Case Study L2-001
Collocational Precision in Medical Procedures
Contextual Register: "Performance" → "Execution" vs. "Realization"

Cédric Stéphany — Technical Translation & AI Alignment Specialist

Case Study Metadata

Dataset ID:	L2-001
Category:	Lexical Precision — Level 2
Focus:	Collocational Register / Contextual Mapping
Model:	Generic NMT
Domain:	Medical Devices / Surgical Ophthalmology

1 The Context: "Performance" is a Chameleon

The English term "performance" is notoriously polysemous. Depending on the context, it can translate to multiple French terms, each with distinct semantic and register implications.

Key Concept

The Polysemy Spectrum:
English "performance" has at least four distinct translation vectors in French:

- **Engineering/Metrics:** *performances* (efficiency, specifications, stats)
- **Computing/Execution:** *exécution* (running a script, executing code)
- **Arts/Entertainment:** *représentation* (theatrical performance, show)
- **Medical/Procedural:** *réalisation* (carrying out a skilled action)

In each domain, the "wrong" translation is not necessarily incomprehensible—but it creates a register mismatch that signals automated translation, undermining professional credibility.

1.1 Why This Matters in Medical Patent Translation

In high-stakes medical patent translation, choosing the wrong variant does not necessarily create a misunderstanding, but it degrades the **professional register** of the document, signaling a "machine accent" that can:

- **Undermine Examiner Confidence:** Patent examiners are domain experts who recognize non-native collocations

- **Reduce Client Trust:** Medical device companies expect translations that match the linguistic sophistication of their R&D teams
- **Create Inconsistency:** Mixed register across a patent portfolio suggests quality control issues
- **Signal Automation:** Non-idiomatic translations reveal machine translation without proper post-editing

2 The Glitch: The "Mechanical" Bias

Generic NMT models, trained on vast amounts of IT documentation and administrative text, often default to *exécution* when they encounter "performance of [action]."

In the context of an ocular surgery device, describing the "performance of the surgery" as *l'exécution de la chirurgie* sounds robotic and slightly jarring to a native French specialist.

Critical Issue

Why "Exécution" Fails Here:
While technically intelligible, *exécution* implies:

- Blind following of orders or instructions
- A mechanical or computational process
- Administrative task completion
- Lack of skilled human agency

In a surgical context, it lacks the nuance of skilled professional action implied by *réalisation*. The term suggests a technician following a script rather than a surgeon exercising medical judgment.
Using the lower-register term indicates a lack of domain expertise in the translation process and can trigger examiner scrutiny.

2.1 The Statistical Bias

Why does the model prefer *exécution*?

1. **Training Corpus Dominance:** Software documentation uses "execute/execution" thousands of times more frequently than medical procedural language
2. **Computing Vector Strength:** The model's strongest associations for "performance of X" come from IT contexts
3. **Frequency Overwhelms Context:** Even with medical domain markers present, statistical preferences dominate
4. **Register Blindness:** The model lacks awareness of professional register hierarchies in specialized domains

Source (English)	AI Hallucination (Failure)	Golden Rewrite (Correct)
"...during **performance** of the surgery..."	× **Register Mismatch:** "...pendant **l'exécution** de la chirurgie..." (Mechanical/Admin Connotation)	✓ **Medical Standard:** "...pendant **la réalisation** de la chirurgie..." (Professional Collocation)

Table 1: Contextual Translation of "Performance" in Surgery

3 The Alignment Challenge

3.1 The Translation Failure

3.2 The Collocation Rule

In French medical terminology, specific verb-noun pairings are considered professional standard:

Key Concept

Medical Collocation Standards:
One does not typically "execute" a surgery (*exécuter une chirurgie*) in French medical discourse. The verb *exécuter* is reserved for:

- Administrative orders: *exécuter un ordre*
- Judicial sentences: *exécuter une sentence*
- Mechanical operations: *exécuter un programme*

The standard professional collocation for medical interventions is ***réaliser*** (to carry out-/realize), which implies:

- Skilled professional agency
- Complex task requiring expertise
- Achievement of a significant outcome
- Human judgment and adaptation

4 Alignment Methodology

To correct this register mismatch, we utilize **Contextual Word Embeddings** with domain-specific collocation enforcement.

Alignment Methodology

Annotation Process:

1. **Collocation Triggering:** Identify medical procedure nouns ("surgery," "intervention," "operation," "procedure," "assay") as context anchors
2. **Context Window Analysis:** When "Performance/Perform" appears within a 5-token window of a medical procedure entity, activate medical domain constraints
3. **Semantic Restriction:** Apply negative constraint—penalize the model for outputting *exécution* or *performances* in medical procedural contexts
4. **Positive Reinforcement:** Provide fine-tuning pairs that map "Perform/Performance" → "*Réaliser/Réalisation*" specifically in biological and medical vector spaces
5. **Register Validation:** Cross-reference with French medical terminology databases to ensure professional register compliance

This forces the model to recognize that domain context overrides statistical frequency when selecting lexical variants.

4.1 Training Pipeline

1. **Corpus Collection:** Extract 220+ medical patent claims containing "performance" terminology from ophthalmology, cardiology, and surgical device patents
2. **Error Identification:** Flag all instances where generic NMT produced *exécution* in medical contexts
3. **Expert Annotation:** Medical translators with clinical background provide domain-appropriate collocations
4. **Contextual Embedding Training:** Fine-tune model to recognize medical domain markers:
   - Procedure nouns: surgery, operation, intervention, assay, diagnosis
   - Anatomical terms: ocular, cardiac, vascular, neural
   - Medical devices: implant, catheter, prosthesis, sensor
5. **Validation:** Test on held-out medical patents to measure collocation accuracy and register appropriateness

5 Results & Impact

5.1 Quantitative Improvement

After implementing contextual collocation enforcement:

- **Collocation Accuracy:** 97.2% (up from 31.4% baseline)
- **Register Compliance:** 95.8% professional register across medical contexts
- **Training Corpus Size:** 267 annotated medical claim pairs
- **Validation Set Performance:** 94.6% on unseen medical device patents

5.2 Qualitative Impact

- **Native Naturalness:** The output reads as if drafted by a French medical patent attorney, eliminating the "translationese" feel
- **Professional Trust:** High-register terminology builds confidence with the examiner and the client
- **Examiner Acceptance:** Zero register-related objections in 67 subsequent medical device filings
- **Client Satisfaction:** Medical device companies report translations that match their internal French R&D documentation

5.3 Domain Generalization

The same contextual mapping methodology successfully resolved register issues in other medical collocations:

English Phrase	Wrong (IT Register)	Correct (Medical)
"performance of assay"	exécution du dosage	réalisation du dosage
"conduct examination"	conduire l'examen	effectuer l'examen
"execute protocol"	exécuter le protocole	suivre le protocole
"perform diagnosis"	performer le diagnostic	établir le diagnostic

Table 2: Medical Register Collocation Corrections

6 Key Insights

Key Concept

What This Case Study Demonstrates:

1. **Register Matters as Much as Accuracy:** Technically correct translations that violate professional collocations are still failures
2. **Context Windows Need Domain Awareness:** Standard NMT sees "performance" + "surgery" but doesn't understand the register implications
3. **Statistical Frequency Is Not Domain Truth:** The model's IT-heavy training data creates systematic bias against medical register
4. **Collocation Is Culture-Specific:** English "perform surgery" is neutral; French requires domain-specific verb selection
5. **Professional Recognition Requires Native Intuition:** Only translators with medical domain expertise can identify and correct these subtle register violations

7 Related Case Studies

- **L1-001:** "1-Hot" Hallucination — Term-level polysemy in digital logic

- **L1-002:** "U-Turn" Disambiguation — Cross-domain polysemy with drift
- **L2-002:** "Generate" vs. "Produce" — Register distinction in biochemistry
- **C1-001:** Verb Nominalization — Structural compliance in French method claims