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Triodyne Inc.

Consulting Engineers and Scientists

5950 West Touhy Avenue Niles, IL 60714-4610 (847) 677-4730

FAX: (847) 647-2047

e-mail: info@triodyne.com

5950 West Touhy Avenue
Niles, IL 60714-4610
(847) 647-6748
FAX: (847) 647-2047

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FAX: (847) 647-0785

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Safety Rules of Thumb

by Ralph L. Barnett¹ and Peter J. Poczynok²

ABSTRACT

Unlike all other engineering disciplines, safety engineering is consensus driven, not research driven. It is almost devoid of physical laws to guide its practitioners. Instead, rules of thumb dominate the behavior of manufacturers, designers, maintenance workers, operators, legislators and code writers. Because rules of thumb presently represent the foundation of safety engineering, it is important to develop a perspective on their strengths and limitations. This bulletin presents their definitions and history together with the related concepts, the Exception Principle and Newton's Fourth Rule.

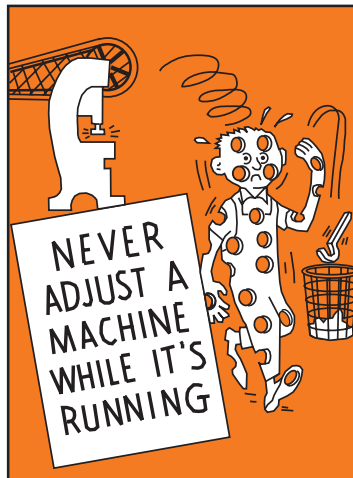
HISTORY

It is widely held that the phrase "rule of thumb" is derived from the English common law which restricted a man to beating his wife with "a whip or rattan no bigger than the width of his thumb (circa 1600's)." Rich [10] takes issue with this historical notion and suggests instead that the derivation of the phrase is based on the practice of brewers using their thumbs to measure the temperature of their beverage.

The following are typical examples of safety rules of thumb:

- Safety Hierarchy: Eliminate the danger; safeguard; warn; train or use personal protective equipment. [1]
- Shut off and lockout machinery before servicing. [8]
- Do not operate machinery without guards in place. [9]

The following poster by the National Safety Council [7] shows a common method of communicating rules of thumb.



¹ Professor. Mechanical and Aerospace Engineering, Illinois Institute of Technology, Chicago, and Chairman of the Board, Triodyne Inc., Niles, IL.

² Research Engineer, Triodyne Inc., Niles, IL.

Although there are clear exceptions to these rules, they are nonetheless easy to comprehend and are widely applicable. "In science, rules of thumb are the poor relations of laws and, although useful, cannot always be depended upon." [3]

RULES OF THUMB

The approximate nature of rules of thumb are emphasized in the following three definitions and descriptions:

"A method of procedure or analysis based upon experience and common sense and intended to give generally or approximately correct or effective results (seems to have run the ship by rule of thumb and word of mouth." – William McFee [4]

"A general principle regarded as roughly correct and helpful but not intended to be specifically accurate (a good rule of thumb is that smart youngsters prepared to enter college at the age of 16 have not been accelerated too much." – L.M. Spencer [4]

"A homemade recipe for making a guess, a mental tool that takes information you already have, and turns it into information you need." – Tom Parker [6]

THE EXCEPTION PRINCIPLE

Insight into the value and construction of a rule of thumb is provided by the Exception Principle. The following has been excerpted from the book "The Society of Mind" by Marvin Minsky [5]:

"The Exception Principle: It rarely pays to tamper with a rule that nearly always works. It's better just to complement it with an accumulation of specific exceptions.

All children learn that birds can fly. So what should they do when told that penguins and ostriches are birds that cannot fly? What should children do with rules that no longer work so well? The Exception Principle says: Do not change them too hastily. We should never expect rules to be perfect but only to say what is typical. And if we try to modify each rule, to take each exception into account, our descriptions will become too cumbersome to use. It's not so bad to start with "Birds can fly" and later change it into "Birds can fly, unless they are penguins or ostriches." But if you continue to seek perfection, your rules will turn into monstrosities:

Birds can fly unless they are penguins and ostriches, or if they happen to be dead, or have broken wings, or are confined to cages, or have their feet stuck in cement, or have undergone experiences so dreadful as to render them psychologically incapable of flight."

We observe that the rule approaches a law when exceptions are continually appended.

The dictionary provides a more formal, albeit, less useful discussion of the exception principle:

"a method or plan of supervision (as of a business) under which only significant deviations from normally expected results or conditions are brought to the attention of a supervisor for consideration and decision." [4]

Sir Isaac Newton (1642-1727)

To study physical phenomena, Newton introduced four philosophical rules [2]. The role of exceptions is described in his fourth rule:

"Rule IV – In experimental philosophy we are to look upon propositions inferred by general induction from phenomena as accurately or very nearly true, notwithstanding any contrary hypotheses that may be imagined, till such time as other phenomena occur, by which they may either be made more accurate, or liable to exceptions."

Newton makes the following comment on Rule IV: *"This rule we must follow, that the argument of induction may not be evaded by hypotheses."*

We observe that Newton was trying to develop laws by inductive inference. Once a proposition was contradicted by other phenomena it became a rule of thumb. Whereas the exception principle might keep this rule if it was sufficiently useful, Newton would modify it to make it more accurate or would place limits on its validity.

CONCLUSIONS

1. Rules of thumb are good servants but bad masters.
2. Without research to give us physical laws, the rule of thumb provides the only guidance for safety practitioners.
3. The fact that contrivances or behavior violate rules of thumb does not mean they are unreasonable per se. Negligent behavior or design cannot be determined by rules of thumb; other corroborating extrinsic factors must be employed.

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