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DESIGNING SAFER

INTEGRATING PRODUCT SAFETY HIERARCHY INTO THE PROCESS

PAPER ABSTRACT: Product Liability is long neglected in industrial design education despite the exponential growth of new consumer product releases. This subject matter is covered in engineering, law, and business schools however, not much in industrial design. According to Consumer Product Safety Commission's National Electronic Injury Surveillance System (NEISS), in 2021, national estimate of injuries treated in emergency departments due to malfunctioning or defective consumer products is 11,738,091!

In a conference last year, a workshop done for peer educators and id professionals to measure the awareness of product safety. Findings were as predicted - focus was heavily on aesthetics and functionality. After reviewing multiple curriculums, speaking to several id faculty, it became apparent that product safety in industrial design education is either not covered at all or briefly mentioned by a few. How can we create awareness to this matter in the id education? How can we convey the message without being discouraging yet rather motivating? How can we educate the future generation of industrial designers to advocate for ethical practices and to design with product safety in mind? Eventually aiming for less product recalls due to the design defects.

In this paper, several different methodologies to implement product safety hierarchy into the industrial design curriculum will be explored. Workshop conclusions, survey results, and student projects of a studio exercise on injury prevention will be shared and discussed. The long-term goal is to educate industrial design students in a way that they would proactively consider product safety hierarchy during the ideation and design development phases.

Keywords: Product Liability, Product Safety, Safety Hierarchy, Ethical Design, Id Education

1. INTRODUCTION

What is Industrial Design?

"The professional practice of designing products, devices, objects, and services used by millions of people around the world every day." According to Industrial Designers Society of America (IDSA). In the extended description highlighted key phrases read as follows on idsa.org: "physical appearance, functionality, and manufacturability of a product", "value and experience a product or service provides for end-users", "improving your life through well-executed design". (IDSA, 2023).

Here's another reputable organization, World Design Organization (WDO)'s description: "Industrial Design is a strategic problem-solving process that drives innovation, builds business success, and leads to a better quality of life through innovative products, systems, services, and experiences." In the extended version it states, "the intent of making a product, system, service, experience or a business, better." (WDO,2023)

While these descriptions may be well written, and for the majority they may describe the industrial design profession effectively, they both doesn't include ethical and safety practices of the field which became unneglectable anymore. According to the Consumer Product Safety Commission's National Electronic Injury Surveillance System (NEISS), only in 2021, national estimate of injuries treated in emergency departments due to malfunctioning or defective consumer products is 11,738,091!

If the same query is searched for the last decade (2011-2021), NEISS estimate is: 135,844,348!

To apprehend the exponential growth of the consumer goods market in recent decades, one of the reliable data resources, US Patent and Trademark Office statistics can be reviewed. If most recent five decades (2020-1980) sorted, the decadal numbers are as follows; According to USPTO total of (utility, plant, design) patent applications made; In 2020: 646,244, in 2010: 520,277, in 2000: 315,015, in 1990: 176,264, and in 1980: 112,379. That's a 475% increase from 1980 to 2020.

While it's encouraging for industrial design profession to witness the pace of the idea generation and technological developments by reviewing the patent application numbers above, if more generic, wider market is considered, "Nearly 30,000 new products are introduced each year, and 95% of them fail according to Clayton Christensen, a professor at Harvard Business School." (MIT Professional Education, 2023).

2. DISCUSSION

Defective products cause safety recalls and safety recalls affect businesses in various ways (CPSC, 2023).

Impacts of safety recalls can be summed under four titles:

1) Financial Impact: Can have significant financial implications for businesses.

2) Brand Reputation: Safety recalls can harm a company's brand reputation and customer trust.

3) Legal Consequences: Businesses may face legal consequences, including lawsuits and fines, as a result of safety recalls.
4) Sales and Market Share: Product recalls can lead to decreased sales and a loss of market share.

Product safety hierarchy which consists of warn, guard, and eliminate, (CPSC,2023) is a valuable structure for achieving safer consumer goods. By integrating the product safety hierarchy into the design, manufacturing, and distribution processes, businesses can prioritize consumer safety and offer safer goods to their customers.

Below are some best practices that utilize the product safety hierarchy:

1. Warn:
- Clear and legible warning labels: Ensure that all potential hazards and risks associated with the product are clearly stated on the packaging, instruction manuals, and in some cases printed, embossed, or carved into the product itself.
- Multilingual warnings: Provide warnings in multiple languages to ensure accessibility to a diverse range of consumers.
- Visual icons: Supplement written warnings with visual symbols or icons to enhance understanding, especially for individuals with language barriers or literacy challenges.

2. Guard:
- Child-resistant packaging: Implement child-resistant features for products that may pose risks to children, such as medicines, cleaning chemicals, or sharp objects.
- Safety barriers and guards: Incorporate physical guards, shields, or barriers into product design to prevent accidental contact with moving parts, hot surfaces, or other potential sources of harm.
- Safety interlocks: Integrate safety mechanisms, such as automatic shut-offs or locks, to prevent unsafe usage or access to hazardous components.

3. Eliminate:
- Hazard elimination: Design products with safety in mind, aiming to eliminate potential hazards altogether. For example, using non-toxic materials, eliminating sharp edges, or removing easily detachable small parts that could pose a choking hazard.
- Substitution: Identify and substitute hazardous materials or components with safer alternatives without compromising the product's functionality or performance.
- Design refinement: Consider form development to elude entrapment or other safety concerns. For example, avoiding circular or triangular openings in the cribs to prevent choke hazards.

Additional best practices:
- Product testing and certification: Conduct thorough testing and seek certifications from reputable organizations to ensure compliance with safety standards and regulations.

- User feedback and reporting systems: Establish channels for consumers to provide feedback, report safety concerns, or request additional information regarding product safety.
- Regular safety reviews: Conduct periodic safety reviews of products to identify and address any emerging safety issues or risks.
- Collaboration and information sharing: Foster collaboration between manufacturers, regulators, and consumer advocacy groups to exchange knowledge and share best practices for enhancing product safety.
- Consumer education: Educate consumers about product safety through public awareness campaigns, user manuals, websites, and other communication channels to promote responsible usage and reduce potential risks.

One example of a product-based company that implemented the product safety hierarchy to address product recall issues is Toyota Motor Corporation. Toyota experienced a significant product recall crisis in 2009 and 2010 due to reports of unintended acceleration in several of their vehicle models (The Atlantic, 2011). To overcome these challenges and enhance product safety, Toyota implemented various measures based on the product safety hierarchy.

1. Warn:
   - Improved communication: Toyota enhanced its communication efforts by providing clearer and more detailed instructions to customers regarding potential risks and appropriate vehicle operation. They also implemented a robust customer notification system to ensure timely dissemination of safety-related information.
2. Guard:
   - Brake override system: Toyota installed a brake override system in its vehicles, which became a standard feature. This system prioritizes braking commands over acceleration commands, thereby helping to prevent unintended acceleration.
3. Eliminate:
   - Enhanced quality control: Toyota took significant steps to improve its manufacturing and quality control processes to eliminate potential defects that could lead to safety issues. They implemented stricter standards and increased scrutiny to ensure the production of safer vehicles.
   - Increased testing and verification: Toyota introduced more comprehensive and rigorous testing protocols to identify and address potential safety concerns before vehicles are released to the market. This included expanded real-world testing and increased collaboration with independent safety organizations.

Through these initiatives, Toyota aimed to restore trust in their brand and prioritize customer safety. By implementing the product safety hierarchy, they addressed the recall issues by enhancing warning systems, implementing additional safety features to guard against risks, and focusing on eliminating potential hazards through improved manufacturing processes and testing procedures.

Another example of poorly handled situation – “Peloton, a renowned fitness equipment manufacturer, paid the price of poor recall management for their recall of its Tread+ and

Tread treadmills in May 2021, following reports of more than a dozen injuries and the death of a child.
The U.S. Consumer Product Safety Commission (CPSC) fined Peloton $19 million because they “knowingly failed to immediately report to CPSC, as required by law, that its Tread+ treadmill contained a defect that could create a substantial product hazard and created an unreasonable risk of serious injury to consumers." (Forbes, 2023)

3. OBJECTIVE

The objective of this study is to create awareness among peer educators and industrial design professionals. Ultimately including product safety hierarchy into the industrial design curricula to properly educate industrial design students on how to integrate product safety into their project development phase. Master the misuse scenarios as well as how a product is going to be used properly, as a student learning outcome. By engaging more empathy, observation and role playing, goal is to lessen, or in some cases prevent, the incidents due to misuse of a product. Eliminate design defects as much as possible by integrating product safety hierarchy into the development cycle.

4. METHODS

4.1. WORKSHOP

During workshop session of a design conference last year, participants given a design brief below at the beginning:
“Design and Sketch a Pizza Cutter
- You have 2 minutes!
- Document your thought process as much as you can
- Feel free to use keywords, call-outs, directional arrows, short statements”

After the time is over, these follow up questions asked: “Did anyone take Product Liability, Planned Obsolescence & Ethical Design into consideration from scratch?”
A brief discussion led to the introduction of the terminology like product liability, planned obsolescence, and resources shared to provide further knowledge about these subject matters.

4.2. STUDIO PROJECT

Ombudsman of Consumer Product Safety Commission, Jonathan Midgett, joined senior level industrial design studio course virtually. A lecture given about the product safety, and some examples of misused product incidents throughout the history that caused major consequences shared.
One of these misfortunate incidents used as a case study and students briefed about the incident which followed by sharing several resources to extend students’ research. Submission requirements asked for proper implementation of the safety hierarchy, iterations on a revised design, graphics, and mechanisms. As a final deliverable students asked to put together a slide deck consisting of design research, ideations, 3D renders and improved warning graphics.

4.3. SURVEY

After completion of the mini studio project on product safety which students spend three weeks in total, they have been asked to fill a survey about product liability, planned obsolescence and ethical design.

5. RESULTS

After reviewing the sketchnotes of the workshop participants, despite the individuals' approaches, mainly the product safety hierarchy wasn't implemented in the initial ideation phase which proves the argument in consideration of the current state of industrial design education and practices. There were designs enabling IoT, functionality, aesthetics, ergonomics, compact designs, iconic references, hygiene, manufacturability, mechanics, ease of use, but only a couple considered guards and safety at the preliminary concept development stage.

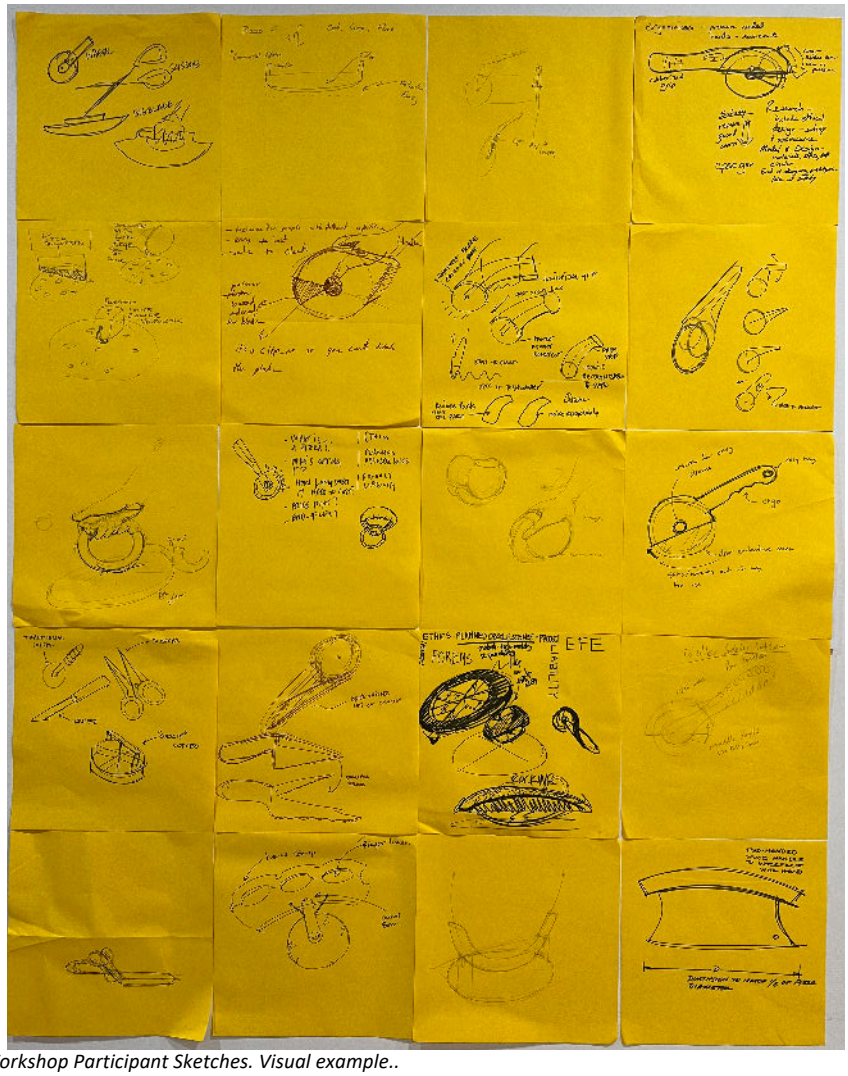

Figure 1. IDC Workshop Participant Sketches. Visual example..

Whereas in the studio exercise, since students properly introduced to the subject matter, reviewed several defective designs, and provided with the right resources, all their final designs were well executed in terms of safety hierarchy. Warn, guard, eliminate method enabled and ultimately led to better thought designs.

Figure 2. Student Project. Visual example..

Survey results are clearly stating the need of the proper education in product liability, planned obsolescence and ethical design. Out of 12 respondents, almost all the participants experienced a malfunctioning product which may or may not cause an injury. While they all agree that their design decisions partially could lead to liabilities, they don't think recent id graduates understand the consequences of their design decisions. There's a mutual agreement that these subject matters shall be covered more throughout the id education however, similar weighing responses marked in what year would be the most appropriate to introduce these. Here's some feedback from the students: "The course assignments could have you look back at failed designs and as a student you research the design and come up with solutions for said design" "The course should be required to be taken once the students have a basic skill set based in ID, so that they may further understand that the things they are capable of creating can have serious liabilities", "I think these issues are not taught enough and should be better implemented into the curriculum.", "A course like this would benefit and open up a new realm for ID students."

6. CONCLUSION

Given the results of these method of measures, once a brief requested from the participants without providing a wider context, resources, and sharing examples of misuse, id professionals tend to create from their learned and practiced behavior which heavily

focuses on aesthetics and functionality. Whereas, when the right resources shared and a brief lecture given to the amateurs, who in this case senior industrial design students with limited experience, results of their designs were promising. This comparison may not be the most reliable measure, especially considering unequal time limits provided (2 minutes for the workshop versus 3 weeks for the studio project), yet it proves that the approach significantly changes the outcome. If product safety hierarchy is introduced in the design schools and expected to be a norm of the process, better design outcomes in terms of product safety would unveil. Ultimately eliminating incidents due to misuse of a product, and resulting in less liability, recalls, and landfill. It's just five minutes of asking a question of; did you consider any safety measures or misuse of this design? There still will be less controllable factors, especially in manufacturing, like "Quality Fade - the deliberate and secretive habit of widening profit margins through a reduction in the quality of materials." (Midler, P. 2007) however industrial designers can eliminate design defects and advocate for better and more ethical design practices.

The goal is to design better products - then product safety and ethical design are part of the process and should be acknowledged, understood, and utilized more often. Especially considering shortened product development times and exponential growth in consumer product launches in recent years. Better and safer designs will lead to less product recalls and less landfill, even longer product life cycles in certain cases.

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