



56

Please sit with your project team

DfM **Design for Manufacturing**

DfA **Design for Assembly**

DfC **Design for Cost**

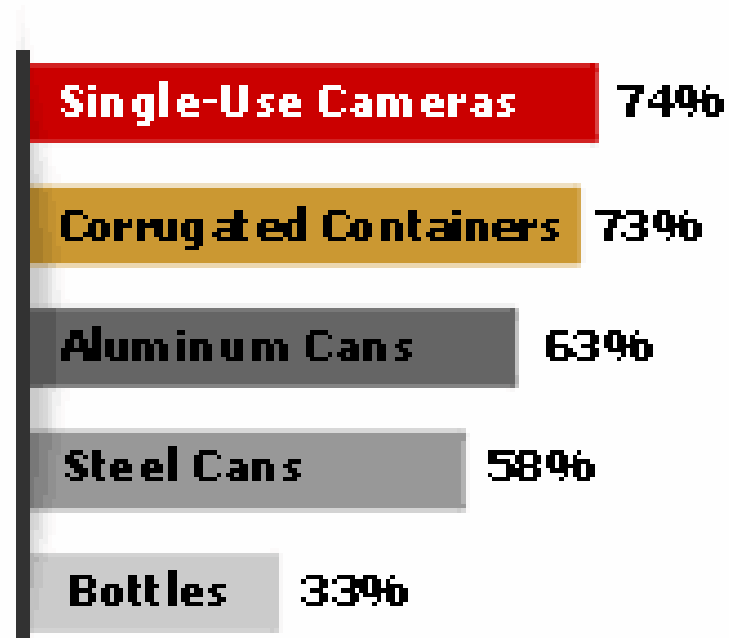
DfR **Design for Reliability**

DfE **Design for the Environment**

On an index card, write down two reasons why you, as a current future professional designer, might want to pay attention to DfE. Or in other words, why does it matter?



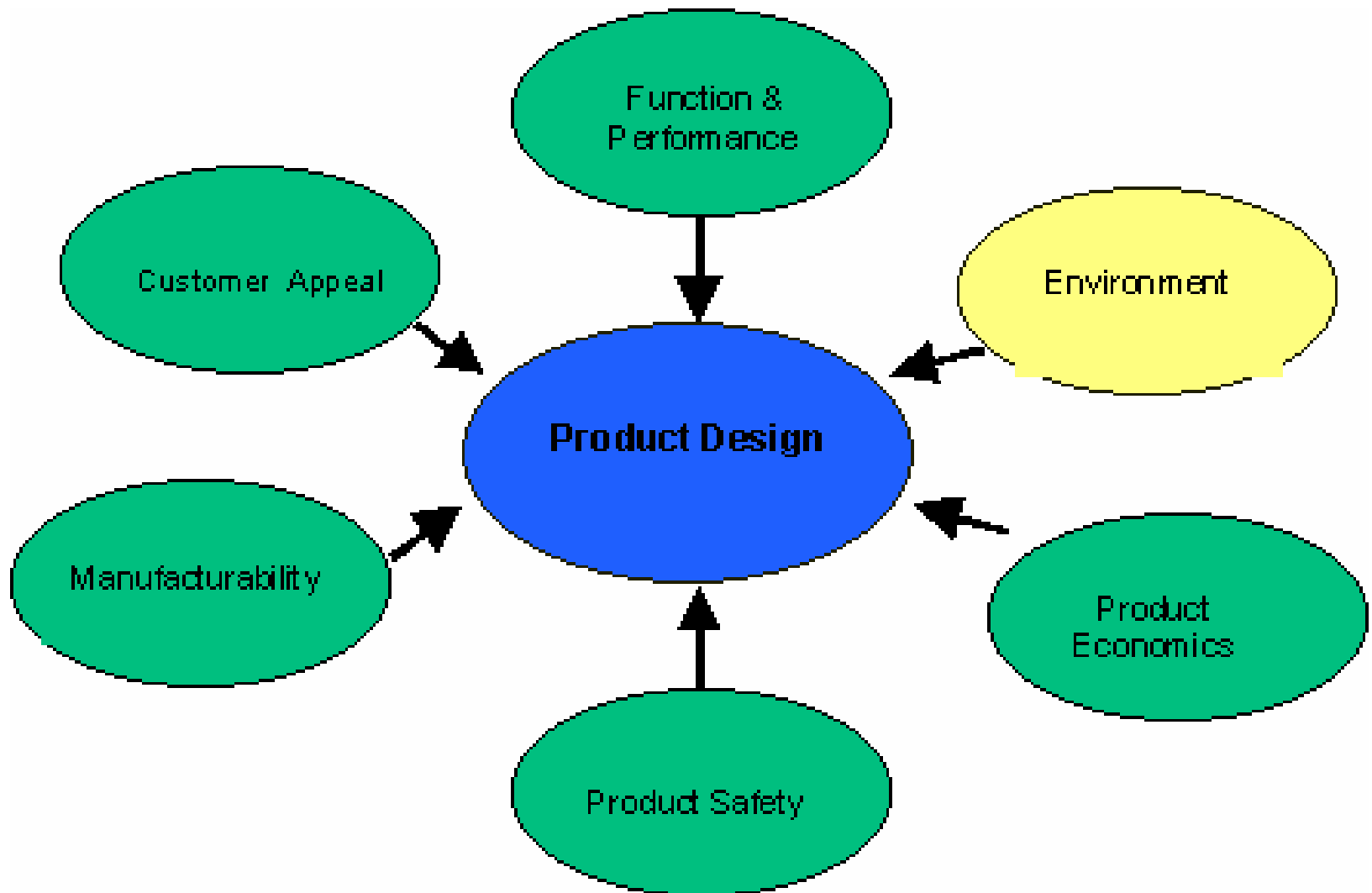
U.S. Recycling Rates

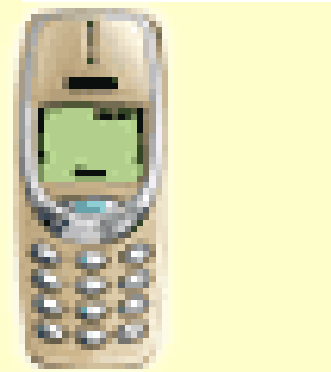


www.kodak.com

Design for the Environment

- **What if products were designed with ingenious connectors that allow quick and easy disassembly?**
- **What if all plastic parts in products were clearly marked by resin type, kept uncontaminated by paint, and no hazardous materials were used during manufacturing?**







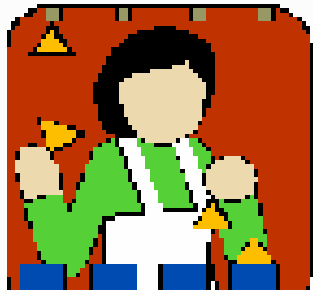
www.bestbuy.com



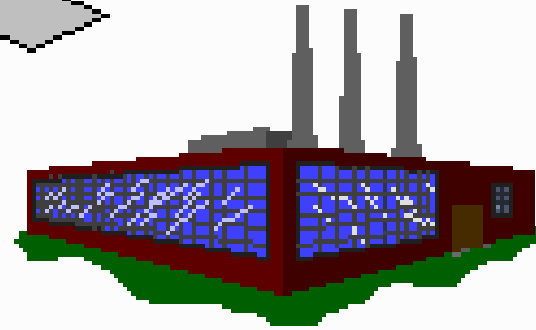
www.andersenwindows.com

DfE challenges

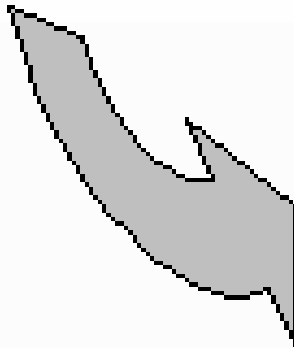
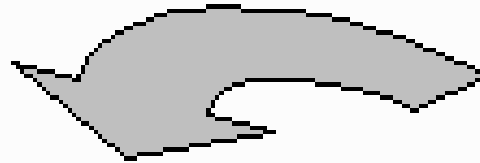
- **Do you go with a snap-fit or an adhesive?**
- **Should your product be easy to take apart using destructive methods, or should it be designed for reuse after take apart using nondestructive methods?**
- **How do you determine the environmental cost of a component or material you purchased?**
- **Should you care about the amount of electricity used in the steel mini-mill to make the 1/8 inch sheet that is part of your product?**



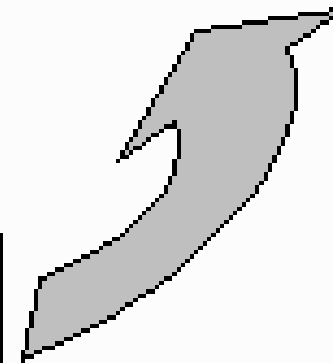
Use of Products



Manufacturing



**End of
Product Life**



Product Life-Cycle

Stages in a product life-cycle

STAGE 1: Premanufacture

STAGE 2: Manufacturing

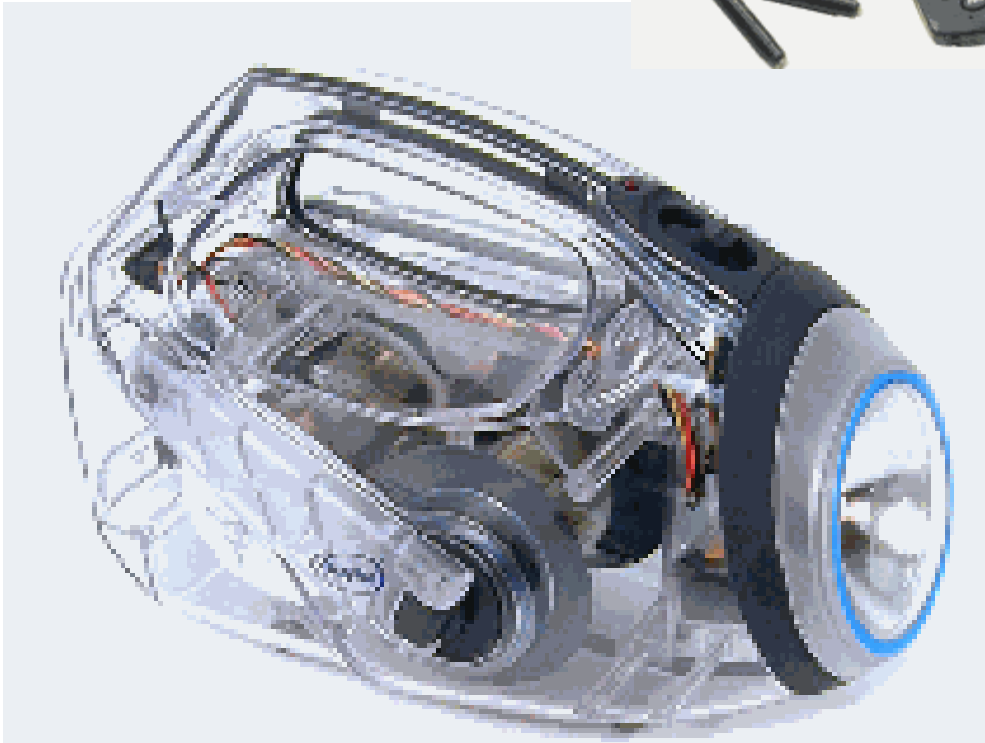
STAGE 3: Product distribution

STAGE 4: Customer use

STAGE 5: End of life

Questions a design team could ask

- | | |
|--------------|--|
| Supplier | Are the parts and materials coming from suppliers that have a good environmental track record? |
| Manufacture | Is the use of hazardous materials avoided during manufacturing? |
| Distribution | Is packaging minimized and is reusable transport packaging (such as collapsible totes) used to transport the product? |
| Use | Is the use of disposable 'one time use' cartridges, containers, or batteries avoided? Is the product energy efficient? |
| End-of-life | Is the product easy to disassemble for reuse or recycling of materials? |



DfE basics

- **Entire life-cycle of a product is accounted for.**
- **First considered during the early stages of the design cycle.**
- **Specific design methods exist for good process.**

DfE methods

- **Assessment tools**
 - Questionnaires
 - Impact analysis
- **Design**
 - Materials
 - Disassembly
 - Minimize energy
- **Labeling**
 - Use
 - Material identification

DfE methods

- **Reduce the weight**
- **Replace a screw with a snap**
- **Minimize the number of parts**
- **Use standard parts**
- **Avoid regulated material**
- **Use recycled materials**
- **Label materials**
- **Minimize adhesives**



www.sony.com

Estimate pounds of batteries used per year (typical student)

Regulations

- **The real driver**
- **Europe, Japan *way* ahead of the U.S.**
- **California leads the way**

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