

Case Study L1-011

Semantic Precision & Register Alignment

The "Coupled In" Trap (Directional Affix vs. Passive State)

Cédric Stéphany — Technical Translation & AI Alignment Specialist

Case Study Metadata

Dataset ID: L1-011

Category: Semantic Precision — Level 1

Focus: Directional Affix / Hybrid Language Prevention

Model: Generic NMT

Domain: AR Displays / Waveguide Optics

1 The Context: Waveguide In-Coupling

In the physics of Augmented Reality (AR) displays, "In-coupling" is the critical active process of injecting light into an optical substrate (waveguide). Terminology must accurately reflect the **Active Functional Vector** of the component rather than a static or joined state.

Key Concept

The Technical Distinction:

- **In-Coupling (English):** The directional act of light entering a medium.
- **Couplé (French Hallucination):** Implies two objects are joined or mated (Passive state).
- **Couplage d'entrée / Injection (Technical French):** Describes the active mechanism of signal entry.

Generic NMT models often fail to parse the "in-" prefix as a directional functional marker, reverting to general language "coupling" (joining things together).

2 The Glitch: Passive Traps & "Frenglish" Remnants

Generic NMT engines struggle with directional prepositions inside technical compounds. In Claim 1 of an AR waveguide patent, the model exhibited two distinct failures:

1. **Functional Erasure:** It translated the active component as a passive adjective (*élément couplé*).
2. **Linguistic Remnants:** It produced a hybrid string (*lumière couplée in*) where the English preposition "in" was left untranslated and appended to the French word.

Critical Issue

The Technical Violation:

By translating "In-Coupling Element" as *élément optique couplé*, the AI describes a component that has already been mated to another, rather than a component designed to inject light. This fundamentally mischaracterizes the active mechanism of the optical display, risking a Lack of Enablement rejection.

3 The Translation Failure

Source (English)	AI Hallucination (Failure)	Golden Rewrite (Correct)
"...an in-coupling optical element..."	<p>× Passive State Hallucination:</p> <p>"...un élément optique couplé..."</p> <p><i>(Literal: An optical element that is coupled)</i></p>	<p>✓ Active Function:</p> <p>"...un élément de couplage d'entrée..."</p> <p><i>(Correct Photonics Register)</i></p>
"...as in-coupled light..."	<p>× Hybrid Remnant:</p> <p>"...comme lumière couplée in..."</p> <p><i>(Frenghish/Linguistic Garbage)</i></p>	<p>✓ Technical Precision:</p> <p>"...comme lumière couplée entrante..."</p>

Table 1: Semantic Hallucination: Directional Vector Failure

4 Alignment Methodology

4.1 Directional Functional Mapping

To override the model’s passive bias, we implement a **Directional Vector Locking** protocol.

Alignment Methodology

Alignment Methodology:

1. **Affix Parsing:** Identify "In-" and "Out-" prefixes in optical/waveguide contexts as functional indicators.
2. **Active Voice Enforcement:** Force the use of nouns of action (*Couplage, Injection*) rather than passive participles (*Couplé*).
3. **Hybrid Suppression:** Use negative constraints to block the retention of English prepositions (in, out, off) within the target French string.
4. **Context Validation:** Verify against "Waveguide" and "Projector" tokens to confirm the Photonics domain.

5 Key Insights

Key Concept

What This Case Study Demonstrates:

1. **Grammar as Technology:** In patents, "Active vs. Passive" is not a stylistic choice; it defines the physical mechanism.
2. **Prepositional Failure:** AI models often treat prepositions inside compound terms as "noise" rather than essential semantic markers.
3. **The Need for Clean Targets:** A "Frenghish" remnant like "*couplée in*" signals a low-quality, generic NMT process that damages legal credibility.

Portfolio: Patent Translation AI Alignment Framework

Author: Cédric Stéphany

Specialization: Technical Translation (FR↔EN) — Patents, Telecommunications, Semiconductors

Last Updated: February 12, 2026