

HEURISTIC EVALUATION & ERROR ANALYSIS OF A SHREDDER

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EXECUTIVE SUMMARY

A heuristic evaluation of a shredder (Fellowes model # W11C, 2012 make) was conducted by the researcher. The researcher referred to the 10 heuristics as suggested by Nielsen (1995) to evaluate the user interface of the aforementioned shredder. This heuristic evaluation was conducted on November 10th, 2013 at Morrisville, NC at the researcher's home-office. To aid the process of the evaluation, the researcher also referred to error analysis¹, which had task analysis as its part. The heuristic evaluation suggested that the shredder had a minimalist design, gave the user an indication of the status of the shredder's operating mode and most of the instructions and safety precautions were part of the interface itself. The main usability issues seemed in terms of unintuitive label of one of the operating modes of the shredder ('I' for on), inconsistency in the way the controls behaved on the interface and the pictorial depiction of instructions and precautions and lack of some of the relevant instructions.

¹ The error analysis was conducted by the researcher as part of a course assignment for PSY 743 Ergonomic Performance Assessment.

FINDINGS SUMMARY

Table 1: Summary of main findings of the Heuristic Evaluation

Sr. no.	Heuristic	Usability Issues	Recommendations
1	Visibility of System Status	Indicates the status of operating modes of the device and the status of safety lock	Can make it more salient by having an indicator in the form of a light against the active mode
2	Match between the system and the real world	Unintuitive label (I) for the 'on' mode	Use 'On', 'Off' and 'Reverse' as labels
3		The current order of the operating modes is on, off and reverse from left to right	Test users regarding which is the most common sequence of using operating modes
4			Separate 'reverse' mode altogether and test this new interface with the users
5	User Control and freedom	The operating modes support undo and redo. 'Off' and 'reverse' provide emergency exits	Avoid the possible misunderstanding of 'O' standing for 'On' by renaming the modes as 'On' and 'Off'
6	Error Prevention	Unintuitive icons for instructions	Test current icons and redesign & test new icons, if need arises
7		Instructions regarding operation, maintenance missing from the interface	Integrate these instructions on the interface or on the device
8			Add a sensor to the device that detects possible violations of the instructions and safety precautions
9	Consistency & Standards	Inconsistent icons	Redesign the icons in a consistent manner
10		Inconsistency in the manner in which the controls operate	Standardize the operation of the controls
11	Recognition Vs. Recall	Relevant instructions depicted on the interface pictorially	
12		Instructions regarding operation, maintenance missing from the interface	Integrate these instructions on the interface or on the device

13	Flexibility & Efficiency of use	Not Applicable	
14	Aesthetic & minimalist design	The interface is uncluttered and there is no information overload	
15		Good affordances in terms of controls and handle	
16	Recovery from errors	Off and reverse modes offer a way to recover from some errors	
17		No clear way of recovering from the error of inserting inappropriate material and over heating of the device	Add a sensor to the device that detects possible violations of the instructions and safety precautions
18	Help & Documentation	Relevant instructions depicted on the interface pictorially	
19		Online manual with information and pictorial depictions available	
20		Instructions regarding operation, maintenance missing from the interface	Integrate these instructions on the interface or on the device

INTRODUCTION

Paper shredder is a device that is encountered pretty frequently in our day-to-day lives. Paper shredders are used not only in large offices (e.g. Government agencies) but also by private individuals at home offices to destroy confidential and private information. Shredding paper ensures that someone with a negative motive does not get an opportunity to misuse one's private information.

History of paper shredder suggests that though it was invented in 1909 it was not used commercially till 1935. From a manually operated hand crank paper shredder in 1935, to the electronic shredders of today, this device has had a long innovation journey. However, paper shredder was not a usual device found at homes/home-offices until mid 1980s when legally warrantless search seizure of garbage left outside homes was allowed, after this more and more private individuals with privacy concerns started using shredders.

Fellowes is an organization that produces business machines, record storage and office accessories. Fellowes is a global leader in shredders and manufactures shredders for various consumers in the categories of government approved, household, small home-offices and commercial shredders. Thus they cater to wide range of consumers, each having a specific need for shredding materials. Fellowes is a world leader in this area, but a highly usable product will ensure a loyal customer base and would definitely add to the bottom line.

METHOD & ANALYSIS

The current study evaluated the user interface of shredder manufactured by Fellowes Company (Model #: W11C, 2012 make). The researcher conducted the error analysis based on the manual of the shredder found online². After the error analysis the researcher referred to following 10 heuristics for evaluating the interface by Nielsen (1995):

1. *Visibility of system status* – The system should always keep users informed about what is going on and where they are in a process.
2. *Match between the system and the real world* – The system should speak the users' language by using words, phrases and concepts familiar to the user. Avoid system-oriented terms.
3. *User control and freedom* – The device should have clearly marked "emergency exit" in case the user selects a function by mistake. Support undo and redo.
4. *Error prevention*- Try and prevent errors from occurring in the first place. Either eliminate error-prone conditions or design a way to check for errors.

² The manual can be found online at http://assets.fellowes.com/manuals/W11C_Manual_3L_2012.pdf

5. *Consistency and standards* – Have consistency in using labels, situations so on and so forth so that users need not figure out every label, situation, etc.
6. *Recognition vs. recall* – Design so as to reduce the load on user's memory by making objects, actions, and options visible. Make the information accessible rather than making the user recall information.
7. *Flexibility and Efficiency of use* – Try and speed up the interaction for the expert user yet the system should cater to both inexperienced and experienced users.
8. *Aesthetic & minimalist design* – Design aesthetically yet keep the design minimalist with only relevant pieces of information as part of the design.
9. *Recovery from errors* – Use plain language for error messages. Ensure that the error messages express the problem and suggest a possible recovery from the error and/or a solution.
10. *Help & Documentation* – It should be easy to search through Help & Documentation, it should be focused on the user's task and context, steps to be taken should be listed and it should not be too long.

The aforementioned 10 heuristics were mainly derived and designed to study user interfaces of websites and software products. However, most of them are applicable to a product like a shredder, evaluated here.

The researcher decided to use the heuristic evaluation rather an expert review since she has background in the cognitive psychology, and an expert review was deemed appropriate and feasible.

The researcher thought that doing a cognitive walkthrough will be akin to doing error analysis and would have been a redundant academic exercise. Thus, the researcher decided to complement the error analysis with the heuristic evaluation.

RESULTS & DISCUSSION

The main and only function of the shredder considered for this evaluation was shredding of paper/card. Its interface can be seen in Fig.1 with components labeled.

The workflow considered here was that of shredding paper or card. To shred paper safely, a user needs to plug-in the shredder, then switch it on by moving the slider control. Ensure that the safety lock is on. Insert the materials (not more than 11 pages or a single card at a time) in the shredder. To be used continuously, the shredder must be used in short bursts of 5 minutes to avoid over-heating of the device. After the material has been shredded, the shredders needs to be switched off using the slider control and unplug the shredder. Other

than safety concerns being of top priority, other sources of errors are inappropriate materials being inserted (e.g. cardboards, paper clips) and too much of appropriate materials being inserted i.e. more than 11 pages at a time or more than 1 card

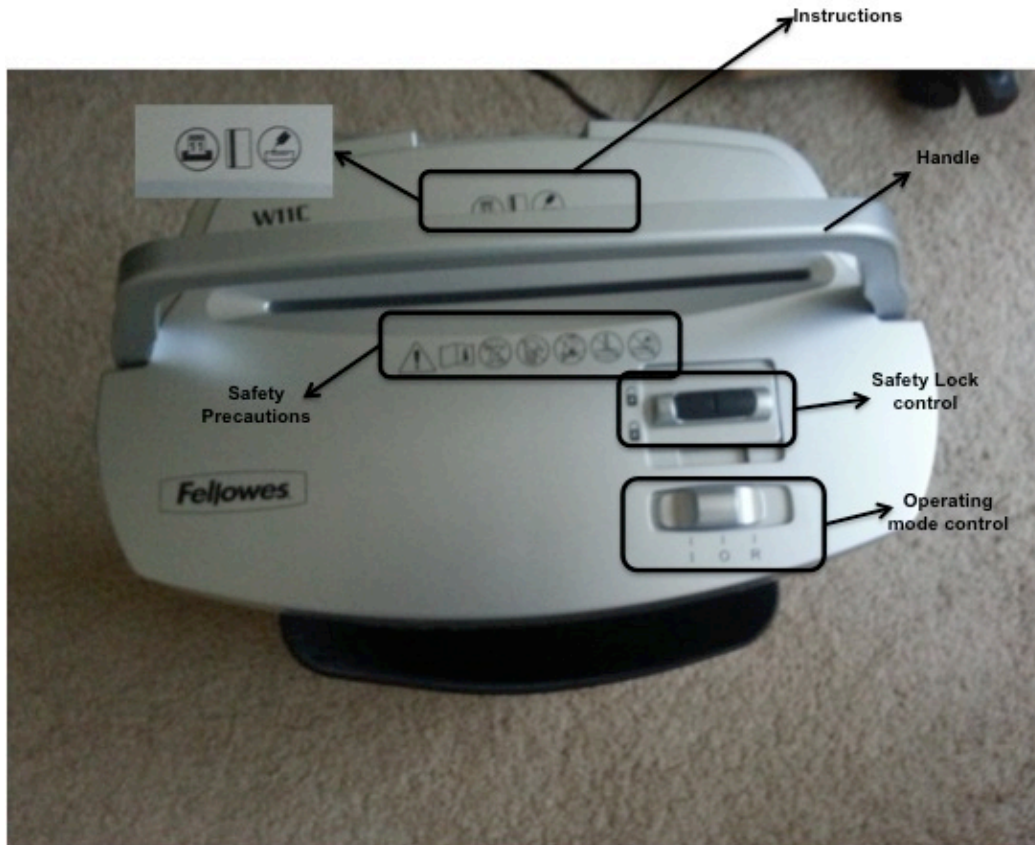


Fig.1: The user interface of the Fellowes W11C shredder (2012 make)

ERROR ANALYSIS:

The error analysis was conducted after referring to the manual of the shredder available online. The error analysis consisted task analysis as its part (Refer to the 'Steps' column in Table 2). The researcher deemed that a task analysis and subsequent error analysis would help in evaluating the interface more thoroughly. The process of task and error analysis uncovered the error of prolonged use of the shredder, which could have been easily missed if the evaluation would have considered the interface alone.

Table 2: Error Analysis of the shredder

No.	Steps	Error	Error recovery	Probability of Error	Error Consequence	Criticality of Error
1	Set Auto off	Auto on is selected	Reselect auto-off	High	Safety is compromised	High

2	Plug in the Shredder	Shredder is already plugged	None	High	Safety is compromised	High
3	Set Auto On	The shredder is still auto off	Reselect Auto-on	High	User unable to shred the paper/card	High
4	Set Safety Lock on	Safety lock is off	Select Safety-lock on	High	Safety is compromised	High
5	Feed Paper/Card	Too much of paper at one time	Not more than 11 pages at a time are fed in the shredder or use the combination of 'off' and 'reverse' mode in case of paper jam	Medium	More than 11 pages result in paper jam. This would affect the longevity of the device	High
6		Insert inappropriate material for shredding	Retrieve the material from the shredder	Medium	May affect the longevity of the device	High
7	Run for 5 minutes	Too much continuous use	Stop using the shredder after every 5 minutes	High	Shredder triggers cool down and takes 20 minutes to cool down. Shredding would become time-consuming. Prolonged use would wear down the shredder and affect the longevity of the device	High
8	Set Auto Off	Not turned off	Select auto-off	High	Safety is compromised	High
9	Unplug the Shredder	Shredder still plugged in	Unplug the Shredder	High	Safety is compromised	High

HEURISTIC EVALUATION:**1. Visibility of status**

The current interface does a decent job of indicating in which mode the shredder is (On, Off, Reverse) and whether the safety lock is on or off.

The user can see the status of the modes by looking at the position of the slider control.

Even though the status can be seen, it can be made more salient by adding a light indicator besides the active mode to let the user know that the shredder is on, off or reverse and whether the safety lock is on or off.

2. *Match between the system and the real world*

Currently, the label for the 'On' mode of the shredder is unintuitive. To switch the shredder on, the user needs to slide the slider control to 'I' to the left (See Figure 1). This does not seem intuitive when compared to 'O' for off and 'R' for reverse.

It is recommended that since 'On' and 'Off' are small words, use the whole words to stand for these modes.

Currently the way the on, off and reverse modes are arranged, off is between on and reverse, with on to the left. A reverse mode is used in case of a paper jam. There are 3 ways to deal with paper jams after emptying the bin as mentioned in the user manual:

- a. Use the reverse mode
- b. Alternately try the on and reverse mode slowly
- c. Switch off, pull the jammed paper and use the reverse mode.

Based on these workflows, it seems like off and reverse mode are appropriately placed side by side. However, it might be still worthwhile to test how frequently reverse mode is used and in which sequence after the on and off mode, to aid the placement of this mode.

Another suggestion is to try a design where the reverse mode is separated altogether and test its usability.

3. *User control and freedom*

In the current interface, the emergency exit for the user is to switch the shredder off or use the reverse mode in case of paper jam by using the slider control. The modes of on, off and reverse support undo and redo.

Since the current shredder is a device where only few workflows are possible, these seem like intuitive enough marked 'emergency exits' with another possible one being unplugging the device. The only possible usability issue might arise if the user mistakenly assumes 'O' to stand for 'On'.

4. *Error prevention*

The current user interface has instructions regarding using the shredder displayed using pictures. For example, the appropriate number of pages, only one card can be inserted in the shredder at a time (See Figure 1).

Since, the shredder is a simple device with limited workflows, the designers have used a minimalist way of presenting the information and appropriately so since it seems unlikely that a user would refer to a manual to use a shredder.

However, some of the general instructions and precautions depicted pictorially do not seem to be intuitive. For example, the image of a card above the shredder opening (See Figure 1) may indicate to a user that one can shred cards in this shredder but not that one has to insert only one card at a time in the shredder.

It is recommended that some user testing be conducted to test the understanding of these icons and based on user feedback some new icons be created, if need arises.

Some of the instructions are missing from the interface. The manual indicates that the shredder can function continuously for 5 minutes but using it more than that period may lead to over heating and auto cooling down of the device for 20 minutes. The user will not know about this auto-cooling down process from the current interface.

It is recommended that other instructions regarding operation and maintenance be included on the interface or the body of the shredder as well.

Another suggestion is to build sensors at the opening of the shredder that indicates if the material being shredded is inappropriate or too much or a safety precaution or an instruction is violated. However, building such a sensor may be too expensive. Since current device is targeted towards small home-office market segment, such a function would unnecessarily inflate the product price.

5. *Consistency and Standards*

There are two places wherein the current user interface lacks consistency. In using the icons, almost all icons except two are presented in similar way – i.e. a symbol is enclosed in a circle for instructions and for safety precautions the symbols are enclosed in a circle with a line across the symbol indicating that it is unsafe to engage in that action (e.g. be careful so that your tie is not close to the shredder opening and gets stuck in it) (See Fig. 1).

These icons are consistent, but the interface has two other icons: one with an exclamation mark in a triangle. This particular icon though inconsistent with other icons on the interface, is a standard symbol for warning and caution and is universal in that sense. Thus, this is not a usability issue.

However, the other icon is curious with 'i' written on a book. The researcher referred to the manual to decipher this icon. This icon suggested that the user should refer to the manual to learn about operation and maintenance before using the shredder. This is a noble intention, however it seems unlikely that users would understand the icon and actually take effort to read the manual before using the device.

It is recommended that the understanding of this icon be tested with the users and alternatively instructions be integrated in the interface or the body of the device.

Another area where this interface is inconsistent is the way the two controls to select the operating modes and activating the safety lock of the shredder work. Both are slider controls but both function in a different manner. While the user has to slide the control up or down to activate or deactivate the safety lock of the shredder, to switch the shredder on or off and to activate the reverse mode, the user has to slide the control to left, center or right respectively.

It is recommended that the behavior of the controls be standardized by choosing either one of the modes of operations (up and down or left to right) rather than having inconsistent modes of interaction on a single interface.

6. *Recognition vs. recall*

The designers of the user interface seem to have done a decent job with this particular heuristic by trying to present most of the instructions and safety precautions for using the shredder on the interface without the need to refer to documentation.

However, the user may need to recall information regarding the maintenance, capabilities and the steps in using the shredder, which are not present on the interface currently. Also some use of memory may be required to make sense of some of the icons used on the interface, which are not intuitive.

It is recommended that other instructions regarding operation and maintenance be made part of the interface or the body of the device.

7. *Flexibility and efficiency of use*

This heuristic does not seem to be relevant to the current interface due to the nature of the device. There does not seem to be any accelerators that would allow expert users to shred more paper in less time.

The device does not seem to differentiate between expert users and novice users.

8. *Aesthetic and minimalist design*

The interface has a minimalist design. The interface does not seem to be cluttered. The designers have included necessary and some of the relevant instructions and precautions pictorially on the interface.

There is enough empty blank space. The interface does not overwhelm the user and there is no information overload for the user.

The interface has good affordances in terms of a handle to remove the shredder head to empty the bin. Though the slider controls behave inconsistently, they are easy and intuitive to operate.

9. *Recovery from errors*

The main errors that the user is likely to commit while using the shredder are to insert inappropriate material to shred and inserting too much of appropriate material.

The interface has the button for reversing the action that may help a user to retrieve some material from the shredder. This may help the user to recover from the error of paper jam - most probably due to too much of a material.

There does not seem to be a way to recover from the error of inserting inappropriate material in the shredder. Neither the manual has any possible way of recovering from this error nor the interface has any indication of exactly what are inappropriate materials (e.g. cardboard) and what to do to in case such an error is committed. The only possible way to deal with this might be that the user switches off the shredder and then deals with the error in some way e.g. by calling help desk. In the current evaluation, there was no way to understand what might be the consequences of inserting inappropriate materials in the shredder in the first place. However, it is recommended that the current interface accommodates information regarding appropriate materials as well or has some type of visual or audio indicator in case the user tries to shred inappropriate materials or more material.

Another error that is possible is trying to use the shredder continuously for more than 5 minutes. It is recommended that the interface should have some indicator that the shredder is being over heated and needs to cool down. In case a user uses the shredder continuously for more than 5 minutes, the shredder triggers a cool down period. If a user is unaware of this auto-cooling function, such a sudden shut down may take the user by surprise and affect the user experience negatively.

10. *Help and documentation*

The designers have tried to embed most of the help and documentation on the interface rightly by recognizing that users would be very unlikely to refer to a user manual to use a shredder designed for small home-offices. The manual is available online, where in most of the information is depicted using pictures as well as text.

However, the researcher realized that some necessary information like the inappropriate materials, operational limitations, trouble shooting and maintenance information is not included on the interface. This information is available in the form of a manual. It is recommended that if possible this information be integrated on the interface or on the body of the shredder, so that the necessary information is handy for the users and it would avoid user errors committed unknowingly.

CONCLUSION

The current user interface of the shredder does well in terms of having minimalist design, having some of the relevant instructions and precautions on the interface, having good affordances and having help and documentation. However, the product can be improved by making the icons and interactions more consistent, integrating other instructional material in the product design, improving the labels, icons and status visibility, and improving error recovery and error prevention by having sensors. Improving the interface design using this heuristic evaluation and testing the new design with users would definitely improve the usability and overall user experience.

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