**Case Study C4-004**
**Structural Compliance in Patent NMT**
Syntactic Discontinuity & Mood Synchronization
*Cédric Stéphany — Technical Translation & AI Alignment Specialist*

**Case Study Metadata**

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|---:|:---|
| **Dataset ID:** | C4-004 |
| **Category:** | Structural Compliance — Constraint 4 |
| **Focus:** | Grammatical Parallelism |
| **Model:** | Generic NMT |
| **Domain:** | Electrical Engineering / Industrial Robotics |

## 1 The Context: Parallel Method Steps

English patent claims typically utilize a series of present participles (e.g., "*comprising: energizing; imaging; comparing*") to define a sequence of method steps. In French, these must be mapped to a consistent grammatical mood—typically the **Infinitive**—to maintain legal clarity and formal parallelism.

> **Key Concept**
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> **The "Mood Swing" Effect:**
> Generic NMT models often process long method claims sentence-by-sentence, losing track of the structural hierarchy established in the preamble. This leads to **Syntactic Discontinuity**, where parallel actions are translated into a fragmented mix of noun phrases, infinitives, and technical nouns.

## 2 The Glitch: Structural Fragmentation

In Case Study C4-004, the generic model exhibited structural oscillation across five parallel steps, violating the fundamental requirement for stylistic and legal consistency within a single claim.

### 2.1 Why This Matters

- **Loss of Parallelism:** Changing the grammatical structure of steps within a list can imply a change in the *nature* of the steps (e.g., a result vs. an action), leading to potential indefiniteness objections.

- **Formal Non-Compliance:** Patent offices require claims to be clear and concise. A fragmented list of actions diminishes the professional integrity of the filing.

- **Ambiguous Scope:** Inconsistent verb moods can create confusion regarding the temporal or logical sequence of the method, weakening the IP's defensibility.

## 3   The Alignment Challenge

### 3.1   The Translation Failure

| Source (English) | AI Hallucination (Failure) | Golden Rewrite (Correct) |
|---|---|---|
| "...comprising: **energizing**; **inserting**; **imaging**; **comparing**..." | × **Syntactic Discontinuity:** <br><br> "...comprenant : <br> **la mise** (Noun) <br> **insérer** (Infinitive) <br> **imagerie** (Noun) <br> **comparer** (Infinitive)..." | **Synchronized Mood:** <br><br> "...comprenant : <br> **mettre** sous tension ; <br> **insérer** ; <br> **imager** ; <br> **comparer**..." |

Table 1: Loss of Grammatical Parallelism in Method Claim Translation

### 3.2   The Statistical Bias

The model's failure stems from its attention mechanism prioritizing local token frequency over the global syntactic list structure. "Energizing" frequently maps to the noun phrase "*mise sous tension*," while "Inserting" maps to the infinitive "*insérer*," leading the model to oscillate between moods without maintaining the parallel sequence established by the English present participles.

## 4   Alignment Methodology

### 4.1   Mood Synchronization Protocol

To ensure structural compliance, we implement a **Syntactic Locking** workflow that enforces a consistent grammatical mood across all method steps.

> **Alignment Methodology**
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> **Annotation Process:**
>
> 1. **Structure Detection:** Identify the method "Comprising" preamble and subsequent step delimiters (semicolons/bullets).
>
> 2. **Target Mood Selection:** Standardize the target grammatical mood (typically the Infinitive for French method claims).
>
> 3. **Parallelism Enforcement:** Ensure that every present participle in the source list is mapped to the same verb form in the target, overriding inconsistent probabilistic defaults.

## 5  Key Insights

> **Key Concept**
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> **What This Case Study Demonstrates:**
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> 1. **Formal Consistency = Legal Clarity:** In patent law, getting the structure right is as critical as the vocabulary[cite: 479].
>
> 2. **Mood Polarization:** AI models struggle with "long-range" structural memory. Human alignment is required to polarize the verb mood across complex, multi-step claims.
>
> 3. **Logical Integrity:** Preserving the *logic* of the sequence depends on presenting all steps as equivalent actions within a unified method[cite: 481].