form of printed or electronic documentation, a knowledge base, or wiki or a live chat system.

*Table 4: Heuristic Evaluation Terms*

## Findings

After completing the heuristic evaluation of the Autodesk Fusion 360, we identified 11 usability problems that violate the usability principles we assessed against. We prioritized the issues to help identify which we believe should be addressed first. Each usability problem has its own number described in the Findings section (see Table 5 below).

Order of Severity	Usability Problem	Heuristic
1	No state for selected function	8. Perceptibility of system state
2	Possible misleading icon: a clock with red dot	1. External Consistency
3	Principle of “Help” function	15. Help and Documentation
4	Different operation of visibility setting	2. Internal Consistency
5	Position of document setting widget	3. Widgets and labels near targets
6	The position of the menu bar	12. Error Prevention
7	Search bar with wrong name inside the bar	12. Error Prevention
8	Operations regarding system setting can't be redone	13. Error Recovery
9	Violation of Conceptual Model	11. User Control and Freedom
10	Shortcut menu by right clicking and drag to eight different directions	11. User Control and Freedom
11	No feedback if no space to add sub-functions to the menu bar	7. Perceptibility of feedback

*Table 5: Order of Severity Table*

Order of Severity	Usability Problem	Heuristic
1	No state for selected function	8. Perceptibility of system state

### 1. No state for selected function

When user clicks on the function button in pull-down menu (red rectangle, Figure 2), the user expects to receive feedback that the user has chosen this function. This missing of information about selected function make users know nothing about which function they are choosing because they do not perceive a change in the status on the menu bar (red rectangle, Figure 3) and a change in the title of the control panel on the right side (blue rectangle, Figure 3) which violates perceptibility of system state.

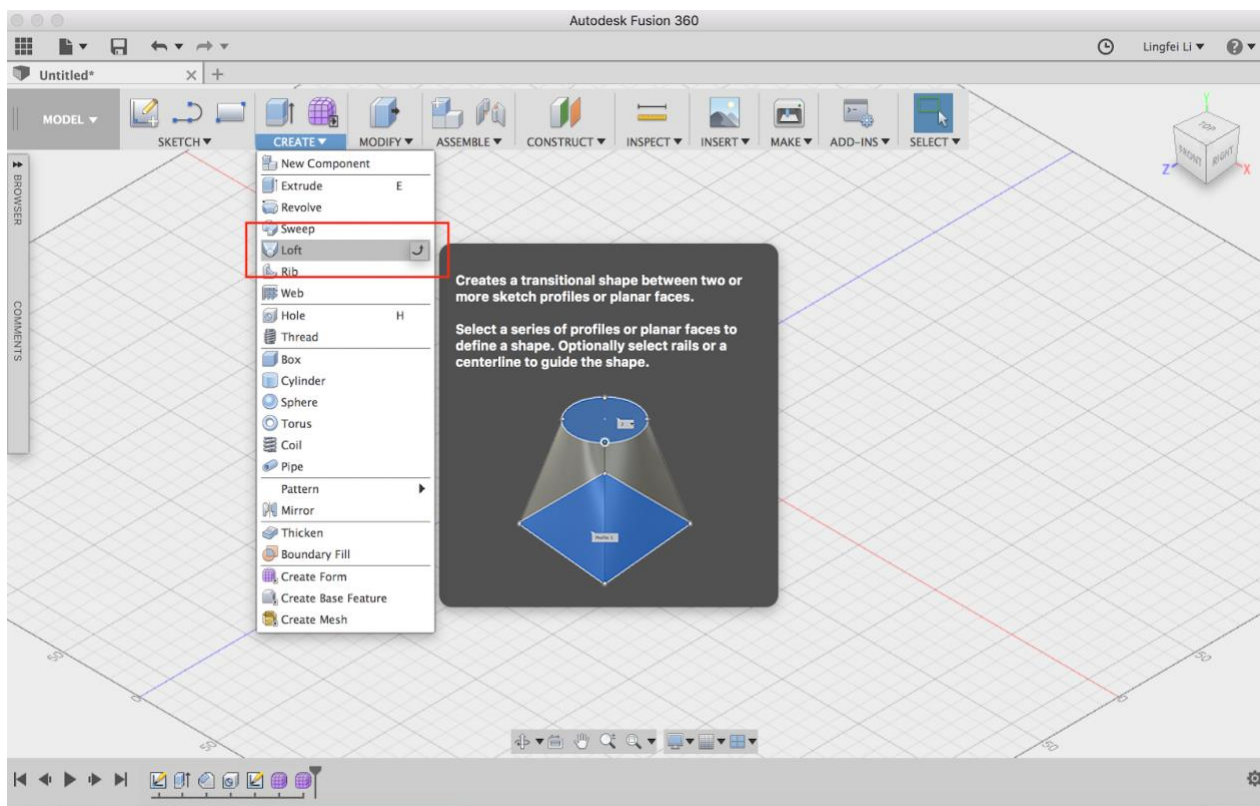


Figure 2: Function button in pull-down menu

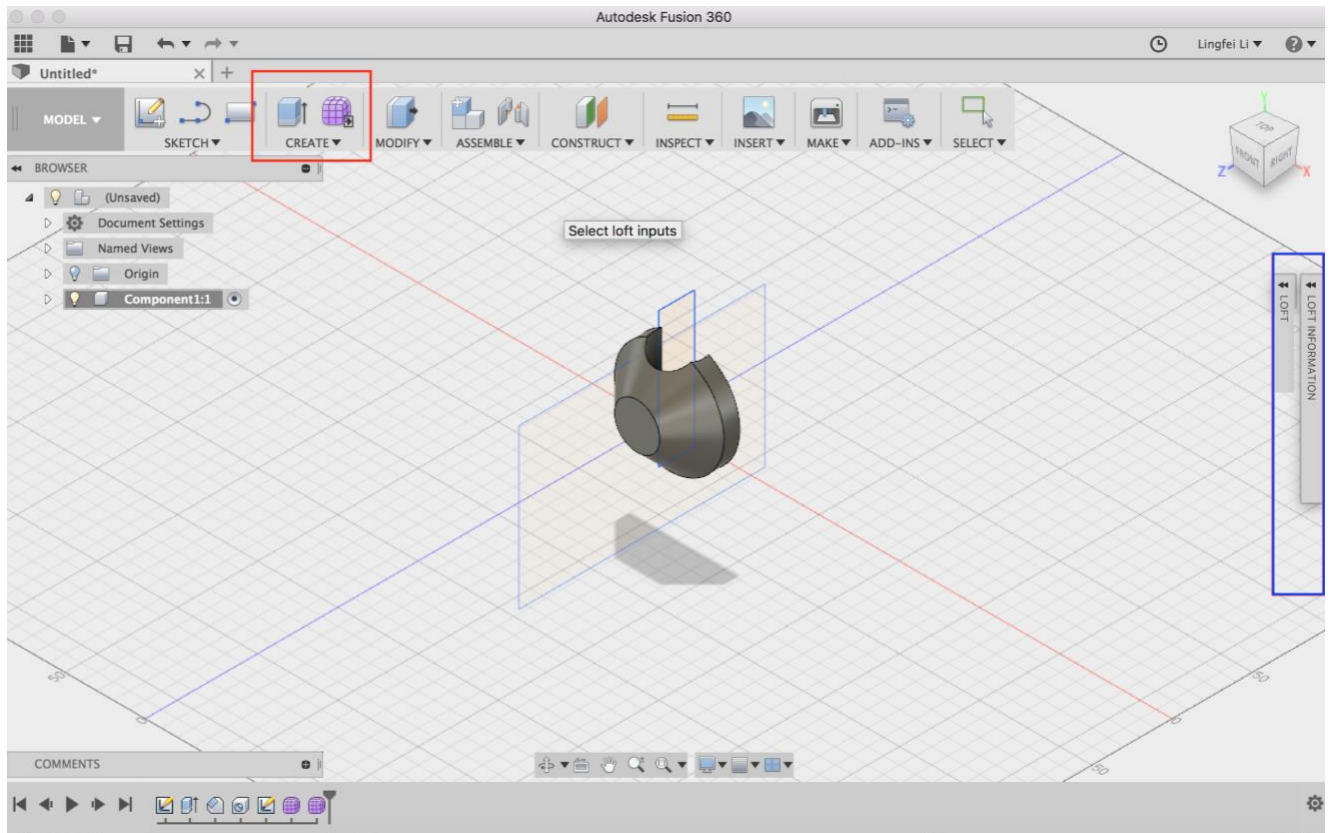


Figure 3: Interface after function button clicked

Order of Severity	Usability Problem	Heuristic
2	Possible misleading icon: a clock with red dot	1. External Consistency

## 2. Possible misleading icon: a clock with red dot

A clock icon on the top of the software window indicates user's "job status". User can click on it to change their status online or offline. When user is offline, the "job status" icon is a clock with red dot (Figure 4). A design change of removing the dot and turning the entire icon into different color may be clearer to user.



Figure 4: A clock with red dot

It violates external consistency because a red dot usually means "having unread notification" (Figure 5).

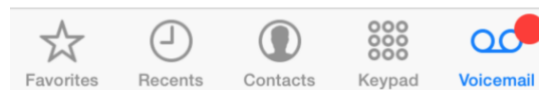


Figure 5: An example of the notification from Voicemail (external analog)

Order of Severity	Usability Problem	Heuristic
3	Principle of “Help” function	15. Help and Documentation

### 3. Principle of “Help function

The user searches a name of function in help part to locate the button for the function and expects the software to indicate where the button was (red rectangle, Figure 6). However, before pressing the enter key on the keyboard, the software does not show any relative information (e.g. location of the function) of the word (name of function). When the user presses enter key on the keyboard, the user is being forced to leave software to a website through an opened browser (Figure 7 on the next page). It interrupts the flow on software and difficult to operate software. It violates the principle that help function should be easy to access because help document is in another browser.

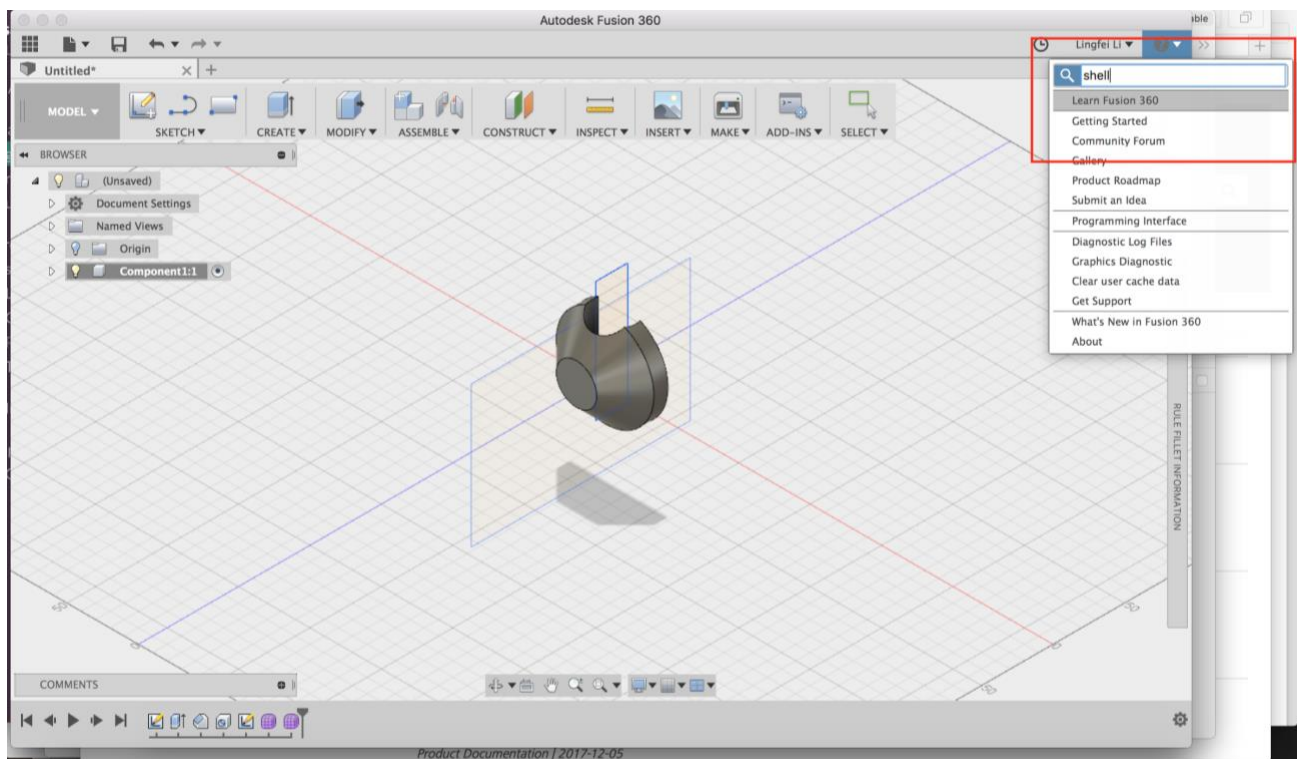


Figure 6: Searched a name of the function in help part to know where the button of function was



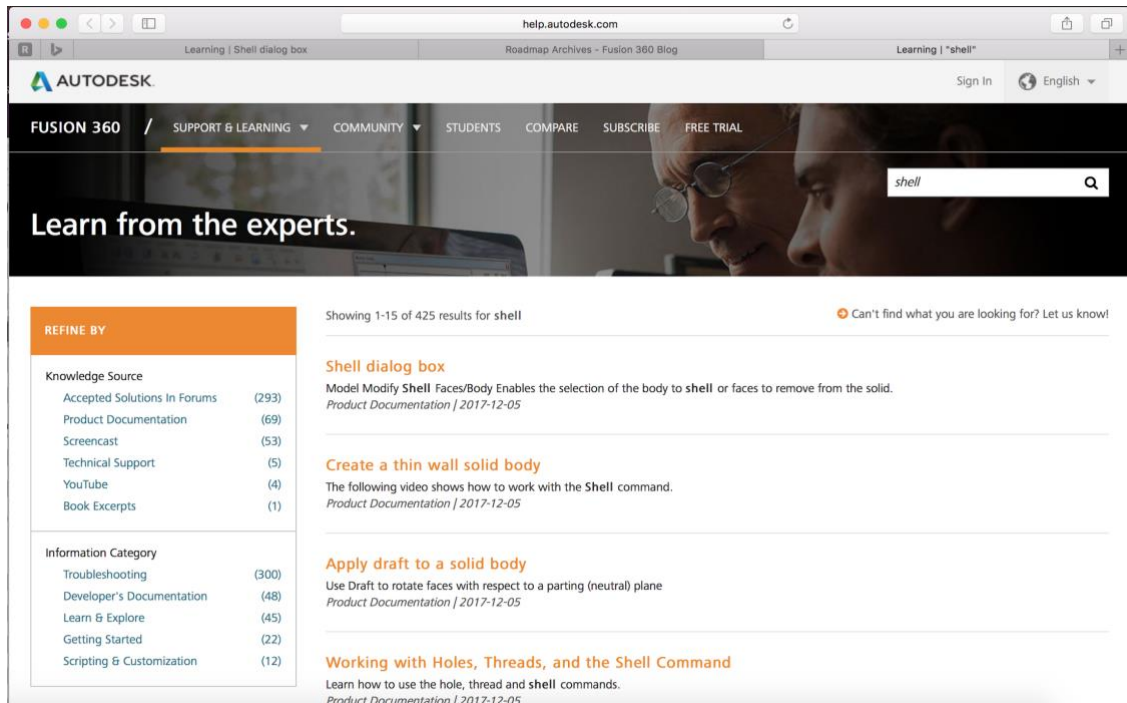


Figure 7: The help documentation from another browser

Order of Priority	Usability Problem	Heuristic
4	Different operation of visibility setting	2. Internal Consistency

#### 4. Different operation of visibility setting

Users can set common components, such as sketches and bodies visible/invisible by clicking on the “light bulb icon” next to the components in the “browser” menu (red rectangle, Figure 8). On the other hand, users have to click on the tool components to control its visibility. (red rectangle, Figure 9). It violates the internal consistency because the signifiers and design patterns aren’t used in a consistent manner throughout the system.

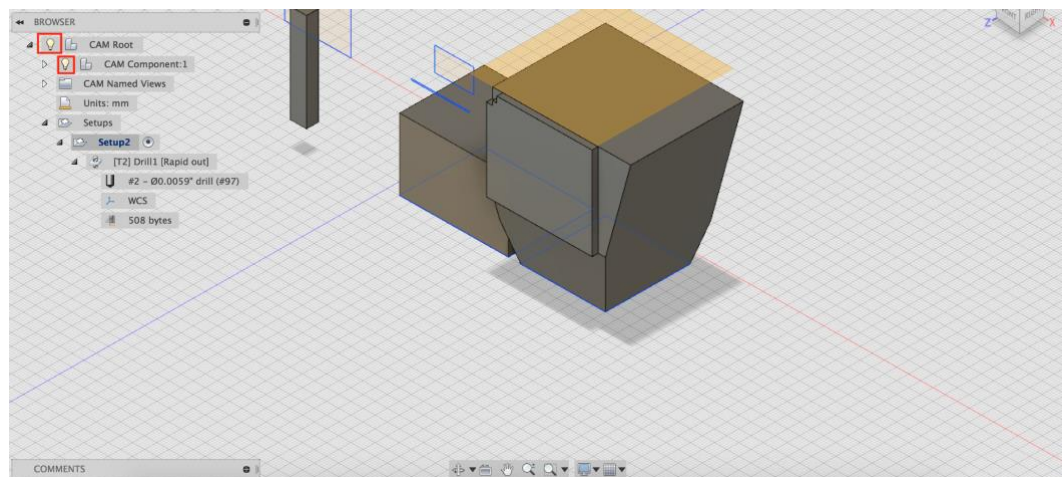


Figure 8: The visibility setting of common components

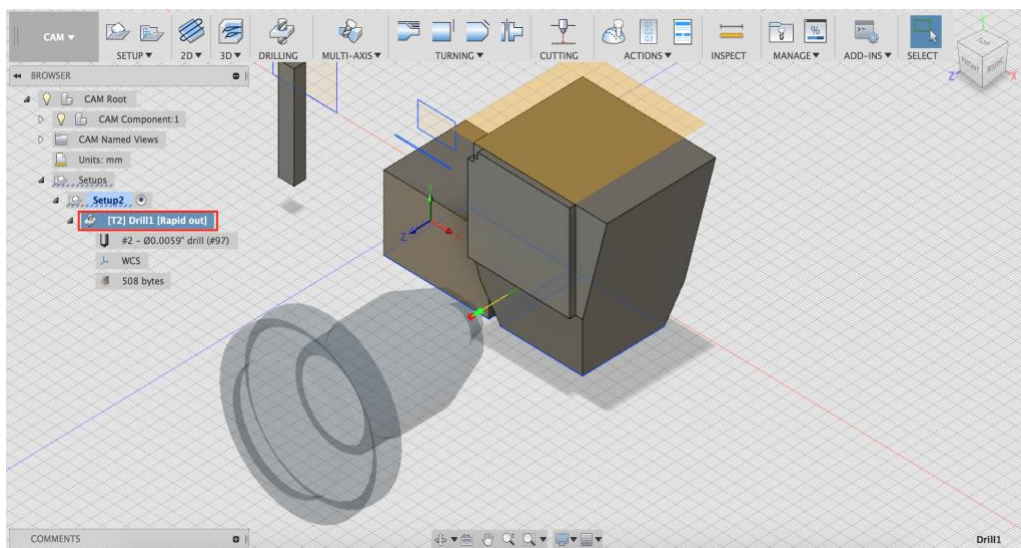


Figure 9: The visibility setting of tool components

Order of Priority	Usability Problem	Heuristic
5	Position of document setting widget	3. Widgets and labels near targets

### 5. Position of document setting widget

When clicking “Units:mm” under Edit drop menu, the box appears on the far-right side. After clicking on the “edit” button next to the “Units:mm” on the left in the window, the box to adjust the units pops up on the right in the window (red rectangle and red arrow, Figure 10). It violates the widgets and labels near targets because they are too far away, and users may not notice that box is for adjusting the units.

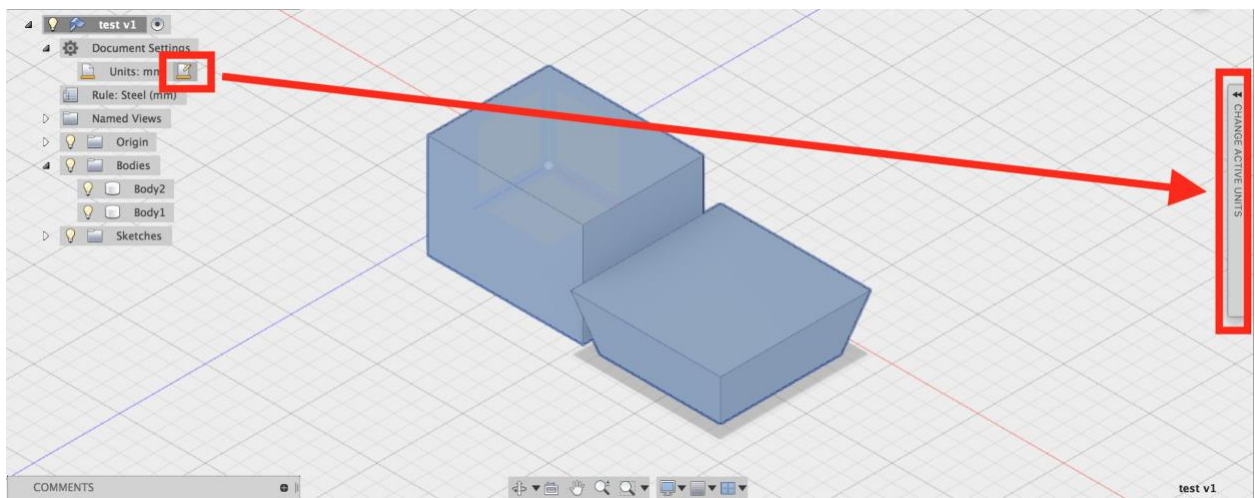


Figure 10: When clicking “Units:mm” under Edit drop menu, the box appears on the far-right side

Order of Priority	Usability Problem	Heuristic
6	The position of the menu bar	12. Error Prevention

### 6. The position of the menu bar

Users can adjust the position of the menu bar (red rectangle, Figure 11). However, if the menu is moved too high, it is not clickable for all the buttons on it and the menu itself (Figure 12). User can't move it or select those function. The freedom of operation violates the heuristic for error prevention because the system does not prevent users from making this error while users may accidentally move menu too high.

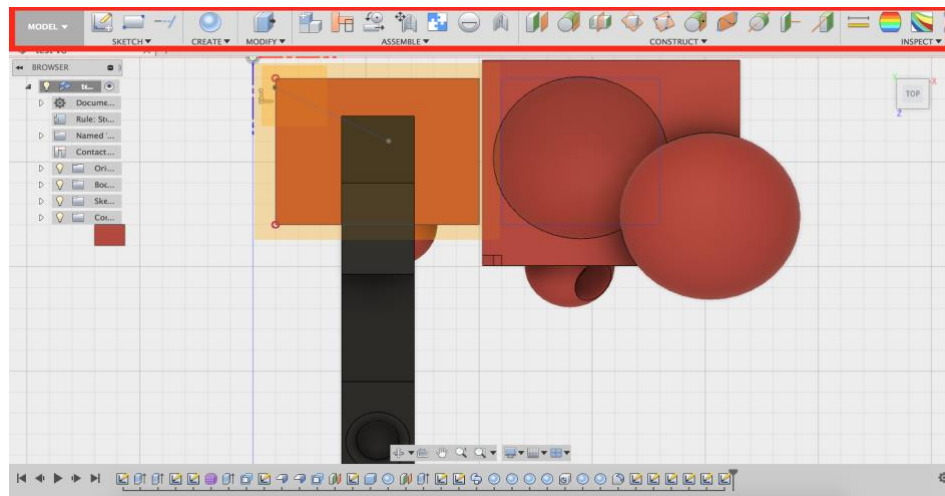


Figure 11: The error position of the ribbon

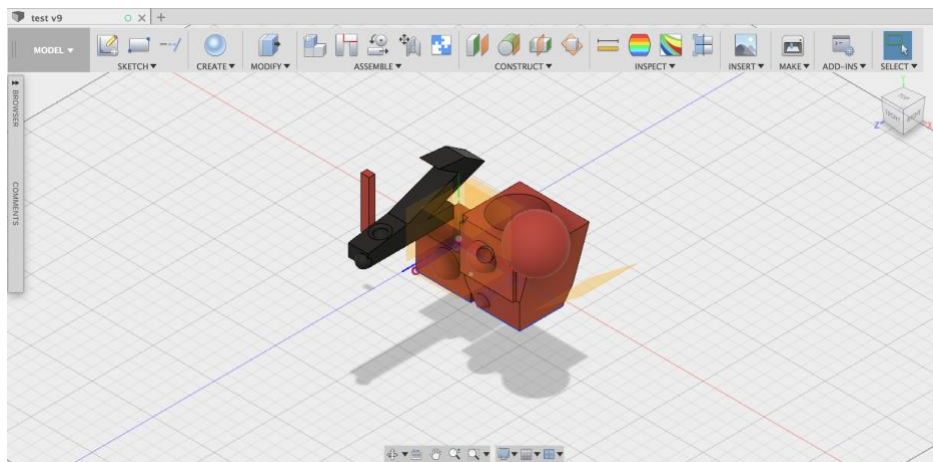


Figure 12: The original position of the menu bar

Order of Priority	Usability Problem	Heuristic
7	Search bar with wrong name inside the bar	12. Error Prevention

### 7. Search bar with wrong name inside the bar

When user uses help function to search a name with slightly wrong spelling of function in help part to find where the function is, a website appears through a browser (Figure 13). Users might expect the software would show possible or associated information. However, since the website shows nothing about that and doesn't keep user from making spelling mistakes, it violates the error prevention because a system should prevent the user from making an error.

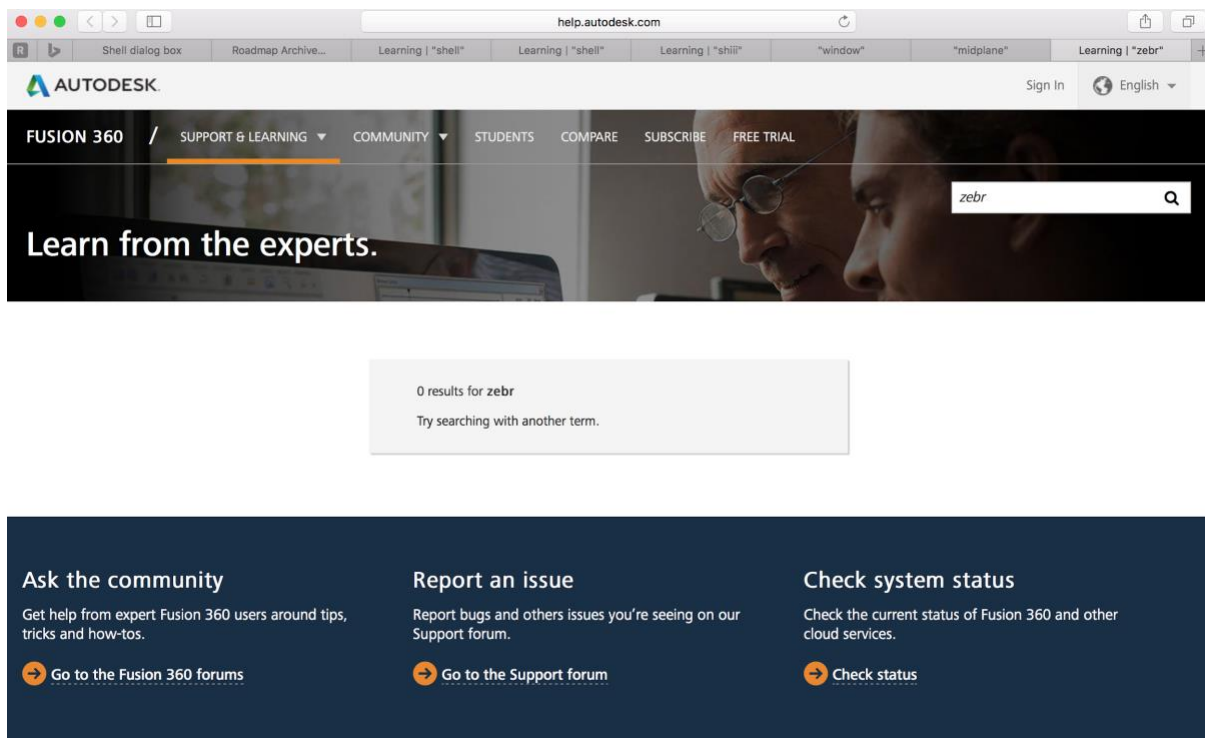


Figure 13: Results of search by name of function with wrong spelling



Order of Priority	Usability Problem	Heuristic
8	Operations regarding system setting can't be redone	13. Error Recovery

### *8. Operations regarding system setting can't be redone*

Users can remove the function from the menu bar by dragging the icon out of the menu bar. When users mistakenly change the setting of system or interface, such as removing function icons from the menu bar, users might expect undo to cancel the last operation of system setting as canceling commands. However, the undo function can only cancel commands used to create or modify components, such as sketches and bodies, but cannot cancel operations of system setting (red rectangle, Figure 14 and 15 on the next page). It violates the error recovery principle that users should be able to undo all their operations easily.

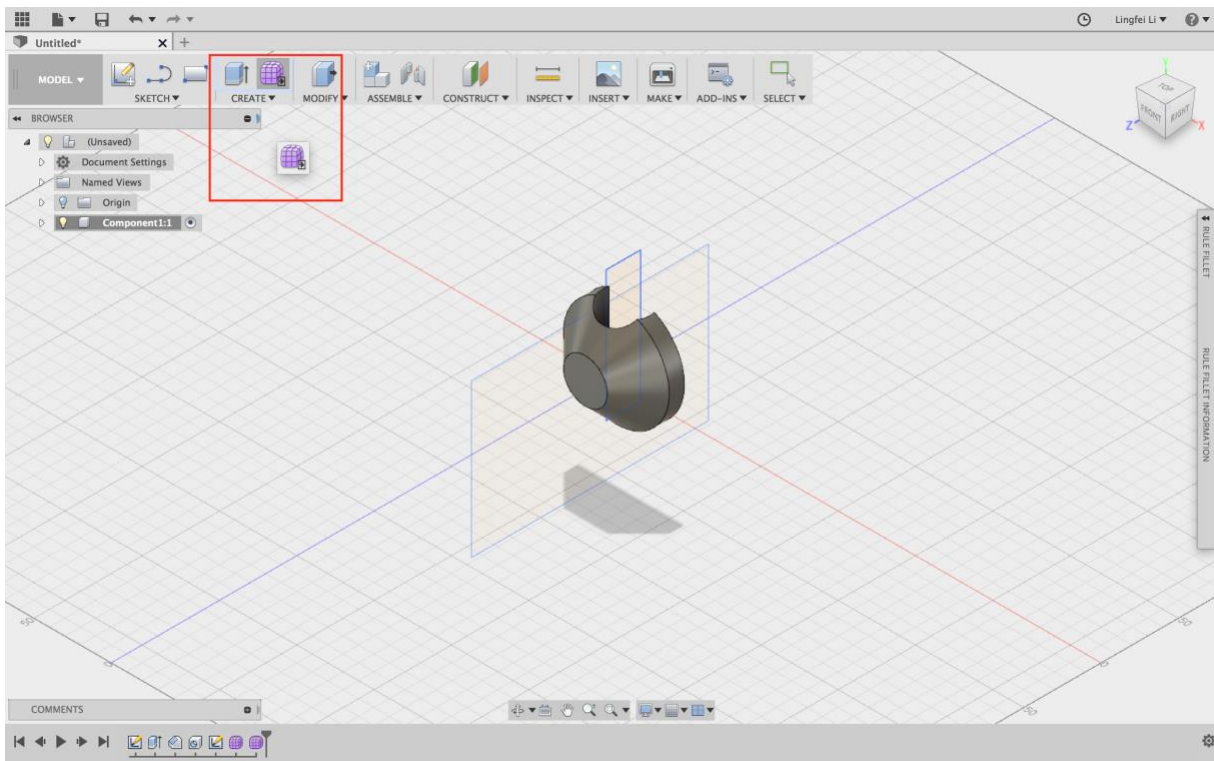


Figure 14: Remove function by dragging the icon out of menu bar

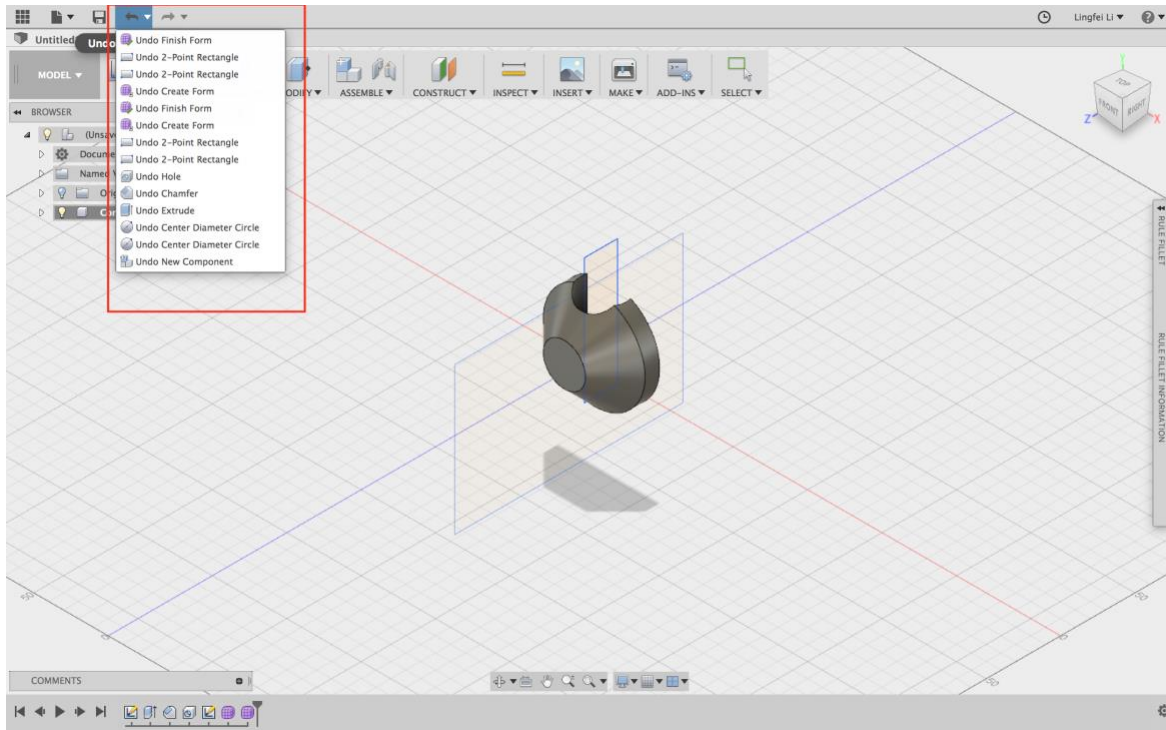


Figure 15: When changing the setting of the system or interface, removing a few functions. Expected to undo to cancel the last operation as canceling function in use

Order of Priority	Usability Problem	Heuristic
9	Violation of Conceptual Model	11. User Control and Freedom

### 9. Violation of Conceptual Model

When the 3D object is created, the software asks for the dimensions in millimeter (mm) (red arrow pointing down, Figure 16). Here the dimension box appears when the object is selected. Generally, if a user wants to deselect the object, naturally the user will click in the blank grid area around the object. But, the software doesn't allow user to deselect the object or to disappear the dimension box by clicking in the blank space. Most of the software has a feature of allowing the user to deselect the object by clicking in the blank space around the object. The user's conceptual model may not clearly match what is shown, violating the User Control and Freedom because users are then unable to cancel their unfinished operation easily and naturally. Either the user needs to press Enter from keyboard or has to click the mousepad on laptop with two fingers. Then the option of OK pops up. After clicking OK, the box disappears.

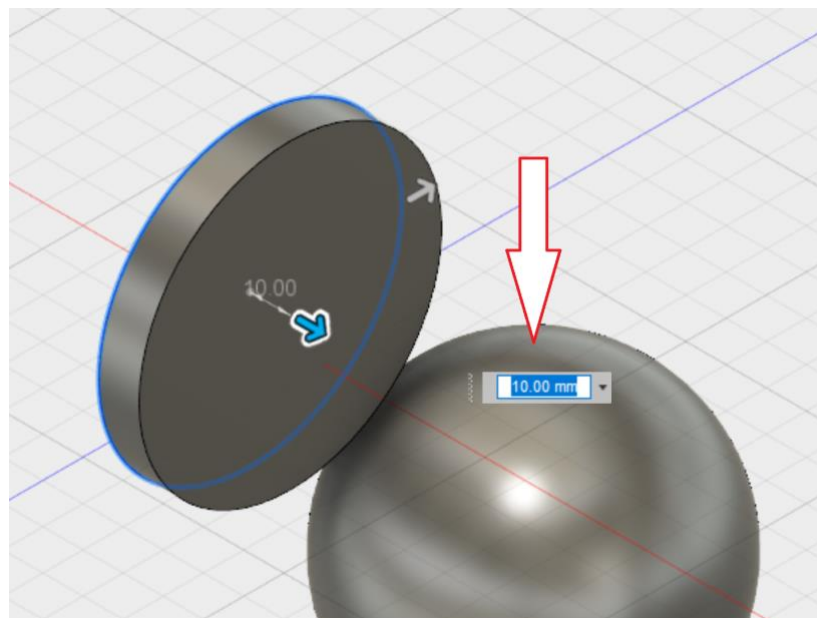


Figure 16: The dimension box does not go when user clicks in other area of the screen



Order of Priority	Usability Problem	Heuristic
10	Shortcut menu by right clicking and drag to eight different directions	11. User Control and Freedom

### 10. Shortcut menu by right clicking and drag to eight different directions

User can press right button on the mouse and drag to eight directions to perform different functions (Figure 17). For instance, users can drag their mouse to upper right to select the “press pull”. However, users may accidentally trigger the “redo” (Figure 18) if they don’t pay attention or moving their mouse too fast. It violates user control freedom because the system should prevent users from triggering an event accidentally.

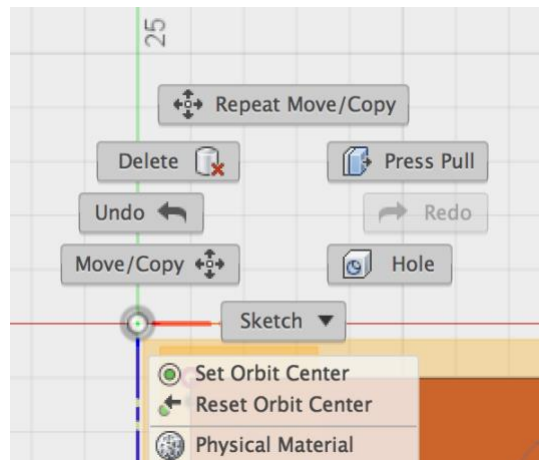


Figure 17: Shortcut menu by right clicking and drag to eight different directions

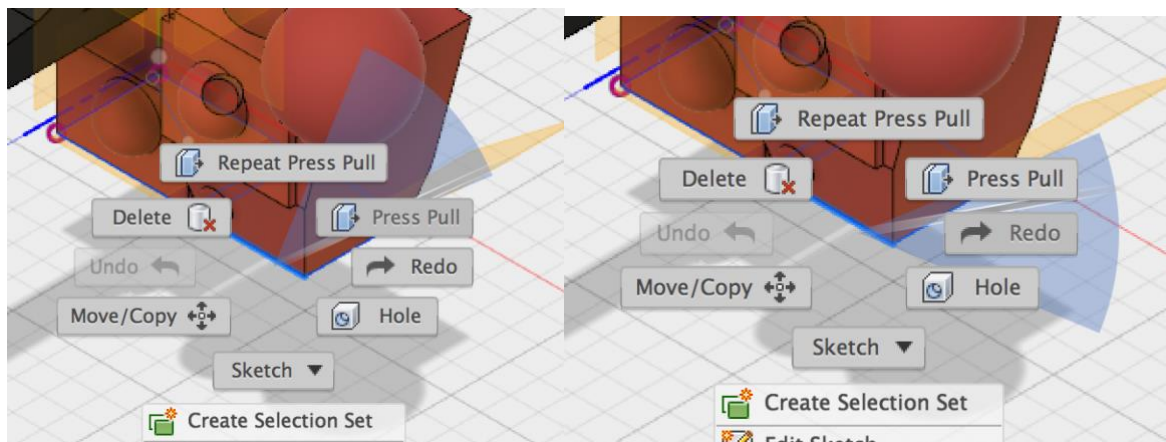


Figure 18: Drag to trigger “Press Pull”

Order of Priority	Usability Problem	Heuristic
11	No feedback if no space to add sub-functions to the menu bar	7. Perceptibility of feedback

### 11. No feedback if no space to add sub-functions to the menu bar

Users can add sub-functions to the menu bar (red rectangle, Figure 19). The capacity of feature icons is 22 on the menu bar when using a 13" display laptop. If space is not enough for the function, when users click the “add to menu” button, the selected feature does not add to the menu bar and nothing will happen. However, if users check the submenu and hover on the same function icon again, users see the “add to menu” icon has already turn into “remove from the menu” icon (red rectangle, Figure 20). It violates the perceptibility of feedback because there is no immediate indication of why the function isn’t added to the menu bar unless users check it again.

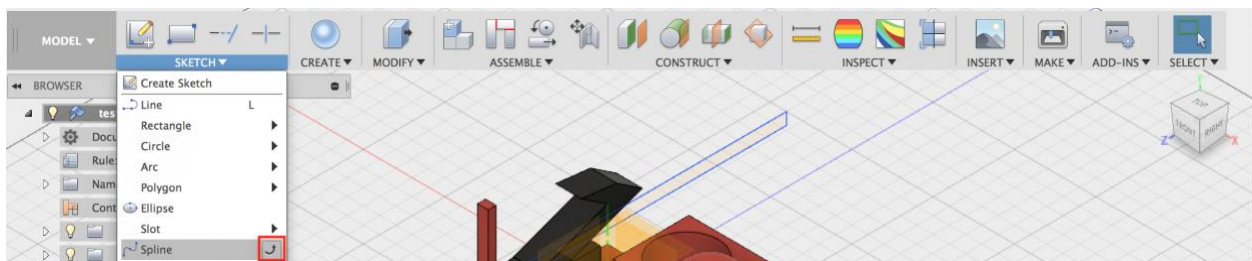


Figure 19: Sketch with some various features to add to the menu bar

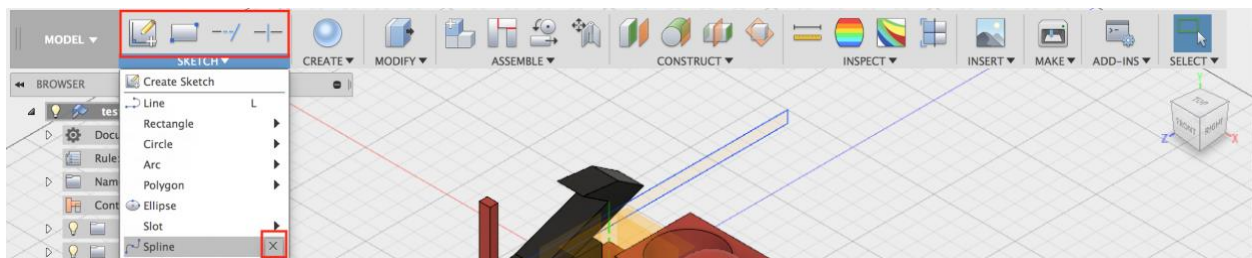


Figure 20: Sketch with some various features to add to the menu bar

# Conclusion

The evaluations were conducted by referencing heuristic evaluation principles. We independently evaluated the Autodesk Fusion 360 against a set of predefined usability and accessibility heuristics and identified which heuristic violations occurred. We consolidated and prioritized usability issues according to the criticality of the usability issues. We consolidated our findings into the report.

By way of heuristic evaluation and analysis, usability problems in the user interface of the software were identified by the team members to be addressed by the developers of the Autodesk Fusion 360. The report recommends some changes to software to help users who are interested in product design, as well as students, are involved in design and technology.

The results of testing reveal that Fusion 360 is perfect in usability, even though there is some slight flaw in interface and interactive way of this software. This report proposes some adjustments to the interface of the Autodesk Fusion 360 that further encourage users to interact software without confusion.

For the test plan, the team members will observe students using the different mechanical engineering software. We will observe how long it takes the student to finish creating the 3D object with two software: their preferred software and Autodesk Fusion 360. During the usability testing, we will interview to establish the user goal for the overall satisfaction of the mechanical software.