Automated Ream Opener (Experimental Design)

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Activity Report

1 Testing & Experimental Design

1.1 Verification Testing

An integral part of constructing a valid design involves a thorough process of verification testing. This form of testing allows one to verify if a product meets the specifications and requirements previously written in the "Logical Design". First and foremost, a core requirement that must be investigated is the paper ream cutting ability of the apparatus. The system must be able to fashion precise lacerations on a paper ream with a consistent rate of success. Furthermore, another essential condition is safety and ease of use. This product will be utilized by employees with physical disabilities, as such designers have placed great emphasis on maintaining their well being and delivering a design that will be accident-proof. In order to test these qualities, the team will run tests at the mailing center with a sample size of fifty reams. Data will be collected from these experiments and conclusions will be drawn on the quality of cut, safety, and ease of use of the device. Specifically, one will ensure that the system is meeting core requirements by applying an iterative process of testing followed by design modifications. Repeating this loop will yield the most optimal solution.

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1.2 Validation Testing

In contrast, validation testing addresses how well the product has met the clients true needs and expectations. In order to do so, designers have developed an experiment that will test how effective the device is at solving the following problem statement. Which is to design and produce an automated tool that will allow a disabled person to easily open a ream of paper. Currently a disabled person cannot accomplish this task, due to a history of paper cuts inflicted upon the employees who attempted to do so. As such the following experiment will help designers confirm whether or not they have delivered a viable solution.

1.2.1 Experimental Questions

Specifically the following questions must be asked of this experiment:

- Question 1: Will a disabled employee be able to operate the apparatus after a 10 minute training brief?
- Question 2: Is the device safe and easy to use?

1.2.2 Hypothesis

If disabled employees are given a 10 minute training brief, then they will be able to operate the device easily in an effective and safe manner.

Furthermore, based off initial tests and determinations it is apparent that the correct answer to both experimental questions will be a resounding yes. The ultimate solution will consist of a singular button press. Therefore,

PP-2017 V2.1

there are zero other possible interactions with the machine. This leaves the user with a convenient experience and emphasizes the notion of ergonomic usage. Furthermore, the apparatus will be fully covered and as such the razor blades utilized within will be inaccessible to the user. Following this manner of thought accidents will be avoided entirely, because the only present risk has been fully accounted for.

1.2.3 Metrics

All projects should obtain hard data to measure the effectiveness of their system. The most important data in this context will be obtained directly from our end users. The following is a concise and direct list of desired metrics.

- Metric 1: Quality laceration success rate.
- Metric 2: Ease of use rating from employees on ten integer scale.
- Metric 3: Safety rating from employees on ten integer scale.

1.2.4 Data Collection

Adhering to the metrics provided above the data that will be collected concerns the success rate of obtaining a quality cut. This is defined by designers to be a laceration that fully dismembers the paper ream cover. Furthermore, the disabled employees will be surveyed for their feedback and as such the team will be able to garner data on the ease of use and safety of the apparatus. Of course this data will be collected via numerous trials. First designers will brief a disabled employee for ten minutes on how to use the device correctly. After doing so, the individual will be tasked with opening fifty reams of paper, while one of the team members stands by and observes their performance. The other members will be tasked with recording the data in live time. Especially making sure to note whether the now cut ream has passed the standard quality inspection. At the end of this trial, the employee will be given a questionnaire that will allow designers to gather information based on the users experience. This feedback will be an integral part of future design modifications. Furthermore, it is apparent from the data collection description that the independent variable will be the number of paper reams being put through the device, in other words our x-axis. Whereas, the dependent variable will be a running total of quality lacerations, the y-axis. Figure 1, displays a sample graph of what a possible test may yield. Continuing forward the experiment will control for bias by having a third party administer the questionnaire, refer to Figure 2. As such employees will not feel any pressure to answer in favor of the designers, since they will not be present. Also, the information will be collected anonymously in order to give individuals the chance to express their honest opinion. Lastly, after consulting with the professor the control was defined to be how many reams of paper a disabled employee could open without the device. The answer to this inquiry is zero. It is not safe for a disabled individual to do so manually due to the risk of paper cuts as noted previously. In that regard this experiment is special in nature because any result greater than zero can be deemed as successful. However, the designers will of course hold themselves to a standard of near perfection in the interest of assisting this noble cause. Upon obtaining a satisfactory volume of data, the team will meet once again and apply rationale engineering judgement to designing appropriate modifications based on user feedback. This cycle will continue to iterate until an optimal solution is uncovered.

Number of Reams	Number of Quality Cuts
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16
17	17
18	18
19	19
20	20
21	21
22	22
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38	38
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49	47
50	48

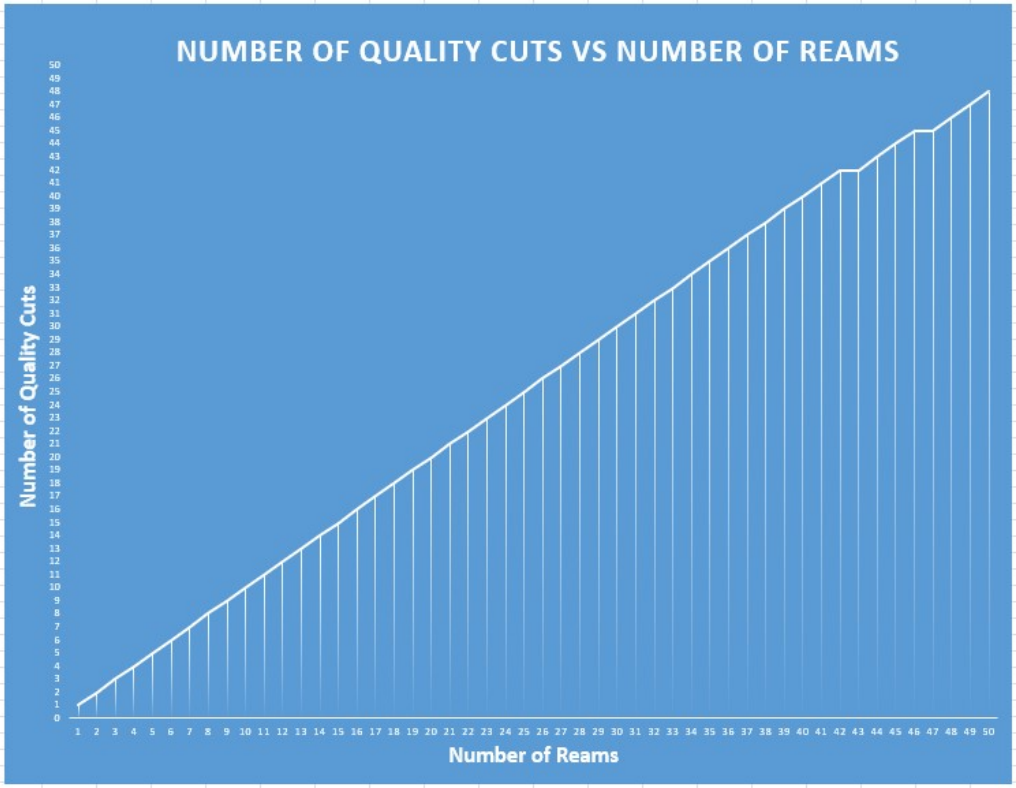

Figure 1. Example of possible data collection organized in line graph format. This illustrates a viable outcome from a live test.

USEFULNESS		1	2	3	4	5	6	7		NA
1. It helps me be more effective.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
2. It helps me be more productive.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
3. It is useful.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
4. It gives me more control over the activities in my life.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
5. It makes the things I want to accomplish easier to get done.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
6. It saves me time when I use it.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
7. It meets my needs.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
8. It does everything I would expect it to do.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
EASE OF USE		**1**	**2**	**3**	**4**	**5**	**6**	**7**		**NA**
9. It is easy to use.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
10. It is simple to use.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
11. It is user friendly.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
12. It requires the fewest steps possible to accomplish what I want to do with it.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
13. It is flexible.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
14. Using it is effortless.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
15. I can use it without written instructions.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
16. I don't notice any inconsistencies as I use it.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
17. Both occasional and regular users would like it.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
18. I can recover from mistakes quickly and easily.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
19. I can use it successfully every time.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
EASE OF LEARNING		**1**	**2**	**3**	**4**	**5**	**6**	**7**		**NA**
20. I learned to use it quickly.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
21. I easily remember how to use it.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
22. It is easy to learn to use it.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
23. I quickly became skillful with it.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
SATISFACTION		**1**	**2**	**3**	**4**	**5**	**6**	**7**		**NA**
24. I am satisfied with it.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
25. I would recommend it to a friend.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
26. It is fun to use.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
27. It works the way I want it to work.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
28. It is wonderful.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
29. I feel I need to have it.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
30. It is pleasant to use.	strongly disagree	○	○	○	○	○	○	○	strongly agree	○
		1	**2**	**3**	**4**	**5**	**6**	**7**		**NA**

Figure 2. Example of possible questionnaire to be given to employees after conducting trials. Safety will be added as a section in the final copy of the survey.