

Foreword

This article first appeared in 'Everyday Practical Electronics' in 1997 (EPE, Oct. 97 pp 688-690). Though the magazine is well distributed, it seems that many people who do not have an interest in electronics, but have a fascination in the Murphy syndrome, became aware of the article too late to acquire an original copy. Pressed by many to get them an offprint or a photocopy of the article, I thought it better to publish this on the net, for all to see and comment on. If you have anything nice to say about the article, please contact barriebc@btopenworld.com (address any to murphy@wrongmail.com).

IT'S PROBABLY MURPHY'S LAW!

by Barrie Blake-Coleman

The all too common outcome of a seemingly predictable chain of events is catastrophe. The more you attempt to avoid it, the worse it appears to get; thus has Murphy's Law been recognized. We surmise that the Murphy Syndrome occurs too frequently to be pure chance, though reason counsels otherwise. Is Murphy's Law a satanic malevolence, an unseen and fiendish conspiracy to create chaos? Or is this interpretation of adverse phenomena irrational and more properly explained in the simple innocence of probability theory?

Though lighthearted, this article expects to challenge current beliefs. In this last respect, readers are forewarned that this article is written and structured so as to be convincing. Perceptive readers who discern dis-ingenuity, non-sequiturs and syllogisms are invited to rebut where appropriate.

Infamous Last Words

Murphy's Law is concisely epitomized by Captain E. J. Smith, commander of the S.S. Titanic, who was heard to utter the memorable words, "Icebergs? So what! She's unsinkable ain't she?" just a short while before the bottom of his ship was ripped open.

An amusing source for the Law of Murphy is the fictional and luckless Edsal Murphy – born (supposedly) in 1852 and died in 1922 and 1923! – although establishing an authentic origin is more difficult. Burns, in 1786, observed that "the best laid schemes of mice and men are prone to go awry" whilst the Victorian satirist James Payne noted that:

***I never had a piece of toast,
Particularly long and wide,
But fell upon the sanded floor,
And always on the buttered side.***

According to some historical sources (e.g. Macquarie), Murphy originated as an incompetent character in wartime U.S Navy training cartoons. Another reference (Berry) quotes a certain inept mechanic at Cape Canaveral. More credible authorities (e.g. Concise Oxford) cite George Nichols, a Northrop project manager, who in 1949 developed the idea of designing components which were impossible to fit incorrectly. The initiative supposedly comes from a remark by Captain. E. Murphy (of the Wright Field Aircraft Laboratory) that electrodes used in rocket sled trials (designed for testing rapid de-acceleration in pilots) were invariably wired incorrectly, as too aircraft valves with a choice of similar connecting ports. This led to the observation that "If there are two or more ways of doing something, and one of them can lead to catastrophe, then someone will do it!"

The fact that a 'failsafe' design was needed is implicit in Murphy's Law – it became formalized by common consent as 'Even if it can't possibly go wrong, it still will'.

The Law is not universally recognized as Murphy's Law, being variously regarded; in a more general form as 'The Law of Continuous Misery', and sometimes as 'Sod's Law' (which claims Murphy was an optimist!), 'Bodes Law' or 'Fingles Third Law', though this latter is obscure. Nevertheless, each version essentially articulates the same sentiment, that occurrences in life appear to be imbued with a malevolent influence, a definite inclination to thwart, confound, confuse, baffle, block, hinder, obstruct, burden, hamper and generally screw up all the things we want to do.

Instances of Murphy's Law abound and are now so axiomatically ingrained in the engineering and scientific community that the majority will nod vigorously when confronted with other people's experiences. As expounded in an earlier consideration, special and general forms exist; typically:

- 1) If a circuit cannot fail, it will.
- 2) A fail safe circuit will destroy others.
- 3) Any wire cut to length will be too short.
- 4) A device selected at random from a group having 99% reliability will be from the 1% group.
- 5) A dropped tool will land where it can do the most damage (also known as the law of selective gravitation).
- 6) Tolerances will always accumulate adversely.
- 7) Interchangeable parts won't.
- 8) If a prototype functions perfectly, subsequent production units will malfunction.
- 9) The last mounting screw will be the one that shears off.
- 10) The more innocuous a design change - the more profound its effect.
- 11) Any error incorporated into a calculation or design will operate in a direction able to create the maximum damage.
- 12) Constants aren't – variables won't. (All constants are variables).
- 13) In any computation, the figure that is most obviously correct will be the source of error.
- 14) A patent application will be preceded by one day (week or month) by another independent worker who will then abandon his own application as unworkable.

The Opposition of Inanimate Objects?

So often have utterly improbable events created havoc that there has grown up a general consensus that animate and inanimate objects are subject to a supernatural influences which sneer at the usual laws of physics and chance.

Indeed, the fact that everyone knows that bread always(?) drops butter side down was the subject of a quasi-serious investigation in a past QED TV program. Not unexpectedly, the 'experts' demonstrated that in the controlled dropping of jam covered bread, no malevolent influence existed and that the two possibilities, jam down or jam up, were equally likely events. In short, Murphy's Law was a fallacy – empirically bankrupt and an observational misnomer.

Unfortunately, these conclusions from the 'experts' were in no way convincing. Those watching could have been forgiven for feeling that just maybe the test conditions were themselves the subject of Murphy's Law. If the Law holds, it applies wherever attempts are made to quantify, or acquire with some certainty, the factors necessary for the Law itself to apply. In these circumstances the Law will act to prevent itself being exposed. A mocking parallel of Le Chatelier's (or possibly Heisenberg's) principle.

Upper Crust

Notwithstanding the old adage about 'those convinced against their will, hold to their opinions still,' few critical observers thought the demonstration a rigorous test of the phenomena (with the proviso that it wasn't easy to do in any circumstances). Skeptical experts - with an unwavering faith in statistical analysis - were clearly not looking beyond the very simplistic manifestation they thought Murphy's Law underpinned. Dropping jam covered bread is all very well, but what does it imply? Was it really a real world simulation of how Murphy's Law works? Of course it wasn't!

We know (don't we?) that the jam only hits the floor when the bread is dropped outside a Murphy 'continuum', in other words, our experience tells us that the moment we deliberately drop jam covered bread in a controlled way over a fixed time frame (i.e. say I drop jam covered bread at 10 second intervals for ten hours) the laws of chance (probability) and statistics immediately apply. Otherwise, by the hypotheses above, Murphy's law would definitely be validated.

If, however, the time frame is 'discontinuous' and this is the day when other Murphy factors are concentrating (you have an important meeting and are wearing a brand new suit) then dropping the bread/toast on your lap is on the cards, and it will tend to do so jam/butter side down!

This latter example is actually a far too mundane version of the Murphy syndrome. More typical is watching a spring loaded cog shoot from the mechanism under repair, skim across the table, launch itself into mid-air, ricochet off a milk bottle and bounce off the kitchen window into the sink.

Similarly, dropped screws, the ones irreplaceable in a mechanism, bounce off umpteen surfaces and then disappear into the most inaccessible crevice. As cog and screw disappear we are left in awe at the impossibility of it all.

“Couldn’t have contrived that in a month of Sunday’s,” we muse to ourselves trying to work out what quirk of fate, ballistics and position had calculated everything so perfectly for the fateful trajectory.

Paranoid

This then, essentially sums up the problems we face in elucidating the elusive quality of Murphy’s Law. We see virtually unique events which are so beyond contriving, so improbable, that its audacity leaves us staggered (and, understandably, a little paranoid). Deliberately pitching cogs at the table, in the hope of striking bottle and kitchen window, will never (in our lifetime) cause a dimensionally inappropriate cog to be lost from sight down the centre orifice of a plug hole.

As we think on matters, we juxtapose several factors. The first is that the loss of the cog is an extremely improbable event. The next follows immediately, that this isn’t the first time this kind of thing has occurred. Then we are struck by the relative ratio of two states, that is, the likelihood of the proposed event (fitting the cog) versus the chances behind the resultant mishap. Similarly, and without attempting to exactly quantify things, we can see that the number (or frequency) of improbable pathways contained in the event is in stark contrast to the direct probability of the event itself. In short, we are left with the proposition that a procedure with a most probable outcome, carrying a high probability of success, resulted in a uniquely improbable and very unfavorable result.

However, the fact that we experience such statistically unfavorable events not infrequently means either that other (dark?) forces are involved, or that these improbable occurrences are in themselves somehow favored. What we are saying then, and the reason Murphy’s Law is generally admitted, is that we will tend to observe events with infinitely small probabilities taking place with a numerically disproportionate frequency. In short, we have to ask what is the probability of regularly witnessing, initiating or participating in, a highly improbable (near impossible) event?

To consider this we need to look harder at the basis and theory of probability, a field of endeavor described by the French mathematician Laplace as “common sense reduced to calculation”.

The Event Isn’t the Issue

As a point of interest it all started with gambling. In 1654, the Chevalier de Mere (a notorious gambler and amateur mathematician) proposed to the celebrated mathematician Blaise Pascal a problem concerning the “division of stakes in a game of dice” should the players be obliged to abandon the game before its conclusion. Pascal communicated the query to Pierre de Fermat (nowadays also notable not only for probability theory but also

for his Principle of Least Time) and the study of probability began. However, for all its power, it remains riddled with contradictions. Treating the theory of probability as an exact methodology is dangerous – it deals with determining uncertainties, not strictly the opposite.

Intuition is important. Say two college students agree to flip a coin and let it land as it will. Heads they go for a beer, tails they watch TV, and if the coin stands on edge they study. Common sense told them that they would be spared the necessity of studying. Indeed, they were gambling effectively only on two favorable possibilities; they were instinctively employing innate probability analysis; given all previous experience concerning coin behavior, it was unlikely that it would land (and stand) on its edge.

Possible and ...

If p is the expectation that tails will appear, then (assuming no bias) there is the same chance – p – that heads will appear. If we are certain that either heads or tails will appear then the value of certainty is $2p$, expressing the probability that any event which is bound to occur will occur.

If we now assign certainty as 1 , then $2p = 1$ and the probability of heads is $1/2$ and the probability of tails is $1/2$. To sum up, each event is equally likely. The same is true of our previously cited slices of jam covered bread. The idea that it could stand on edge is simply not considered!

But what if we *do* consider the edge possibility? Suppose that the number of ways in which a certain event can happen is h and the number of ways it can fail to happen is f . Let's suppose, further, that both possibilities are equally likely. Then the probability that the event *will* happen is:

$$h/(h + f)$$

... and the probability it will *fail* to happen is;

$$f/(h + f)$$

... and the probability that it will happen, or fail to happen, is:

$$h/(h + f) + f/(h + f) = (h + f)/(h + f) = 1$$

That is, the chance that it will happen or fail to happen is a certainty. Now, we have agreed (?) that the coin cannot stand on edge but must fall with either heads or tails showing. That is, the number of ways in which the coin can stand on edge is 0 and the number of ways this can fail to happen is 2 (i.e. heads or tails). Therefore the probability that the coin will stand on edge is (in this scenario at least) $0/2$, or 0 .

... Impossible

This leads us to consider that *the probability of the occurrence of an impossible event is 0*, and *the probability of the occurrence of an event which is certain is 1* and that *the probability of the occurrence of a doubtful-yet-possible event is some value between 0 and 1*.

It dawns on us, perhaps, that the coin example is too idealistic, too trite. Concede that there is a finite possibility that the coin will land on its edge – this is the real world. So we write the probability of occurrence as some very small fraction: **fr over 2**. The ratio of the two dominant, but equally likely, events (heads or tails) will be numerically vast compared to the edge probability **fr**.

Our college students knew they faced a finite risk of having to study, but they were gambling very much with the odds against it.

Intuition tells us that the longer a statistically determined event has failed to happen, the more probable becomes its occurrence. (Fruit machine players believe this). Conversely, though it may be an absolute rule that in a fruit machine the odds remain fixed each time the sequence starts, by definition, if the odds on a certain improbable event (jackpot) are finite, each such improbable event, as it takes place, is viewed as taking the re-occurrence of the same event further away. Yet this, on a strict statistical basis, is wrong - it could as easily happen next time round.

Likewise, we might reason conversely, that the failure of a statistically predictable (and normally distributed) event to occur over time brings the likelihood of occurrence closer. We would be very surprised (though it is equally probably) if all the predicted events occurred at the end of time. But, unlikely as it is, this could happen. Nevertheless, in terms of Murphy's Law this is the point where dry calculation losses touch with reality. In the real world sheer statistical probability is just one factor amongst other effects and influences.

Back to our cog (above). The numerical ratios are arguably a reflection on the possibility of unlikely events occurring often. In terms of occurrence, the number of situations in which we find ourselves throughout our lives means that we are continually becoming players in improbable events. In terms of a perception of time and circumstances, very unlikely events appear to happen regularly to some people. Sometimes, we intuit that it is far too often! Just like the coin, we know life can land on its edge and that this remote possibility will happen only when we are least prepared, or equipped, to handle it.

Can we conclude anything from this?

Only that our lives are not wholly measured by chance, nor are we prone to be the victims of an ill-fated jinx. The more we do, the greater the opportunity for becoming an unwilling participant in a Murphy scenario. Murphy occurrences, and our perception of them, increase in direct proportion to circumstances and our ability not to be able to cope with them - a fact with which we are all acquainted. Fate rules. We have only limited control over the conditions which optimize the factors governing Murphy's Law.

So, let us try to formalise Murphy's Law and give structure to our empirical statement. The possibility of a Murphy occurrence (**Mo**) through the coincidence of any one of **n** different events of improbability (**p~**) able to take place over a given time span (**t**) is:

$$\mathbf{M_o} = \mathbf{t} * (\mathbf{n} * \mathbf{sum(p\sim)})$$

... where **sum(p~)** means the summation of single event **p~** terms. Now, **Mo** approaches **1** as **n** and **t** are increased and **p~** becomes more finite (increasing to **1**). Time is important because event sequences are invariably time dependent; thus, as **t** becomes vanishingly small, **Mo** vanishes accordingly. Likewise, the absence of an event or event sequence over unit time means that a right-hand term reduces to zero and accordingly **Mo** is zero. As **p~** increases positively over unit time so too does the value for **Mo**, but this may be countered by a reducing value for **t** (time span).

This restates Murphy's Law in a way which denies any supposed demonic intervention, and accounts for the more pragmatic aspects. The message is simple, i.e. in any given time span there is a high risk of the occurrence of highly improbable events - but they may not always be negative and you may not always participate in them. However, as regards chains of adverse occurrences and unfavorable events, they can and do appear to cluster.

Hence, the explanation is not, as advocated by some, *that a large number of improbable outcomes leads to the certainty of an improbable outcome*, but rather that in Murphy's Law it is the improbable (inexplicable) outcome which tends to be probable!

The two statements are not tautological, since in the first instance, a Murphy occurrence would mean that any observer insisting that an outcome was so uncertain (i.e. certain to be improbable) that the result could not be predicted, would be demonstrably wrong! Likewise, in a field of likely outcomes, Murphy dictates that the outcome is not predictable.

Murphy will by definition confound. It suggests that the improbable is favored – in a nutshell there is a high probability that a highly improbable event will occur, or the chances of participating in an improbable event is high. This doesn't imply that improbable events are themselves made intrinsically probable, rather their occurrence is. We distinguish between the implicit improbability of an event in itself, and the likelihood of such events occurring.

Biased Conclusion

As a final comment, some observers will hotly deny Murphy's Law, because it implies bias in the laws of chance – they rightly insist that probability is just that, and cannot be violated, without realizing that Murphy's Law implies no such thing, since each Murphy event has its own statistical identity. That is to say, a Murphy is not removed from the statistical environment.

Others avoid acknowledging any contradiction by insisting that we be reminded that adverse events are as equally probable as favorable ones, again misunderstanding the basic Murphy dictum. (Forgetting, for instance that getting it right is one critical path requiring control,

getting it wrong is a plethora of pathways independent of control). Some find refuge in fatalistic acceptance, yet others refuse the evidence of their own experiences and, entirely un-flustered by misfortune, simply ignore it altogether. Pragmatists on the other hand recognize that it will get you in the end and plan accordingly.

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