ChatGPT

Phase 1.1: Constructed Languages — Design Principles Taxonomy

Logical Languages (Loglangs – Lojban & Loglan): Both Lojban and its predecessor Loglan were engineered as "logical languages" with predicate-logic grammars. Their syntax is *unambiguous and regular*: every sentence has exactly one parse [1] [2]. For example, Lojban bridi (predicates) carry fixed argument slots, so speakers must explicitly indicate who does what to whom. This enforces clarity but also imposes a cognitive discipline: one must frame ideas in terms of explicit predicate arguments rather than relying on context or intuition. Crucially, Loglan's designer aimed to minimize obligatory grammatical categories ("metaphysically parsimonious" [2]). Tense, aspect, number, gender, etc., are *available* but *optional*. For instance, Lojban has tense particles (pu 'past', ba 'future', ca 'present'), but a simple sentence like *klama* ("go") has no time marked by default [3]. In effect, speakers can choose which distinctions to encode. Computation-wise, such a language resembles a formal logic: every utterance corresponds neatly to a semantic template, potentially easing semantic parsing in an AI system.

Both languages also integrate **attitudinal and evidential markers**. Lojban devotes a whole set of cmavo (short particles) to express emotion, stance, and source of knowledge [4] [5]. For example, a speaker can prepend *ui* (happiness) or *ti'e* (hearsay) to a sentence to make those attitudes explicit. These are optional grammaticized elements: one *may* encode one's confidence, desire, or evidence source, whereas natural languages often leave these implicit in tone or omitted. The cognitive implication is that speakers habitually label the epistemic status of statements. For LLMs, this suggests that prompts including explicit markers (like "as far as I can tell") could engage latent features corresponding to certainty or source, analogous to Lojban's approach.

Overall, Lojban/Loglan's design *obliges* clarity but leaves many dimensions optional: you only mark time, quantity, or polarity when needed. This means a speaker is constantly deciding "should I encode this distinction or rely on context?" [2] [3]. In terms of human cognition, proponents claim this encourages analytical, logical thinking (testing the Sapir–Whorf hypothesis). In AI terms, a model trained on such explicit structure might develop latent representations that align with predicate-argument logic, reducing ambiguity but requiring comprehensive tokenization of roles.

Philosophical Language (Ithkuil): Ithkuil represents the opposite extreme: *maximal semantic density*. It is deliberately complex, packing **many semantic categories into every word**. As its introduction notes, Ithkuil "can convey large amounts of linguistic information using fewer words… its grammar… reflects the speaker's cognitive intent explicitly" [6]. For example, what takes nineteen English words can be rendered by two Ithkuil words (see illustration in [21])—a dramatic compression. Its morphology encodes up to nine *Configurations*, four *Affiliations*, six *Extensions*, evidential/mood *Essences*, and more [7]. In practice, every Ithkuil verb carries affixes for aspect (32 fine-grained aspects), mood, evidentiality (14 *validation* categories) [8], valence, etc. **Causation** and subordination are handled via case-frames rather than conjunctions (every embedded clause is indicated morphologically). In short, nothing is left implicit: if a nuance exists, Ithkuil can (and often must) mark it.

This “lossless encoding” philosophy has cognitive and computational parallels. Speakers of Ithkuil must constantly decide the precise intent and encode it morphologically, which is cognitively demanding. But it also guarantees that every semantic detail is unambiguous. For neural models, Ithkuil suggests a scenario where each token corresponds to a very high-dimensional meaning vector (since each word triggers dozens of semantic features). It raises the hypothesis of a *native latent format*: if meaning is fully decomposed, an ideal latent space might mirror Ithkuil’s categories. Indeed, Ithkuil forces **evidentiality** as a grammatical requirement [8]; contrast that with English (where evidentiality is usually optional or absent). If training data included Ithkuil, an LLM would have to allocate bits of its latent space to all 14 validation distinctions.

Minimalist Language (Toki Pona): By contrast, Toki Pona is a *sparse* language built on **semantic primitives**. It has only ~120–137 root words [9], each with broad meaning (e.g. *ilo* = tool, device; *soweli* = animal, especially mammal). The design focus is minimalism: “maximal meaning with minimal complexity” [10]. There is no inflection, no grammar beyond basic syntax. Complex ideas are expressed by compounding and relying on context. For example, *jan utala* (lit. “person fight”) can mean “soldier, warrior, fighter” [11]. In essence, Toki Pona’s vocabulary roughly aligns with near-universal semantic primes: words for person, thing, good, bad, many, one, etc. Cognitive implications are notable: speakers must constantly resolve ambiguity using context. Every utterance is massively underdetermined, so understanding is a contextual inferencing task. For an LLM, Toki Pona-like input would likely produce latent representations where information is highly entangled – each token has low information content, so meaning is distributed across many tokens and the surrounding context. This is akin to working in a very low-dimensional semantic subspace where each basis vector is a “primitive.”

Engineered Ambiguity Control (Comparison): We can summarize how these conlangs manage core semantic distinctions:

- **Negation:** Lojban/Loglan use explicit negators (*na* before a predicate); if absent, the sentence is positive. This operator is optional (use it when you want to assert falsehood). Ithkuil encodes negation morphologically (e.g. a negative suffix), making it explicit in the word. Toki Pona has the word *ala* (“no/not”), but given the language’s simplicity it is used only as needed (often context alone can imply negation).
- **Quantification:** Lojban provides quantifier words (*ro* “all,” *su’o* “some,” *nurma* “no amount,” etc.). They are lexical and optional. Ithkuil handles quantity via its **Configuration/Affiliation** system (nine configurations and four affiliations to distinguish sets vs. collections vs. partitive, etc.) [7]. Every noun in Ithkuil inflects for these, making quantity and grouping explicit by default. Toki Pona has only a few quantifiers (*wan* “one,” *mute* “many,” *ala* can mean “none”), but none are obligatory; context often suffices.
- **Tense/Aspect:** Lojban/Loglan allow tense particles (e.g. Lojban *pu, ba, ca* for past/future/present), but sentences default to “neutral” aspect if none given [3]. Ithkuil’s verbs include aspect/mood morphology (32 aspects) [12]; each utterance inherently carries an aspect and “Perspective.” There is no simple “past/future/present” unmarked category. Toki Pona has no grammar for tense or aspect; time is indicated by context words (e.g. *tenpo ni* “now,” *tenpo suno kama* “future day,” etc.), so tense is entirely contextual.
- **Evidentiality:** Lojban/Loglan include evidential and epistemic markers in the attitudinal system [5], but these are optional choice-markers. Ithkuil requires a “validation” prefix on every verb form, with 14 categories (how the speaker knows the info) [8]. Toki Pona has no evidential system at all.
- **Causation:** None of these conlangs *require* encoding causation morphologically. Lojban can express “because” or causal notions via predicates/connectives (*ca’ike le ka…* “because of the fact that…”), but

there is no single mandatory operator. Ithkuil handles subordinate clauses through case-frames, which can encode purpose or cause. Toki Pona uses prepositions (e.g. *tan* "from") or explanatory phrases, but again with no obligatory marker.

Feature	Lojban / Loglan	Ithkuil	Toki Pona
Negation	Explicit particle (*na*); optional to mark a predicate as false.	Morphological (negative affix); explicit in word form.	Word *ala* "no/not"; used if needed, else context.
Quantification	Lexical words (*ro* "all", *su'o* "some", *nurma* "none", etc.) – optional.	Encoded by Configuration/ Affiliation (9×4 system) in nouns – built-in.	Few words (*wan*, *mute*, *ala*) – optional; relies on context.
Tense/Aspect	Optional tense/aspect particles (*pu, ba, ca*); default neutral.	Aspect/mood built into verbs (32 aspects) with no default neutral.	No grammar; time by context (*tenpo* phrases).
Evidentiality	Optional evidential markers (e.g. *ti'e* "I hear that…") [13] .	Mandatory evidential prefix (14-way Validation) on every verb [8] .	None; no grammatical evidential distinctions.
Causation	Expressed via connectors (e.g. *ca'ike* "because"); no obligatory form.	Expressed via subordinate case-frames/purpose roles.	Expressed by context words (e.g. *tan* "because of"); no special grammar.

In summary, Lojban/Loglan minimize what is *forced* on the speaker (few obligatory markings) [2] , whereas Ithkuil maximizes explicit marking (many distinctions are built into every word) [6] [8] . Toki Pona lies at the other pole: almost nothing is obligatory. These contrasts illustrate that **making a distinction optional versus mandatory** can be a deliberate design choice.

Cognitive/Computational Implications: Logical conlangs push grammar closer to the level of thought-logic, potentially making any neural "parser" align with formal structures. Philosophical conlangs push grammar to carry the weight of meaning, analogous to very high-dimensional embeddings. Minimalist conlangs force reliance on context and may resemble low-dimensional latent spaces. Across all, we see that conlang design choices (which features are obligatory) could *in principle* shape what distinctions speakers habitually attend to. The next phase will examine whether real human languages (natural or constructed) actually produce such effects (Sapir–Whorf evidence) – and by analogy whether an LLM's "thoughts" could likewise be shaped by the structure of its training languages.

Integration to Phase 1.2: Notably, Loglan/Lojban were created *to test* the Sapir–Whorf hypothesis [14] [15] , and Toki Pona's minimalist philosophy is likewise SW-inspired [16] . In other words, conlang designers *assume* that forcing certain grammatical distinctions (or eliding others) will influence cognition. Our taxonomy thus lays the groundwork for Phase 1.2: assessing the empirical strength of linguistic relativity. Are the obligatory categories above truly shaping speakers' thoughts? And by analogy, does an LLM's latent space "think" differently if trained on data with different grammatical emphases?

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