

Your device has no feelings: Avoiding awkward anthropomorphism in technical writing

John Maloney, Ph.D., ELS

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<http://john.maloney.org>

This note is part of an ongoing series intended to ensure that readers focus on your research rather than on phrases that may not sound natural in English. Every reviewer has a threshold for encountering awkward wording; if this criterion is exceeded, reviewers tend to shift their focus to language differences and may even refuse to finish reading the manuscript. My goal is to suggest more natural phrases and strategies for communication to keep the focus on your high-quality study.

A sometimes confusing aspect to the English language is the degree to which an object can be described as having human feelings or taking human-like actions. We call this “**anthropomorphization**” of the object, and certain anthropomorphic descriptions do (or do not) sound natural in technical writing. **The purpose of this note is to survey the spectrum of anthropomorphizing verbs and phrases to clarify where awkwardness arises in technical writing.** Such awkwardness can cause reviewers, editors, and readers to stop thinking about the research program and start thinking about whether the language is being used correctly. We must avoid this possibility.

Clever and provocative anthropomorphism can certainly enhance non-technical writing. For example, Callies (in “Why money can’t buy you anything in German: A functional-typological approach to the mapping of semantic roles to syntactic functions in SLA,” *Cross-linguistic Influences in the Second Language Lexicon*, 2006: 111-129) offers several examples that sound natural in non-technical prose in English but sound unacceptably unnatural when translated directly into German:

California **grows** the best oranges.

The 3rd of October **celebrates** the day of German reunification.

69 million dollars **bought** him the election.

Although a state, a date, and a quantity of money can’t possibly take any conscious action, the meaning is clear. Such anthropomorphization would be considered excessive in technical writing, however, where the goal is not to create a new and notable phrase but rather to express questions, results, and procedures clearly. A reasonable strategy in academic and technical writing is to be as objective as possible without sacrificing readability. We constrain ourselves to use more straightforward language—not to make reading tedious but to allow our reader to focus on the purpose, importance, results, and implications of our research. A reader who finds too many unusual or awkward expressions might decide that we cannot properly articulate our findings. A colleague for whom English is not a first language might find our writing indecipherable. This potential loss of attention prompts us to consider our words carefully.

Let's consider several examples from the technical literature. It sounds natural, for example, to say that a steel beam "**carries a load**" even though no beam has ever picked up a weight and walked off with it:

"In materials science, mechanical failure is defined as the loss of a material's capacity to carry **a load** and is measured by a material's strength and ductility." Zhang, *Nature Nanotechnology* 7.9:551–552 (2012).

Furthermore, it sounds natural to say that a titanium film between a silicon substrate and a gold film "**serves** as an adhesion layer" even though the layer hasn't the consciousness to commit to serve any goal. Consider the related examples:

"After virus entry into the host cell, the viral genome is uncoated and **serves** as a template for the translation of a single polyprotein..." Pedersen et al., *Nature* 449: 919–922 (2007).

"Surface ligand attachment **plays a part** in specifying the endocytic compartment." Nel et al., *Nature Materials* 8:7:543–557 (2009).

"...the polymer is in its extended state and **acts** as a 'shield' to block the binding of large biotinylated proteins..." Ding et al., *Nature* 411:59–62 (2001).

"The front end of the biochip **performs** the required unit operations for the sample preparation" Brolo, *Nature Photonics* 6:709–713 (2012).

Here, the common element is that the material or device is following the intention, the behest, of the researcher who designed and assembled the system. However, it begins to sound less natural to say that a film "defends against" a condition, for example. It also sounds unusual in English technical writing to say that a beam "feels a vibration" or that a thin film "suffers in alkaline conditions." The suggestion that an inanimate object has personal emotions such as experiencing a condition or feeling endangered goes too far, and we prefer to use more objective language, language that seems more appropriate for objects or materials: "the beam **undergoes** vibration (or is **exposed** to vibration)" and "the film **degrades** in alkaline conditions (or is **attacked** in alkaline conditions)."

It's not always possible to define logically what sounds natural in the English language; however, we can apply certain broad rules. For example, it sounds unnatural to ascribe a thought process to any material. Consider the difference between "deciding" (requiring a higher degree of sentience) vs. "**reacting**" or "**responding**" (requiring a lower degree of sentience). Since even a plant or a biological cell can **react** or **respond**, it doesn't sound particularly unnatural for a material to do the same:

"...if the block is made from a substance that **reacts** to light and dark in different ways, the interference pattern is stored inside the material." Haw, *Nature* 422:556–558 (2003).

“A phytochrome is a two-component system that consists of a membrane-bound, extracellular sensor that **responds** to light...”
Levskaya et al., *Nature* 438:441–442 (2005).

However, we wouldn’t say that an inanimate material “addresses a situation” or “dedicates itself to a task” or “studies an environment.”

Some additional examples are useful to consider. The following examples are drawn from my own experiences as a technical editor (note that I’ve changed the non-bolded parts of the sentences to anonymize the authors). Certain undesirable terms sound more unnatural than others. In every case, the revised term or terms are intended to avoid surprising the reader with an overly anthropomorphic term that might cause them to pull attention from the purpose of the paper.

I find that the most common awkwardly used anthropomorphic verb is “to experience”:

- ✗ The technology has **experienced** substantial regulatory attention.
- ✓ The technology has **received** (or **has been the focus of**) substantial regulatory attention.

- ✗ The supplemental T-beam **experienced** (or **felt**) high periodic shear stresses.
- ✓ The supplemental T-beam **was exposed to** high periodic shear stresses.

- ✗ The outer coating of the implanted device **experienced** the maximum magnetic flux.
- ✓ The outer coating of the implanted device **was the site of** the maximum magnetic flux.
(Or: The maximum magnetic flux **was induced in** (or **occurred in**) the outer coating of the implanted device.)

- ✗ A hazardous situation can arise if the coal **experiences** a high unloading rate.
- ✓ A hazardous situation can arise if the coal **undergoes** a high unloading rate.
(“To undergo” is an irregular verb. The present perfect tense, corresponding to “has experienced,” would be conjugated as “has undergone”; the past tense, corresponding to “experienced,” would be conjugated as “underwent.”)

- ✗ China **experienced** twelve major earthquakes between 1980 and 1990.
- ✓ Twelve major earthquakes **occurred** in China between 1980 and 1990.

The second most awkwardly used anthropomorphic term is “to judge”:

- ✗ The model **judges** (or **perceives**) the importance of the external factors during a sampling window.
- ✓ The model **evaluates** the importance of the external factors during a sampling window.
- ✗ When the **judgements** are accomplished, the algorithm stores the completed graph in short-term memory.
- ✓ Following **evaluation**, the algorithm stores the completed graph in short-term memory.

Other unnatural-sounding terms and their more objective replacements follow:

- ✗ The normalization step **guards against** numerical instability during the inversion process.
- ✓ The normalization step **avoids** (or **prevents**) numerical instability during the inversion process.
- ✗ The first virtual joint represents the **bondage** of the two real nodes.
- ✓ The first virtual joint represents the **connection** (or **coupling**) between the two real nodes.
- ✗ The failure likely originated from the loss of cohesion in the water-**invaded** region.
- ✓ The failure likely originated from the loss of cohesion in the water-**infiltrated** region.
- ✗ The revised simulation results are **agreeable** with the test results.
- ✓ The revised simulation results are **consistent** with the test results.
- ✗ The shape of the failure mechanisms should also **respect** the normality condition.
- ✓ The shape of the failure mechanisms should also **satisfy** the normality condition.
- ✗ The planned path is completely **divorced** from the agent model.
- ✓ The planned path is completely **uncoupled from** (or **decoupled from** or **independent of**) from the agent model.
- ✗ Then, the first two criteria **decide** whether the storage capacity is sufficient.
- ✓ Then, the first two criteria **determine** (or **govern**) whether the storage capacity is sufficient.

- ✗ The enterprise has continued to **exert** significant green efforts.
- ✓ The enterprise has continued to **implement** (or **apply**) significant green efforts.

- ✗ The reconciliation was **assisted by** vast amounts of experimental data.
- ✓ The reconciliation was **enabled by** (or **performed in conjunction with** or **furthered by**) vast amounts of experimental data.

- ✗ Increased urbanization worldwide will **demand** more comprehensive tunnel-building techniques.
- ✓ Increased urbanization worldwide will **require** (or **necessitate**) more comprehensive tunnel-building techniques.

- ✗ The vibration of active matter **enjoys** several higher-order modes.
- ✓ The vibration of active matter **exhibits** (or **features** or **involves** or **presents**) several higher-order modes.

- ✗ We studied whether chlorine ions **prefer** to stay in the ground state.
- ✓ We studied whether chlorine ions **tend** to stay in the ground state. (Or: “We studied whether Cl⁻ ions **are energetically restricted to** the ground state.”)

- ✗ The **aim** of the intra- and inter-type particles is to improve the mechanical properties.
- ✓ The **aim of using** the intra- and inter-type particles is to improve the mechanical properties. (Or: We **use** the intra- and inter-type particles to improve the mechanical properties.)

- ✗ The device will work properly if the disc springs and friction devices **collaborate**.
- ✓ The device will work properly if the disc springs and friction devices **work in conjunction**.

- ✗ The following checklist can be used to evaluate the post-earthquake **health** of the building.
- ✓ The following checklist can be used to evaluate the post-earthquake **integrity** of the building.

- ✗ The turbulence in the opposite chambers **compels** lateral collision of the flows.
- ✓ The turbulence in the opposite chambers **causes** (or **induces**) lateral collision of the flows.

- ✗ This approach allows the numerical technique to **ignore** the components of the drop table.
- ✓ This approach allows the numerical technique to **omit** (or **discard** or **avoid incorporating** or **operate independently of**) the components of the drop table.

The consistent element here is that the overly anthropomorphic term ascribes thinking to the inanimate object. The problematic aspect is often the emotional component of a common word. For example, “ignoring” something implies more emotional participation than “**omitting**” something. As a result, the latter is more appropriately used in the technical literature:

“The analysis **omits** invertebrates, which are largely undocumented but probably make up at least 95% of all species...” Myers et al., *Nature* 403:853–858 (2000).

Let’s now consider other examples of verbs that do sound natural when used in conjunction with common elements of a study or report:

A figure or table can “**display** or **show** or **list** or **distinguish** or **present** or **reveal** or **indicate** or **exhibit** or **compare**” a feature or result.

An object or condition can “**provide** or **achieve** or **ensure** or **deliver**” a result, “**apply**” a constraint, “**regulate** or **maintain** or **avoid** or **exploit** or **suppress** or **induce** or **exert** or **apply** or **satisfy** or **violate** or **maintain**” a condition, “**employ** or **use** or **incorporate** or **rely on**” a feature, “**resist**” failure, “**exert** or **apply** or **suppress**” a force, or “**minimize** or **maximize** or **optimize** or **preserve**” a metric.

Again, it is understood that we accomplish these goals using the device or conditions.

A procedure or algorithm can “**analyze** or **process** or **evaluate** or **explore** or **identify**” data or a condition. However, “investigate” sounds somewhat unnatural for a simple algorithm—better to say that we **investigate** a system using the procedure.

A metrology tool can “**measure** or **determine** or **quantify** or **record** or **identify**” data. However, “characterize” can sound unnatural for a simple device—better to say that we **characterize** the system using the tool.

Data or results can “**show** or **indicate** or **reveal** or **demonstrate** or **confirm** or **verify** or **falsify** or **support**” a feature or conclusion or hypothesis.

In the literature, we commonly find reports in which the research (or study or paper or section of the paper) is said to “**consider** or **address** or **focus on** or **discuss** or **explain** or **describe** or **explore**” an issue or approach or “**survey** or **review**” the state of the literature. However, certain style guides prohibit this use, most notably that of the American Psychological Association (*Publication Manual of the American Psychological Association* 6th ed.). The APA would recommend “In this study, we **address**...” or “In this

section, we **review...**,” for example. Here, we must refer to the style guide of the journal of interest for instructions.

When describing a “smart” or “intelligent” material or process, authors might deliberately employ strong anthropomorphism for provocative effect. A network might be described as “**learning**.” An algorithm might be described as “**thinking**.” An inanimate thin film stack that cyclically incorporates oxygen vacancies might be described as “**breathing**,” as in a paper I coauthored in 2017:

“...the electrochemically driven **breathing** response of these specific non-stoichiometric oxide films presents advantages for high-temperature actuation.” Swallow et al., *Nature Materials* DOI:10.1038/nmat4898 (2017).

Because such descriptions tend to surprise the reader, a suitable rule might be to use one such term at most in a research report—and only if the rest of the manuscript is carefully edited to avoid English-language errors. The goal must remain that the language sounds objective and credible to reviewers, editors, and readers.

About the author: John M. Maloney (<http://john.maloney.org>) received his Ph.D. in 2012 in the area of biological cell chemomechanics from MIT’s Department of Materials Science and Engineering, where he most recently held an appointment as Research Scientist. He has published research reports in *Nature Biotechnology* and *Nature Materials* and holds 10 patents in the area of microfabrication and medical device design. As a freelance technical editor, certified by the Board of Editors in the Life Sciences, he has edited over 1,200 manuscripts, focusing on helping non-native English speakers articulate their research results with sophistication and technical precision.