

# The Craft of Scientific Writing

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Unit 3

- the English verb

“They also serve who only pull and tug” (Schoenfeld, Ch. 27)

- A proud ocean liner enters the harbor; in order to maneuver into its assigned dock it needs help from small tugboats
- Auxiliary verbs are such tugboats
- French verbs can make at least 8 maneuvers unaided (“temps simples”): *présent*, *imparfait*, *passé simple* (literary French only), *futur simple*, *conditionnel*, *présent du subjonctif*, *imparfait du subjonctif*, *impératif*, — you get the idea.
- In addition, French has another 8 or so “temps composés” that involve auxiliary verbs as “tugboats”
- English may have even more “ tiroirs verbals ” (“verbal drawers”, i.e., tense-aspect-mood combinations, or TAMs) than French (which doesn’t have the continuous aspect), but the vast majority are “temps composés”, i.e., compound verb tenses.
  - English verb **tenses** [narrow sense of the word]: **present, past, future**
  - English verb **aspects**: **imperfect** (narrative, habitual), **perfect** (complete), **continuous** (ongoing).\*\* English verb **moods**: **indicative, imperative, conditional**, (chiefly US) **subjunctive**
- but only few TAMs unaided:
  - simple present (“I speak English”, i.e., I habitually do so, I can speak it.)
  - simple past/preterite/narrative past (“I took the A train”)
  - present imperative (“Go home/Go to sleep/Pay now or cry later”)
  - subjunctive present (“The court decrees that the defendant be taken to the gallows and hanged by the neck until dead.”)
  - subjunctive past (“If only I were a millionaire”). Cf. “derekh ha-mish`ala” in Hebrew.
- the rest requires “tugboats” (auxiliary verbs)
- TAMs are usually called “tenses” [broad sense of the word]

(\*) Other Indo-European languages with continuous aspects: Dutch (“Ik lees”=I read, “Ik ben aan het lezen”=“I am [in the middle of] reading”), Italian (“sto parlando”=I am talking), Spanish (“estar haciendo”=to be doing. Both are much less commonly used than in English though.

# Some common English tenses [broad sense]

- **Simple present:** “I play the piano” (I habitually play), “I speak Hebrew” (I *can* speak it)
- **Present continuous:** “I am playing guitar” (i.e., I am playing right now)
- **Present perfect:** “We have synthesized the molecule in Scheme 1”
- Present perfect continuous: “[It’s been a hard day’s night, and] I’ve been working like a dog.”
- **Simple past/narrative past/preterite:** “I flew to Dallas via Frankfurt”, “In order to clarify this issue, we ran additional CASSCF calculations using a (20/18) active space.”
- **Past continuous:** “As I was walking past the library, I saw her in the window.”
- **Pluperfect/past perfect:** “As we had previously synthesized compound **1** for an unrelated study, we methylated it to yield compound **2**” (i.e., while talking in the simple past or present perfect, you refer to something that happened *even before that*)
- **Simple future:** “I will drive to Monterey”.
  - Alternate modal auxiliary verb: “shall”. In practice, used in more formal language, legalese: “Punishment shall be a term in prison of no less than two and no more than five years.”
  - “We shall fight on the beaches; we shall fight on the landing grounds, we shall fight in the fields and in the streets, we shall fight in the hills; we shall never surrender.” (Winston Churchill)
    - “Mr. Churchill, you are drunk!”
    - “And you, madam, are ugly. But I shall be sober in the morning.”
- **Conditional:** “I would do this if I could.” “We would carry out the full GW calculation if we had the computational resources.” “We would be able to resolve the peaks if the resolution of our spectrometer were high enough” “Should you be in Israel at that time, it would be our pleasure to host you at Weizmann.”
- **Future perfect:** “By the time you will be finished, my dog will have had puppies.”

# Inflection of the English verb

- A typical English verb may have five different inflected forms:
  1. the base form, plain form, or **bare infinitive** (**go, write, climb**): used for:
    - infinitive (to go, to write, to climb)
    - imperative (Go tell it on the mountain!)
    - present subjunctive (Resolved, that the law of ... be declared null and void.)
    - present indicative (I go, you write, they climb) except 3rd person singular
  2. the “-s” form: **present** indicative, **3rd person singular** (**he goes, he writes, he climbs**)
  3. the **simple past**/preterite/imperfect past (**I went, you wrote, she climbed**)
  4. the **past participle**: Identical to past tense for all regular verbs and some irregular verbs (I have **climbed**, you have **calculated**), different for irregular verbs. Used in
    - “perfect” tenses (I have climbed the mountain, I have gone home)
    - the passive voice (my car was fixed, the house was built)
    - adjective and adverbial phrases: the bag left on the train cannot be traced, I found my violin broken, I’m going to have that bad knee looked at by an orthopedist
    - Note irregular verbs:
      - I have **gone** home, not “I have went [sic] home” [VERY common mistake]
      - It is **written**, not “it is wrote [sic]”; it is **done**, not “it is did [sic]”
  5. the **-ing form** (going, writing, climbing), used as:
    - **present participle**: in “continuous” compound tenses: I am going, I am writing, I am climbing
    - **gerund**: verb used as a noun
      - when the going gets tough
      - writing Hebrew is hard; the writing is on the wall (הכתובת על הקיר)
      - climbing Mount Everest without breathing apparatus is basically impossible

# Irregular verbs

- Most English verbs are regular: climb/climbs/climbed/climbed/climbing
- A couple hundred are irregular
  - These include some of the most commonly used (and oldest) ones, usually of Germanic origin (later imports or formations tend to be regular)
- Examples:
  - to do: I do/you did/it is done/a done deal/I am doing it already
  - to go: I go/you went/she is gone/—/I am going
  - to write: I write/you wrote/it is written/a writ of *certiorari*/I am writing
  - to tear: I tear up the letter/you tore it up/the curtain was torn/the torn curtain/I am tearing his wretched paper apart
  - to teach: I teach/you taught/I have been taught/the teaching/I am teaching
  - to think: I think/you thought/it was thought that.../the thinking was that, the thought was that/I am thinking about...
  - to speak: I speak/you spoke/English is spoken there/English speech/I am speaking
    - archaic narrative past: spake (“Thus spake Zarathustra”, as Nietzsche’s book is called in translation)
  - Google “irregular English verbs” for more
- Defective verbs: missing one or more forms
  - can/could      • shall/should      • will/would      • may/might      • must      • ought to
  - impersonal verbs: it rains/it snows      (Cf. expression: “I rained on his parade”)

[\*] The archaic “writ” basically only survives in legalese (בשפה המשפטית).

E.g., a “writ of divorce”; a “writ of certiorari” is a formal request to the US Supreme Court to hear a case (usually: because it involves a Constitutional issue)

# To be or not to be

- a special place for “to be”:
  - I am; you are; he is; we are; you are; they are
    - poetic/religious use only: thou art
  - I was; you were; he was; we were; they were
  - It has been said
  - That actor/singer is a “has-been”
  - Are you being silly? The unbearable lightness of being

# Passive voice (as opposed to active voice)

- compare the Hebrew *binyanim* הופעל, פועל, נפעל, vs. הפעיל, פיעל, פעל
  - even though the נפעל can sometimes act as a reflexive (I entered/נכנסתי) in the role usually reserved for the התפעל (I washed myself/התרחצתי)
- **Simple present:** “[We hold these truths to be self-evident, that] all men are created equal, that they are endowed by their Creator with certain inalienable rights, that among these are life, liberty, and the pursuit of happiness” [US Declaration of Independence]
- **Present continuous:** “I am being taken to the airport” (i.e., right now)
- **Present perfect:** “The molecule in Scheme 1 has been synthesized”
- Present perfect continuous: “[It’s been a hard day’s night, and] I’ve been working like a dog.”
- **Simple past/narrative past/preterite:** “The mixture was cooled in liquid nitrogen”, “In order to clarify this issue, additional CASSCF calculations were run using a (20/18) active space.”
- **Past continuous:** “As the mixture was being stirred vigorously, it exploded.”
- **Pluperfect/past perfect:** “As compound 1 had previously been synthesized for an unrelated study, we methylated it to yield compound 2”
- **Simple future:** “The replacement engine will be flown to the base tomorrow”.
  - Alternate modal auxiliary verb “shall”: “I shall”. In practice, used in more formal language, legalese: “Cruel and unusual punishments shall not be inflicted.” (8th Amendment, US Constitution)
- **Conditional:** “If this simulation were that simple, I’m sure it would have been published already.”
- **Future perfect:** “The missile will have been launched.”

# Present and past participles: recap

- **Past participle:** used for:
  - **perfect tenses** (it has been done/you have been warned/...)
  - **passive voice** (it is created/taken/synthesized/...)
  - adjectival constructions: “as pure as the driven snow”; “the chicken eaten by the children was tainted”
  - adverbial constructions: “Seen from this perspective, entropy can be considered a measure of information”
  - formation: add “-ed” for regular verbs; many irregular forms: drive->driven, sing->sung, make->made, show->shown, hang->hanged (form of execution)/hung (all other uses)
- **Present participle:** used for:
  - **continuous tenses** (it is being done/I am driving/...)
  - adjective phrase (the boy sitting there is Ender Wiggin)
  - adverbial phrases (looking at your draft, it seems we haven’t got the story straight yet)
  - nominative absolute: “This being said, I admit that...”  
“Having reconciled our differences, we buried the hatchet.”  
“A well-regulated militia being necessary to the security of a free state, the right to keep and bear arms shall not be infringed.” (2nd Amendment, US Constitution)
  - dangling participle: “Broadly speaking, the project was successful”
  - formation: add “-ing”. Fairly regular with some exceptions:
    - if stem ends in “-ie”, replace by “-ying” to avoid awkward “-ieing” ending: lie->lying, die->dying
    - consonant doubling: dub->dubbing, ship->shipping, panic->panicking,... [largely follows pronunciation]
    - final silent “e” dropped: believe -> [don’t stop] believing

# Gerund

- **Verb used as noun:** examples
  - "This takes some doing"
  - "The waiting is the hardest part
  - "Don't stop believing"
  - "The proof of the pudding is in the eating."
- Formation of gerund basically equivalent to present participle
- Not to be confused with the *gerundivum* in Latin (which indicates an action that ought to be done):
  - Nunc est bibendum: "Now it is [upon us to] drink/Now we must drink/Now it's drinking time"
  - Cato the Elder (234-149 BCE), the original "broken record" orator, would insert in any speech on *any* subject the phrase "Ceterum censeo Carthago delenda esse" ["Otherwise, I hold [the opinion] that Carthage is to be wiped off the map."]
    - hence nickname "Cato Censor"
  - English has no real equivalent of the gerundivum. Schoenfeld considers this a loss for scientific writing; I agree.

# Formation of compound verb tenses: recap

## Active voice (פעיל)

- **Present, past, & future continuous:** [form of “to be”]+present participle
  - “I am playing guitar.” (i.e., right now)
  - “As I was walking past the library, I suddenly saw her.”
  - “I will be flying to Dallas tomorrow.”
- **Simple future/future imperfect:** “will”+bare infinitive
  - “I will follow”
- **Conditional:** “would”+bare infinitive
- **Present perfect, pluperfect/past perfect, future perfect:** [form of “have”] + past participle
  - “We have synthesized the molecule in Scheme 1”
  - “As previously, we had built the 250 MHz instrument, we then proceeded to modify it for this application.”
  - “By the time you will be finished, my dog will have had puppies.”

## Passive voice (סביל)

- **Present, past, & future continuous:** [form of “to be” in passive voice]+past participle
  - “The Hammond organ was being played.” (i.e., right now)
  - “The new prototype will be flown to Dallas tomorrow.”
- **Simple future/future imperfect:** “will be”+past participle
  - “The Mozart sonata KV 545 will be followed by the Bach Prelude and Fugue BWV 846.”
- **Conditional:** “would be”+past participle
- **Present perfect, pluperfect/past perfect, future perfect:** [form of “have”]+”been”+past participle
  - “The molecule in Scheme 1 has been synthesized”
  - “As previously, the 250 MHz instrument had been built, we then proceeded to modify it for this application.”
  - “By the time the Clore House renovation will have been completed, my cat will have had kittens.”

# Active vs. passive voice in scientific writing

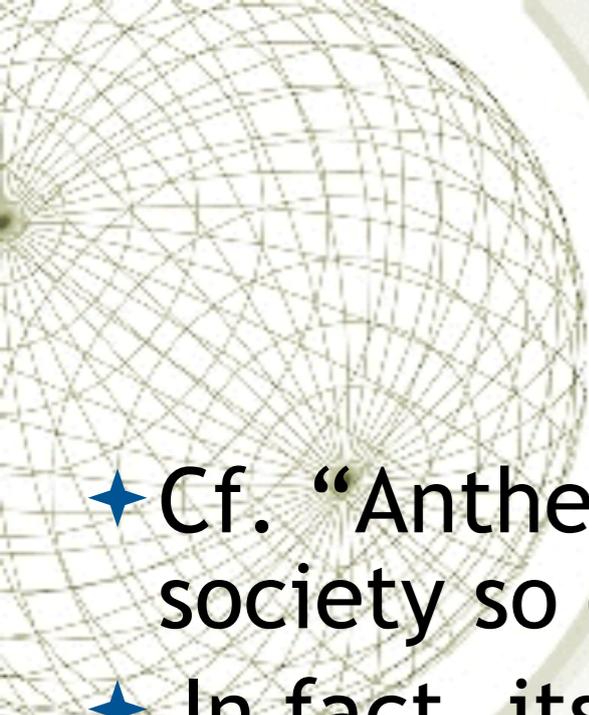
- Virtually all publications for a general audience prefer the active voice, or even demand it. Consider, e.g., recommendations in:
  - *The Economist* style guide
  - George Orwell, “Politics and the English Language”
  - Strunk & White, “The Elements of Style”
- In contrast, in scientific writing the passive voice is commonly used
  - Focus should be on the facts and arguments, not on the authors
  - However, in recent years, journal editors have become more tolerant of limited use of the active voice
    - For example, when discussing a judgment call by the authors (or the authors of another paper), use of the active voice is not only legitimate but effective.
      - “Based on these observations, we argue that,,,”
      - “Weinhold[12] proposed a quadruple bond in C<sub>2</sub> based on natural bond orbital (NBO) analysis”
      - Schoenfeld: “You should bravely step forward” and say “We argue that...” rather than “It is being argued here by the present authors”...
  - My personal view: consider the active voice a “spice”. Spices makes for tasty food when used in moderation, but when overused make the food unpalatable for most dinner guests

# An aside: the concept of language “registers”

- In sociolinguistics, language “registers” are different varieties of the same language that are spoken or written in different social contexts. Martin Joos (1961) identifies five main registers:
  - **Frozen register** or “static register”: Printed, unchanging language. E.g., Bible quotations, the US Constitution, ... Legal documents are typically at least partly in the frozen register (quotations from laws or legal precedent, standard legal phrases,...)
  - **Formal register**: one-way, uninterrupted communication. Technical vocabulary, exact definitions are important. Scientific papers are almost always in the formal register.
  - **Consultative register**: two-way participation, with some interruptions. Conversational behavior, including generic acknowledgments such as “uh-huh”. “go on”, etc. are permitted, as are “in plain English” elaborations. Examples: professor/student, doctor/patient, lawyer/client, ...
    - Scientific presentations fall somewhere between the formal and the consultative registers, with plenary lectures at prestigious conferences representing the “formal” edge and presentations at group meetings the more “consultative” end.
  - **Casual register**: in-group friends and acquaintances. Ellipsis [=omission of words], slang, ..., and interruptions common.
  - **Intimate register**: family and close friends. Nonpublic; private vocabulary; nonverbal messages; intonation often as important as actual words.
- Interrelation with dialect and sociolect:
  - Dialect usages may be acceptable in casual and intimate registers, never in the others
  - “Slang” and colloquialisms are acceptable also in the consultative register (especially with Americans), in *very* small doses even in scientific writing.

# Most common verb tenses in scientific writing

- **present perfect:** to report experiments etc. that were completed. Most common tense in all of scientific writing. Usually passive.
  - Passive (more common): “Compound 1 has been synthesized.”
  - Active (less common): “We have completed construction of the reactor.”
- **simple present, active:**
  - for unchanging laws, facts of Nature, etc.:
    - “The speed of light in vacuum equals 299 792 458 m/s” (it is, was, and will be);
    - “The vibrational entropy of a polyatomic molecule in the RRHO approximation is given by Eq. (3).” (That equation is, was, and will be correct under the stated conditions.)
  - other factual statements: “The present discussion consists of 3 sections: A, B, and C,”
  - expressed opinion of authors: “Based on this, we contend that...”
- **simple past, passive:** “When potassium wire was immersed in water...’
- **pluperfect:** used when, while speaking in the present perfect or simple past, one needs to refer to an action completed still further in the past. “As we had synthesized exemplamine in 2003, we methylated it to yield methylexemplamine.”
- Future: “Applications will be reported in a subsequent paper.”



## *Even in active voice, 1st person singular taboo/verboten/מוקצה*

- ★ Cf. “Anthem” by Ayn Rand: dystopian novella describing a society so collectivist that even the use of “I” was outlawed.
- ★ In fact, its use in scientific writing *is* considered taboo/*verboten*/מוקצה/simply not done.
- ★ This aside from confusing examples like “Analysis revealed that Cl and Br were present in appreciable amounts; but as stated in Part I I found I only in traces.”
  - ★ Better: “as stated in Part I, only traces of I were found.”
  - ★ Better still: “...that chlorine and bromine... as stated in Part I, only traces of iodine were found...”
  - ★ **Scientific writing has zero tolerance for ambiguity**
    - ★ But: “It is impossible to speak in such a way that one cannot be misunderstood.” (Karl R. Popper)

# What with single-author papers?

- ★ One is still allowed to use “we”
  - ★ Especially distasteful to European writers, who are reminded of the *pluralis majestatis* (Queen Victoria: “We are not amused.”)
  - ★ It is however in fact a *pluralis auctoris* (inclusive of readers or listeners).
    - ★ “In the next section, we shall apply the variational theorem to Eq. (1) and consider the implications of the result.” is perfectly acceptable even for a single author to write. You are, as it were, “walking the reader through” the derivation.
- ★ One can also use 3rd-person circumlocutions
  - ★ “The present author concludes...”
    - ★ When referring to one’s own single-author paper in a multi-author paper: “...was shown by one of us [11]...” or “...was shown by Shmendrik [14]...” (if that happens to be your name).
  - ★ “... was demonstrated by Shlepper and Klumnik [13] and by the present author [14].”
  - ★ In less scholarly contexts: “... the session will be chaired by yours truly” (על ידי עבדך הנאמן).

# Four observations on scientific writing

1. Ambiguities: “Zero is too many”.

“Creative ambiguity” may be desirable in literature, poetry, songwriting [allowing the reader/listener to read their own meaning into it]. In contrast, scientific writing should be as clear, precise, and unambiguous as humanly possible.

- The most similar type of writing is probably “legalese” (the peculiar style in which laws, legal documents, and contracts are written). In fact, legalese is probably even less tolerant of ambiguities.

2. However, “It is impossible to speak in such a way that one cannot be misunderstood.” (Karl Popper)

3. And: “Le meilleur est l’ennemi du bien.” (Voltaire). Literal translation: “The best is the enemy of the good.” Free translation: “The worst enemy of ‘good enough’ is toxic perfectionism.”

4. הלל אומר: ... ואל תאמר דבר שאי אפשר לשמוע שסופו להשמע

“Hillel said: Do not make a statement that cannot be understood in the hope that it will eventually be understood.” (Pirkei Avot 2:5)

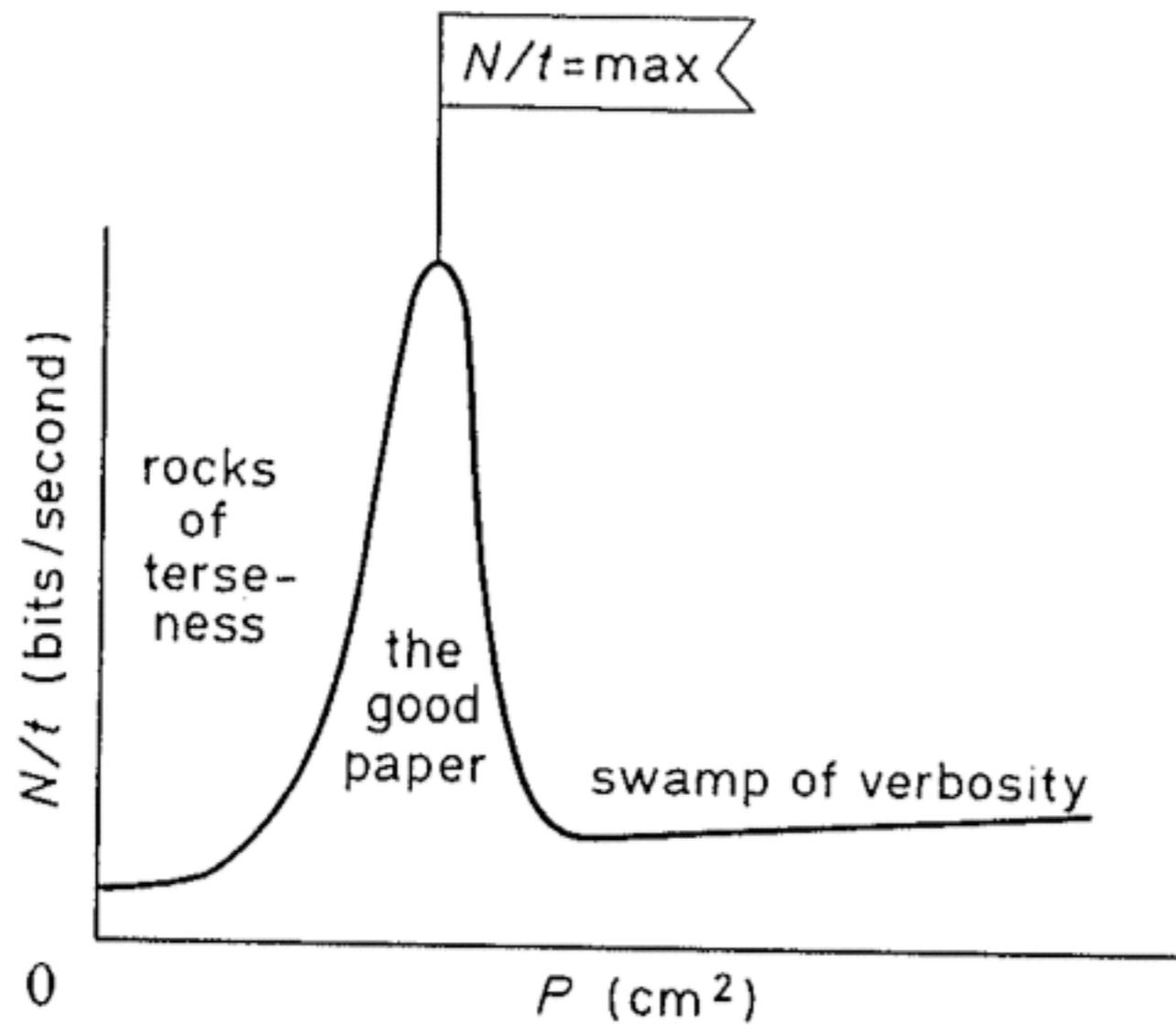
# George Orwell's 6 rules of writing

1. Never use a metaphor, simile, or other figure of speech which you are used to seeing in print.
2. Never use a long word where a short one will do.
3. If it is possible to cut a word out, always cut it out.
4. Never use the passive where you can use the active.
5. Never use a foreign phrase, a scientific word, or a jargon word if you can think of an everyday English equivalent.
6. Break any of these rules sooner than say anything outright barbarous.

How applicable are they in formal scientific writing? My \$0.02

You can honor the first five “commandments” in spirit, but rarely to the letter

1. Your #1 enemy is ambiguity. If the clearest and most unambiguous way to state something happens to be an overused cliché, then “use it in good health”.
2. (Also 5.) Long Greek-or Latin-derived words are often more widely understood by non-Anglosphere readers (as long as they are fellow specialists) than “pure English” words (especially colloquialisms, slang).
  - For example, a “stroke” may not immediately be recognized as the English equivalent of a “Schlaganfall” (German), “beroerte” (Dutch), “attacco appoplettico” (Italian), שבץ (Hebrew),... but the “highfalutin/posh” term *cerebrovascular accident* (CVA) will be recognized by pretty much any doctor, regardless of mother tongue.
3. Compact writing can actually be *harder* to understand when the concepts being presented are very difficult. Schoenfeld calls for steering a middle course between “the swamps of verbosity” and “the rocks of terseness”.
4. The passive voice is an accepted convention of formal scientific writing.



*Fig. 1.* Characteristics of written communication.

$N$  = knowledge;  $t$  = time needed to acquire knowledge;

$P$  = area of paper needed to transmit knowledge.

The origin of the graph represents communication by telepathy – it saves paper, but takes an infinitely long time!