

Ethics and Engineering

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Further reading...

<https://ethicaldecisions.net/>

Why ethics?

- Two essential points:
 - Ethics is **hard**, much like engineering.
 - When organizations go astray ethically, it is usually because **we don't know how to think about the issues**
 - *...not because we are **bad people**.*
- This is evident in 2 case studies.
 - Ford Pinto – a classic case
 - Guidant Corporation – a more recent case

Ford Pinto

- Early 1970s: Exploding gas tank in Ford Pinto
 - in low-speed collisions.



Ford Pinto

- The company knew of the danger.
 - Decided not to fix the defect.
 - Would have cost \$11 per car.
 - To fix bolts that punctured the gas tank on collision.



Ford Pinto

- Dennis Gioia was centrally involved.
 - Later became a professor of management and organizational behavior.



Ford Pinto

- Gioia tells the inside story honestly in an article.

Pinto Fires and Personal Ethics:
A Script Analysis of Missed Opportunities

Journal of Business Ethics **11**: 379–389, 1992.

Dennis A. Gioia



Ford Pinto

- Gioia held engineering and MBA degrees.
 - He wanted to make a **positive contribution** and saw business as an opportunity to do so.
 - So he joined Ford as Field Recall Coordinator.



Ford Pinto

- Cost-benefit analysis showed that the defect should not be fixed.

Costs: \$137 000 000

(Estimated as the costs of a production fix to all similarly designed cars and trucks with the gas tank aft of the axle (12 500 000 vehicles \times \$11/vehicle))

Benefits: \$49 530 000

(Estimated as the savings from preventing (180 projected deaths \times \$200 000/ death) + (180 projected burn injuries \times \$67 000/injury) + (2 100 burned cars \times \$700/car))

Ford Pinto

- OK to put a value on human life?
 - We do it all the time.
 - Suppose you can buy a car with a safety option that reduces the chance of a fatal crash by 1 in 1000.
 - How much would you pay for the option?
 - Multiply by 1000 – this is the **value of your life**.

Ford Pinto

- 1978: Ford executives prosecuted for reckless homicide.
 - After 3 teenage girls were killed by exploding gas tank in Indiana.
 - Ford executives acquitted due to lack of evidence.

Ford Pinto

- Gioia later began using the Pinto case in his classes.
- Then and for years afterward, he believed he had made the right decision at Ford, given the evidence at hand.
 - Then he changed his mind (according to his article).
 - **Why?**
 - He doesn't explain.

Ford Pinto

- Lesson: We often make the wrong decision because **we don't know what is right.**
 - **Not** because we are **bad people.**
 - We don't have the **conceptual equipment** to analyze the issue.



Guidant Corporation

- The Pinto case may seem easy to you.
 - But try this one:
 - *The case of Guidant Corporation defibrillators*



Now part of Boston Scientific

Guidant Corporation

- A tragic malfunction.
 - Joshua Oukrop died of heart failure on a cycling trip.
 - His implanted defibrillator malfunctioned.
 - Guidant had known of defect for some time.



Lee Oukrop with photo of his deceased son, Joshua

Guidant Corporation

- Guidant did not notify doctors or patients.
 - Although it notified the FDA as required by law.
 - Joshua's doctors were furious.
 - They said they would have replaced the device.



Guidant Corporation

- Guidant's argument
 - Lethal risk of leaving device in place: **0.10-0.24%**.
 - Risk of replacing it: **0.42%**
 - Doctors & patients would want to replace it (as did Joshua's doctors).
 - This is why FDA doesn't require public notice of defect.
 - Better not to notify.



Dr. Joseph M. Smith
*Guidant executive
at the time* 17

Guidant Corporation

- Argument from Joshua's doctors
 - Dr. Maron: "It is a statistical argument that has little to do with real people"
 - People have a "right" to know.
 - Joshua's father: "Whoever made this decision at Guidant, I pray he doesn't have a son who this happens to."



Barry J. Maron
One of Joshua's doctors

How about professional ethics?

- Professions exist to assure the public of certain **standards of conduct**.
 - Clients need not research competence and responsibility of every individual.



How about professional ethics?

- Professions exist to assure the public of certain **standards of conduct**.
 - Clients need not research competence and responsibility of every individual.
 - Professionals make an implicit **promise** to abide by these standards.
 - A **Code of Ethics** help to clarify the promise.
 - **Professional ethics = obligations under this promise**



How about professional ethics?

- Professional ethics is necessary...
 - ...for the very **existence** of the profession.
- But the professional promise **cannot anticipate** every situation.
 - ...and codes of ethics tend to consist of **generalities**.



AIChE Code of Ethics

- Regarding the Pinto case...

[Engineers should] *hold paramount* the safety, health and welfare of the public and protect the environment in performance of their professional duties [emphasis added].

- How safe is safe?
- If safety is paramount, should we sell only the safest possible car, regardless of price?

AIChE Code of Ethics

- Regarding the Guidant case...

[Engineers should] formally advise their employers or clients (and consider *further disclosure*, if warranted) if they perceive that a consequence of their duties will adversely affect the present or future health or safety of *their colleagues or the public* [emphasis added].

- Guidant's failure disclose a defect did **not** adversely affect the health or safety of the **public** as a whole.
- But it adversely affected **some individuals** (while benefiting others). Does this matter?

Ethical principles

- But we must have principles for resolving such issues in an **objective way**.
 - Otherwise, we can rationalize anything.
 - **Generalization principle**
 - **Utilitarian principle**
 - **Respect for autonomy**

Ethics in a nutshell

- We should all **play by the same rules.**
- Ethics is **how we agree** on the rules.
 - Nobody says this is easy.
 - Why should we expect ethics to be easy, especially in a complicated world?



Generalization principle

- Basic premise: We always act for a reason.
 - Every action has a rationale.

Generalization principle

- Basic premise: We always act for a reason.
 - Every action has a rationale.
- So, if the reason justifies the action for me...
 - It justifies the action for **anyone** to whom the reason applies...
 - ...due to the **universality of reason**.

Example - Theft

- Suppose I steal a watch from a shop.
- I have 2 reasons:
 - I want a new watch.
 - I won't get caught.
 - *Security at the shop is lax.*



Example - Theft

- So I am making a decision for everyone:
 - All who want a watch and think they won't get caught should steal one.



Example - Theft

- So I am making a decision for everyone:
 - All who want a watch and think they won't get caught should steal one.
- But if all do this, they will get caught.
 - The shop will install security.
 - My reasons will no longer apply



Example - Theft

- I am not saying that all these people actually **will** steal watches.
 - Only that if they did, my reasons would no longer apply.



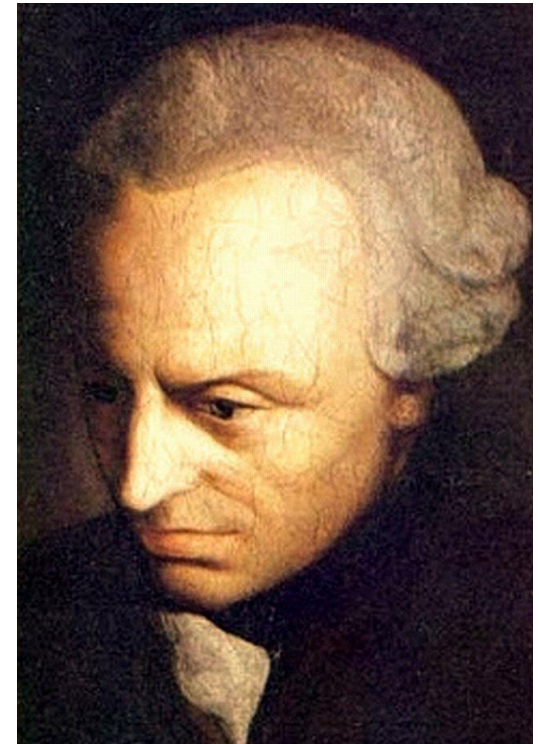
Example - Theft

- My reasons are **inconsistent** with the assumption that people will act on them.
- I am caught in a contradiction.
 - My reasons imply that these people **should** steal.
 - These same reasons presuppose that they will **not** steal.



Generalization principle

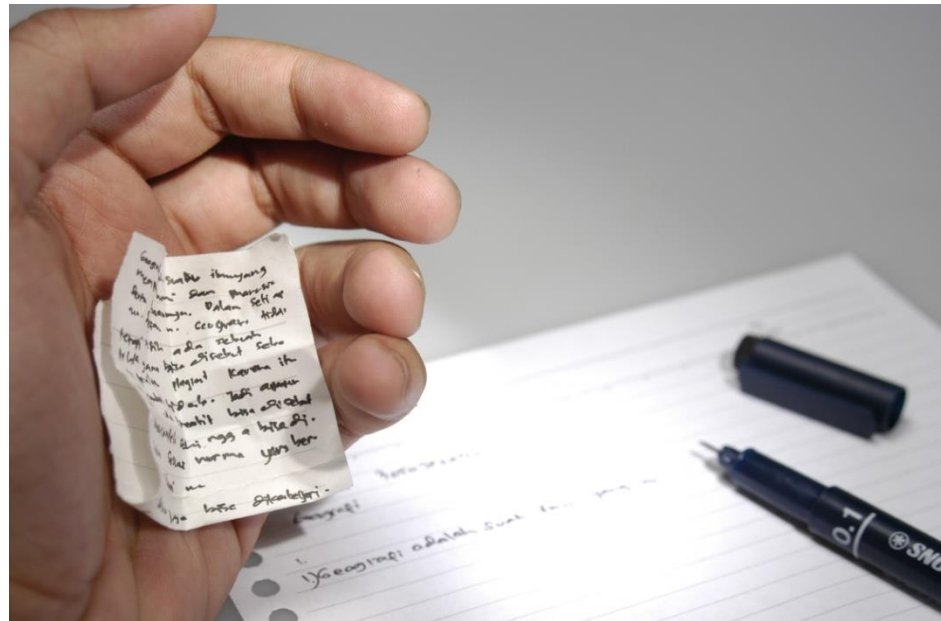
- The principle is:
 - The **reasons** for an action should be **consistent** with the assumption that **everyone with the same reasons acts the same way**.



Immanuel Kant, 1724-1804

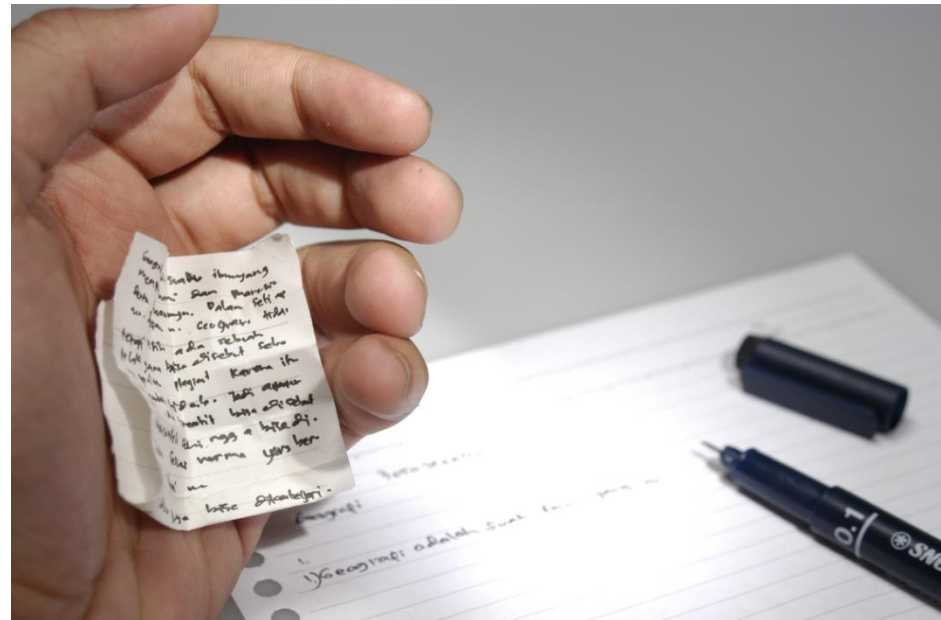
Example - Cheating

- What is wrong with cheating on an exam?
- My reasons:
 - I will get a better grade.
 - Which means I will get a better job.



Example - Cheating

- Nearly all students have these reasons.
- If they all cheat...
 - Everyone will have a top grade.
 - Good grades won't get me a better job.



Example - Agreements

- **Breaking an agreement** violates generalization principle.
 - If I break it merely for convenience or profit.



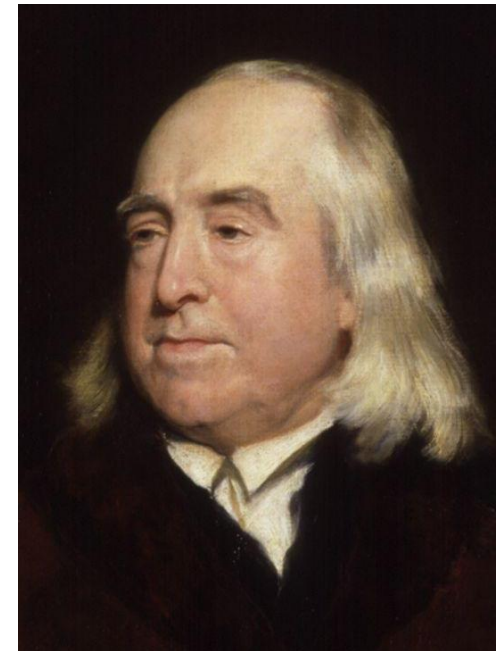
Example - Agreements

- Suppose everyone broke agreements when convenient.
 - It would be impossible to **make** agreements in the first place.
 - And therefore impossible to achieve my purposes by **breaking** them!
 - The whole point of having an agreement is that you keep it when you **don't want** to keep it

Utility

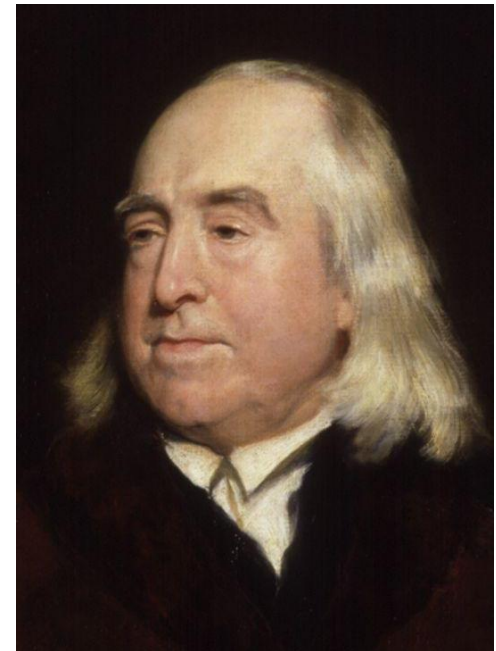
- Basic premise: Action is a means to an end.
 - You may want to achieve some goal.
 - Maybe your ultimate goal is happiness.
 - Whatever it is, let's call it **utility**.
 - It's what you regard as **inherently valuable**, as the **end** to which your actions are a **means**.

Jeremy Bentham
Father of utilitarianism



Utility

- If I regard something as inherently valuable...
 - I must regard it as inherently valuable for **anyone**.
- To be consistent, I must create as much utility as I can for everyone.
 - “The greatest good for the greatest number.”



Maximizing utility

- More precisely, I should maximize **net expected utility**:

$$\max_d \sum_i \Pr(i | d) \sum_j u_j(i | d)$$

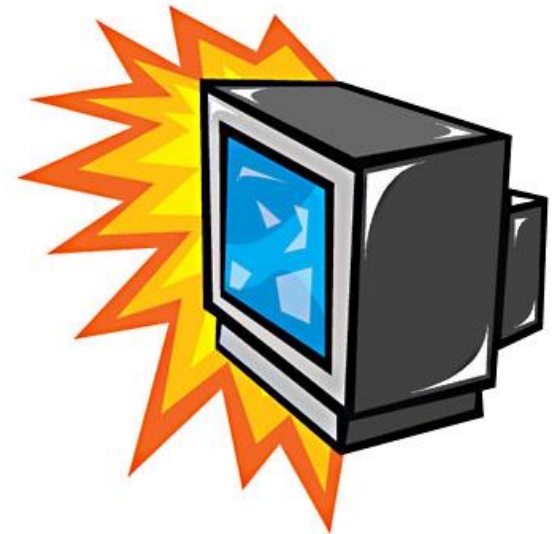
where

$\Pr(i | d)$ = probability of outcome i given decision d

$u_j(i | d)$ = net utility for person j in outcome i given decision d

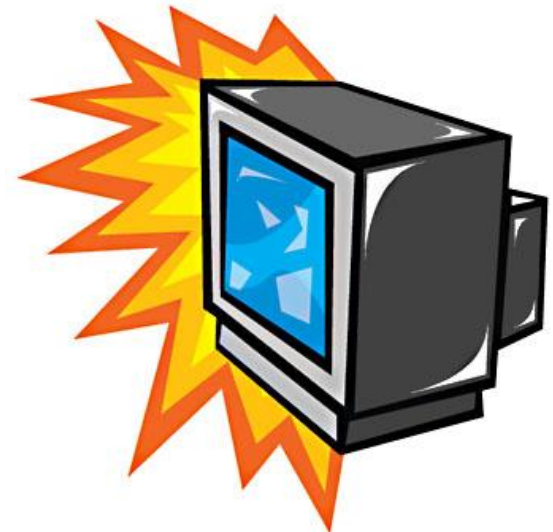
Maximizing utility

- For example, suppose I listen to loud TV in my hotel room at 2 am.
 - Keeping other guests awake.
 - Why is this unethical?
 - May not violate hotel rules.



Maximizing utility

- For example, suppose I listen to loud TV in my hotel room at 2 am.
 - Keeping other guests awake.
 - Why is this unethical?
 - May not violate hotel rules.
- It reduces net utility.
 - Maybe it makes me a little happier.
 - But it substantially reduces utility of other guests.



Utilitarian principle

- An act is ethical only if I can rationally believe that **no other act...**
 - creates **more net expected utility...**
 - and **satisfies other ethical principles.**
 - Counts **everyone's** utility.



Autonomy

- Autonomy = self-law
 - I act **autonomously** when I freely make up my own mind about what to do, based on coherent reasons I give for my decision.
 - An **agent** is someone who can act autonomously.
 - Humans are agents, insects are not.



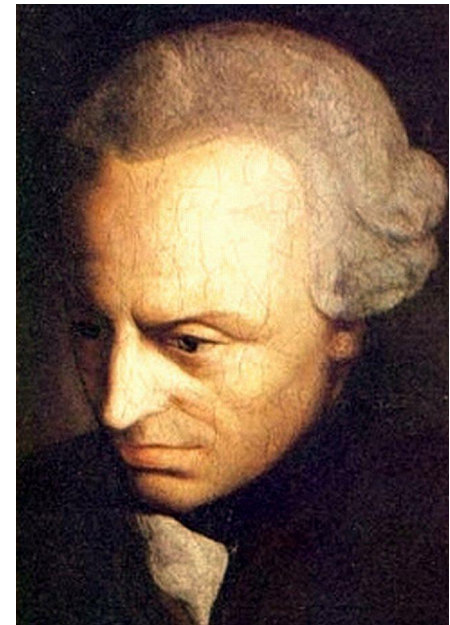
Autonomy

- Why must actions have reasons?
 - An MRI machine can detect our decisions **before we make them.**
 - We are determined by chemistry and biology, as are insects.
 - How to distinguish us from insects?
 - Our behavior has a **second kind of explanation.**



Autonomy

- Dual standpoint theory.
 - Our autonomous decisions can be explained as based on the **reasons** we give for the decisions.
 - ...**as well as** the result of chemistry and biology.
 - An insect's behavior has only the **latter** kind of explanation.



Immanuel Kant
Proposed a dual standpoint theory in his book,
Grundlegung zur metaphysik der Sitten

Autonomy

- Fundamental obligation: **respect autonomy.**
 - This rules out murder, coercion, slavery, etc.

AUTONOMY

Action plans

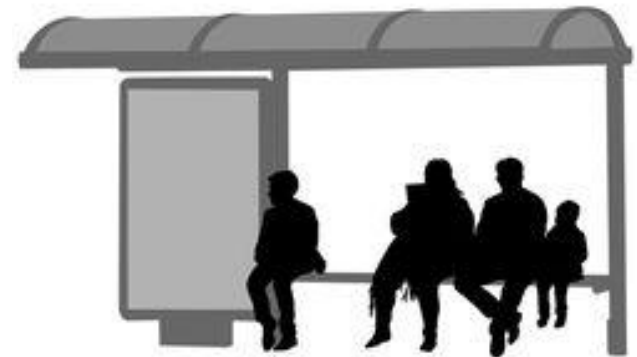
- To make things more precise...
 - An action has the form of an **action plan**.
 - *If the reasons for my action apply, **then** do it.*
 - *Example: “If I want to catch the bus, and the bus stop is across the street, and no cars are coming, then cross the street.”*



© Can Stock Photo

Coercion

- Coercion does **not** violate my autonomy if it is **consistent with my action plan**.
 - I start to cross the street to catch a bus, and you pull me *out of the path of a car*.
 - This is *consistent* with my action plan.
 - Not a violation of autonomy.



© Can Stock Photo

Principle of autonomy

- *It is unethical for me to select an action plan that I am rationally constrained to believe **interferes** with an **ethical** action plan of another agent **without informed consent**.*

Case studies revisited

- Ford Pinto
- Guidant defibrillators

Ford Pinto

- The cost-benefit analysis was a legitimate **utilitarian** calculation.
 - Considered net expected utility, measured in monetary terms.
 - *Not just company cost.*
 - Failure to fix the defect **may well have satisfied the utilitarian principle.**
 - But there are **two other principles** to satisfy!

Ford Pinto

- Failure to fix violates **autonomy**.
 - Ford was rationally constrained to believe that the defect would cause serious injury or death for at least one person.
 - *In fact, many people (as assumed by Ford's cost/benefit analysis).*
 - *This is **violation of autonomy** without informed consent.*



Ford Pinto

- Failure to fix violates **autonomy**.
 - Why no informed consent?
 - *True, **all car manufacturers** are rationally constrained to believe that **people will be killed in their cars**.*
 - *But customers give **informed consent** to this risk, because they assume the normal risks of driving.*
 - *A defective gas tank is not normal and therefore **not a risk assumed by the customer**.*



Ford Pinto

- Failure to fix may violate **generalization principle**.
 - Violation of **implied warranty**.
 - *There is an implied **agreement** that the product is fit for the purpose for which it is sold (**warranty of merchantability**).*
 - *Perhaps a car that can explode in low-speed collisions is unfit for driving your kids to school (for example).*
 - *Violation of this agreement, merely for profit or convenience, is contrary to generalization principle.*



Ford Pinto

- Conclusion...
 - **Ford's decision not to recall was unethical.**

Guidant Corporation

- Guidant's decision conforms to **utilitarian principle**.
 - It minimized risk for 14,000 patients.
 - Would have potentially saved 100-200 lives.
 - *If problem had not been broadcast by news media.*



Guidant Corporation

- Guidant's decision conforms to **utilitarian principle**.
 - It minimized risk for 14,000 patients.
 - Would have potentially saved 100-200 lives.
 - *If problem had not been broadcast by news media.*
 - *This is a factual claim. If it is false, the analysis is different.*
 - *Possibly, the risk of replacement is predictably lower for some patients, but for the sake of argument we assume otherwise.*



Guidant Corporation

- Violation of **autonomy**?
 - Patients have a **right** to know about their health status?
 - *A right claim is not an argument.*
 - But patients **want** to know.
 - *The autonomy principle doesn't require us to give people anything they want just because they want it.*

Guidant Corporation

- Violation of **autonomy**?
 - Interference with patient's **action plan** to be informed of any risk?
 - *This is not an action plan.*
 - *An action plan must involve an **action by the agent**.*
 - *Informing the patient is an action taken **by the company**.*
 - *No interference with action plans.*

Guidant Corporation

- Violation of **autonomy**?
 - Exposure to lethal risk **without informed consent**?
 - *In the Ford case, failure to **recall** defective cars exposed customers to **unnecessary risk** without informed consent.*
 - *Guidant's failure to recall defective devices did **not** expose patients to unnecessary risk.*
 - *If replacement had lower risk, this would be an autonomy violation.*

Guidant Corporation

- Violation of **generalization principle?**
 - **Implied warranty** perhaps not an issue.
 - *Defibrillator was fit for the purpose for which it was sold.*
 - *Patients are willing to replace it, even though the risk of replacement is higher than the original risk of failure.*
 - *So they presumably would have been willing to receive the implant in full knowledge of the risk.*



Guidant Corporation

- Conclusion...
 - **Guidant's decision was ethical**
 - ...albeit very difficult and unpleasant.

Guidant Corporation

■ Follow-up.

- Guidant later got into legal trouble.
 - *For failing to notify FDA of additional problems with its defibrillator, and continuing to sell some defective devices.*
 - *FDA also found quality control problems at plants.*
- Guidant sentenced to pay \$296 million in fines and forfeiture.

By JOEL ROBERTS / AP | December 27, 2005, 12:55 PM

FDA Issues Warning To Guidant



In a file photo Dr. William J. Groh, a cardiologist who is the director of the pacemaker and implanted defibrillator clinic at Indiana University's medical school holds a Guidant Contact Renewal 3 defibrillator in his office in Indianapolis Friday, June 24, 2004. / AP

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Guidant Corp. said Tuesday the U.S. Food and Drug Administration sent the company a warning letter about unresolved problems it found during an inspection earlier this year at the medical device maker's St. Paul, Minnesota, facility.

Questions?
Other ethical issues?