imü dilbilimi

GRASPING GRAMMAR: THE HAPTIC TURN IN LANGUAGE DOCUMENTATION

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ABSTRACT

Language documentation has developed robust standards for recording the optical and acoustic dimensions of speech events, but it less often preserves the material conditions under which force-sensitive grammatical contrasts become interactionally available. In domains involving manipulation, fit, resistance, fracture, and effort, visually similar events may differ in ways that are grammatically relevant yet not recoverable from image or waveform alone. This chapter proposes the Haptic Minimal Pair (HMP) as a controlled elicitation method that holds visual geometry constant while varying a single material parameter such as friction, compliance, mass distribution, or toleranced fit. The proposal is methodological rather than conclusive: drawing on exploratory field observations from Sakha, Telengit, and Cilician Arabic, the chapter presents proof-of-concept cases showing how materially calibrated stimuli can make posture predicates, handling verbs, fracture constructions, and ideophones more observable, more comparable across sessions, and more archivally accountable. It also outlines a compact metadata protocol for preserving both digital design specifications and the physical instantiation of stimuli under CARE-aligned, community-governed archival conditions. The chapter argues that documentary adequacy in force-sensitive domains requires not only recording what speakers say and what cameras capture, but also documenting the calibrated material constraints that make particular grammatical choices pragmatically available.

Keywords: documentary linguistics; language documentation; force-sensitive grammar; elicitation design; Haptic Minimal Pair; 3D printing

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ÖZ

Belgeleme dilbilimi bugüne dek konuşma eyleminin optik ve akustik boyutlarını kaydetmede detaylı standartlar geliştirmiş olsa da kuvvete duyarlı dilbilgisel karşıtlıkların ortaya çıktığı maddi ve etkileşimsel koşulları aynı titizlikle arşivleyememektedir. Nesne manipülasyonu, direnç, esneme veya kırılma gibi fiziksel temas içeren eylemlerde görsel olarak birbirine benzeyen olaylar, dilbilgisel açıdan derin farklılıklar taşıyabilir; ne var ki bu ince ayrımlar standart ses ve görüntü kayıtlarında genellikle kaybolmaktadır. Bu çalışma, görsel geometriyi sabit tutarken sürtünme, esneklik, kütle dağılımı ya da geçme toleransı gibi tek bir maddi parametreyi değiştiren kontrollü bir veri derleme yöntemi olarak Dokunsal Minimal Çift'i (DMÇ) önermektedir. Öneri, yöntemsel niteliktedir: Çalışma; Saha (Yakut), Telengit (Altay) ve Çukurova Arapçası üzerine yürütülen keşif niteliğindeki saha gözlemlerinden hareketle, maddi olarak kalibre edilmiş uyaranların duruş ve kavrama eylemlerini, kırılma yapılarını ve yansıma sözcüklerini nasıl daha gözlemlenebilir, karşılaştırılabilir ve arşivsel bakımdan denetlenebilir kıldığını gösteren yöntemsel gösterim örnekleri sunmaktadır. Bölüm ayrıca, dijital tasarım özellikleri ile uyaranların maddi üretim düzeylerini birlikte koruyan, CARE ilkeleriyle uyumlu ve topluluk-temelli bir üstveri çerçevesi önermektedir. Çalışma, kuvvete duyarlı alanlarda yapılacak nitelikli bir dil belgelemesinin yalnızca kameranın kaydettiği sesi ve görüntüyü değil, o dilbilgisel seçimleri pragmatik düzeyde mümkün kılan fiziksel ve maddi uyaranları da kalibre edilmiş biçimde kayıt altına alması gerektiğini savunmaktadır.

Anahtar Sözcükler: belgeleme dilbilimi; dil belgeleme; kuvvete duyarlı dilbilgisi; veri derleme tasarımı; dokunsal minimal çift; 3D baskı

1. Introduction

Over the last three decades, documentary linguistics has consolidated a rigorous methodological paradigm for producing archives that are ethically grounded, philologically durable, and analytically tractable (Himmelmann 1998, 2006; Woodbury 2003, 2011). At the centre of this paradigm lies a commitment to comprehensive, naturalistic corpora: records of language as it is used in the course of ordinary, situated activity. This commitment has reshaped the field's evidential standards. Analyses are now expected to remain accountable to a primary documentary record that can support reuse, reinterpretation, cross-linguistic comparison, and community-oriented forms of access and benefit (Himmelmann 1998; Woodbury 2011). These developments have unfolded alongside the standardisation of high-quality audio-visual recording, time-aligned annotation, and increasingly robust digital archiving infrastructures (Austin 2006; Conathan 2011). Yet for all this progress, contemporary documentary practice remains uneven in what it captures well. Sound and image are preserved with increasing fidelity, but the material physics of the communicative encounter are usually left implicit. Documentary records are therefore rich in waveform and pixel while treating physical constraint as background. Variables such as mass distribution, frictional profile, compliance under pressure, and dimensional tolerance are rarely specified, even though they may be crucial to the event being documented. Nor are these properties reducible to visible form alone. They become interactionally and semantically salient in contact: through hands that probe, test, slip, adjust, fail, and try again.

This matters because, in many linguistic systems, grammar is not organised only around what can be seen. It is also organised around what must be felt, resisted, managed, or overcome. When such resistances are absent from elicitation settings, or when they vary unpredictably across sessions without being parameterised in the archive, part of what is grammatically available to speakers may remain pragmatically dormant. A corpus may thus appear comprehensive—especially when supported by careful transcription and glossing—while remaining thin in precisely those domains where language is calibrated to engagement with a resisting material world. What is missing in such cases is not simply more speech, but a replicable account of the biophysical conditions under which particular morphosyntactic resources become relevant and worth deploying (Woodbury 2011).

The issue, then, is methodological rather than merely technological. Many morphosyntactic systems are tuned to manipulation events in which causal relations are not recoverable from static geometry alone. They emerge through effort, obstruction, slippage, support, pressure, and release. Talmy's force-dynamic framework is particularly useful here because it makes explicit a contrast space that languages recurrently lexicalise and grammaticalise: enabling and blocking, overcoming, stable support, and collapse (Talmy 1988). At the same time, it offers a practical diagnostic for documentary design. If an elicitation stimulus cannot generate physical resistance, then the constructions organised around resistance are likely to be under-elicited. In fieldwork terms, these are often the very contexts in which speakers recruit highly specific handling predicates, contact verbs, instrumental morphology, and aspectual packaging to distinguish, for example, a single successful completion from repeated, effortful attempts. They are also contexts that recruit directive sequences and conversational repair, because resistance makes trouble publicly observable and interactionally accountable.

Where the stimulus cannot push back, the communicative ecology that licenses force-dynamic construals is correspondingly weakened. The well-known Atsugewi materials provide a particularly clear illustration—not because they are typologically anomalous, but because they make the dependence of grammatical selection on non-visual, haptic parameters unusually explicit. Atsugewi motion verbs require the selection of dependent roots that conflate motion with figure-type distinctions that are often tactile and material in character: -caq- for 'a slimy lumpish object' and -staq- for 'runny icky material' (Talmy 1985; cf. Talmy 1972). Beyond figure-type, the system also encodes causal vectors in prefixal satellites, including uh- for causation by gravity, ca- for motion due to wind, and cu- for axial pressure exerted by a linear object. Talmy's attested example brings these dimensions together in a single verbal complex.

(1) s'w-cu-sta̱q̇-cis-a
1SG-axial.pressure-runny.icky.material-into.fire-FACT
'I prodded the guts into the fire with a stick.' (Talmy 1985: 77)

What matters for present purposes is not simply the descriptive richness of the form, but the conditions that license it. A recording that captures only visible displacement, without a controlled account of the object's resistance and the applied force that organised the action, may be insufficient to reconstruct why this rather than another morphological constellation was selected.

Comparable dependencies on material constraint and haptic feedback are documented in a range of other languages. These include Navajo classificatory handling stems (Young & Morgan 1987), Tzeltal handling verbs sensitive to modes of grasp and placement (Brown 2008), and Korean kki-ta as a widely cited tight-fit predicate in which forceful insertion, rather than mere containment, becomes salient (Choi & Bowerman 1991). Such cases suggest that the problem is not marginal. They reveal a broader documentary blind spot: where elicitation relies primarily on images, videos, or objects whose resistive properties remain unspecified, the resulting archive may preserve what moved while under-specifying what had to be overcome for that movement to occur.

This chapter takes that asymmetry as a methodological problem for language documentation. Its central claim is that if we want to document grammars that are sensitive to manipulation, force, and material resistance, then audio-visual recording alone is not enough. What is also needed is a principled way of calibrating and documenting the physical conditions under which these grammatical contrasts become available in interaction. The broader aim is not to displace established documentary practice, but to extend it: from the recording of visible action to the documentation of the resistive material environments within which particular forms become pragmatically and grammatically motivated. Although the demonstrations in this chapter focus on force-sensitive domains, the methodological logic is broader: the HMP framework is in principle applicable wherever linguistically relevant contrasts depend on parameterizable, non-visual properties of the elicitation ecology.

2. Beyond Audio-Visual Adequacy: Material Conditions as Documentary Evidence

Comparative documentary practice has often depended on a disciplined reduction. By stabilising a representational field, pictorial stimuli—ranging from The Pear Stories to spatial elicitation kits such as the Topological Relations Picture Series—hold constant a set of perceptual cues, thereby making cross-site comparison feasible in the absence of a shared elicitation metalanguage (Chafe 1980; Bowerman & Pederson 1992). That achievement is not in question. The present concern is not documentary linguistics as such, but visually dominated elicitation ecologies in force-sensitive domains. Cross-linguistic research on sensory lexicons shows that the relative codability of perceptual domains varies substantially across languages, and that vision cannot simply be assumed to be universally privileged in lexical encoding (Majid et al. 2018).

In domains where morphosyntax is recruited to track manipulation, causation, and event segmentation, the relevant semantic contrasts are rarely just configurational. They are force-dynamic and contact-sensitive, keyed to properties discovered through resistance rather than ocular inspection. A picture can be exemplary for ensuring recognisability, but it cannot compel a participant to discover that an object jams, that a surface slips, that a material yields, or that a fit must be physically forced. The gap is therefore not a vague call for 'multimodality', but the absence of an archivable account of material constraint.

Force dynamics is not an optional enrichment of spatial description; it is a recurrent grammatical route into causation, control, and event segmentation (Talmy 1988). It is also unusually sensitive to elicitation ecology. A static line drawing can effectively elicit descriptions of containment or support. However, even typologically robust dynamic stimuli explicitly designed to capture manipulation and change of state, such as the widely used Cut and Break video clips (Bohnemeyer, Bowerman, & Brown 2001), remain vulnerable to visual conflation: they successfully depict the kinetic trajectory and visible outcome of an action, yet leave the applied force and felt resistance entirely uncalibrated. They cannot generate wedging, sticking, coming loose, or the distributional ecology of constructions deployed when outcomes are contingent on physical pushback.

Where the stimulus cannot resist, grammars of attempt, effort, and failure are pushed to the margins of the record—not because speakers lack these resources, but because the encounter provides no durable reason to deploy them. The audio-visual record is then vulnerable to visual conflation: a tight fit and a merely careful placement may look identical from one camera angle; low friction and poor grip can be visually indistinguishable; compliance under pressure may only be visible as a final outcome, not as a felt gradient. Without an explicit record of the resistance profile that organised the action, the corpus cannot reliably support reproducible inferences about why a particular handling predicate, aspectual packaging, or diathesis alternation was locally licensed. Semantic conflation is a useful analytic precedent for characterising this documentary risk. Haviland, following Talmy, uses the term for cases where a single lexical item bundles distinct semantic components—his standard illustration is English climb, which conflates vertical displacement with effort—so that an elicitation context that renders only one component salient can obscure the conditions licensing the full package (Talmy 1985; Haviland 2006: 141–142).

In the present chapter we extend this logic from the lexicon to the stimulus ecology: visual protocols can inadvertently produce documentary conflation, collapsing materially distinct events into a single "same-looking" scene because geometry and outcome are preserved while resistance is erased. Under such conditions, contrasts organised around sticking, jamming, slipping, wedging, or graded fit may be systematically under-elicited—or misanalysed as discourse noise—because the stimulus makes the relevant force-dynamic component pragmatically inert. The methodological point of

the Haptic Minimal Pair (HMP) is therefore de-conflational: by holding visual geometry constant while manipulating a single physical parameter (e.g., compliance, friction, clearance), the protocol forces grammars to resolve distinctions that the visual record would otherwise collapse, making the licensing conditions for handling predicates, attempt/repair formats, and telic packaging reproducible in the archive. Crucially, material constraints do not always target the same grammatical stratum across languages. While Atsugewi makes the dependency affixal, other systems distribute it differently—often through phonosemantic selection (e.g., impact ideophones), diathesis morphology (e.g., medial voice alternations), or large descriptive-verb inventories. The evidential burden is nevertheless uniform: where grammatical retrieval depends on deformation, friction, tightness of fit, or grip-type control, the archive must retain enough of the constraint regime to render token distributions interpretable as grammar rather than as accidental stimulus physics.

A further pressure on elicitation design comes from referential indeterminacy (Haviland 2006). Realia can mitigate this, but exclusive reliance on familiar artefacts introduces a counter-risk: indexical saturation. Because such objects carry stabilised labels and embodied routines, interaction can collapse into rapid naming ("that's a basket"), bypassing the morphosyntax recruited for part structure, graded fit, attempt, and repair (Levelt 1989). Novelty is an imperfect corrective: unfamiliar local artefacts may inhibit ready-made labels yet also trigger guarded guessing rather than description. The design target is narrower—stimuli that are physically legible while remaining lexically and culturally underdetermined.

3. From Calibrated Material Stimuli (CMS) to Haptic Anchoring

The approach developed here grows out of field observations among the Chulym, Sakha, and Telengit communities, where spatial and motion-related distinctions repeatedly emerged as linguistically salient in naturalistic settings (Başbuğ 2016; 2023). Material constraint belongs in the archive as something described, measured, and made reproducible. In this context, 3D printing emerges not merely as a high-tech novelty, but as a critical methodological tool for creating stimuli with calibrated, 'built-in' physical properties within language documentation practice. Some remarks from iterative prototyping during the development of the MumuLab framework (Turkish Patent and Trademark Office, Trademark App. No. 2025/152264) demonstrate that nominally identical elicitation tools or mascots—derived from a single digital mesh—can generate divergent interactional routines solely as a function of variations in density, compliance, or surface friction. Drawing on pilot field studies conducted for the CODE Model (Andiç & Başbuğ, in review), we distinguish between the stimulus as a physical tool and as a cognitive trigger—a distinction that can be further sharpened through a semiotic lens. In Haviland's Peircean framing, an index signifies by a physical or causal link to what it stands for—his linguistic illustration is ouch, whose meaning is licensed by an imagined causal coupling between bodily pain and

the utterance (Haviland 2006: 143). I treat calibrated objects as enabling a comparable coupling by design: when a hand encounters a controlled roughness, jam, slippage, or elastic give, the artefact's resistance becomes a haptic index for the very parameter the grammar is recruited to encode. While the concept of 'haptic anchoring' originates in ecological psychology to describe how physical resistance provides a reference frame for bodily postural stability (e.g., Mauerberg-deCastro et al. 2014, p. 303), I repurpose it here as a methodological warrant for language documentation. On this view, the Haptic Anchor (HA) is not a metaphorical "grounding" claim but a strict methodological warrant: linguistic choices (attempt morphology, repair formats, handling predicates, telicity) are made publicly accountable to a reproducible, archivable resistance profile. In short, the CODE protocol implements an engineered indexicality in which contact physics is not backgrounded but converted into an explicit evidential condition of the documentary record.

The Calibrated Material Stimulus (CMS) refers to the engineered object itself, defined by precise physical parameters (e.g., a specific friction profile). In contrast, the Haptic Anchor (HA) refers to the interactional effect: the process by which a speaker's linguistic retrieval is grounded in the object's immediate physical resistance. While the CMS ensures that every participant encounters the same physical challenge, the HA ensures that their grammatical output is a direct response to that calibrated reality rather than a generic label. A rigorous protocol does not require exhaustive fabrication detail; it requires documentary variables. We identify four primary loci that recurrently reorganise morphosyntactic retrieval across the grammars surveyed here:

Mass and its distribution: Reorganises effort profiles, directly shifting event segmentation, completion metrics, and the encoding of agentivity.

Frictional profile: Reorganises grammatical control, yielding structural contrasts between slippage (often construed as diminished control) and dragging (often construed as sustained effort).

Toleranced fit: Reorganises spatial placement, systematically distinguishing loose volumetric containment from forcing, jamming, and the iterative repair sequences that a tight interference fit structurally invites.

Grasp affordances: Reorganises handling predicates, as lexical retrieval frequently depends on biomechanical grip-type control and contact geometry rather than the transfer trajectory.

The point is not to legislate a universal parameter set, but to ensure that whatever parameter regime makes a contrast pragmatically live is retained in the deposit as part of what renders the linguistic record interpretable.

3.1. The Haptic Minimal Pair (HMP) Framework

If additive manufacturing is treated not merely as a fabrication technique but as a parametric system for translating digital specification into constraint-bearing material form, its principal methodological contribution lies in the formalisation of what I term the Haptic Minimal Pair (HMP). While terms like 'haptic phonemes' have been used metaphorically in Human-Computer Interaction (HCI) to describe basic vibrotactile signals for artificial interfaces (e.g., Enriquez et al. 2006), the Haptic Minimal Pair (HMP) proposed here operates within the domain of language documentation. It is not an artificial signaling system, but a methodological framework designed to elicit and isolate natural morphosyntactic responses to physical constraints. By analogy with phonological minimal pair methodology—where tightly controlled acoustic contrasts isolate phonemic distinctions—the HMP framework enables the systematic manipulation of a single physical parameter (e.g., internal density, surface friction, elastic compliance) while preserving constant visual geometry. The analytic objective is controlled variable isolation: resistance is introduced as a distinctive haptic feature under conditions of geometric invariance.

The analogy to phonological minimal pairs is methodological rather than isomorphic. In the physical world, it is difficult to change surface friction without simultaneously altering grip affordances; therefore, the HMP is a heuristic method rather than a tool for perfect isolation. The goal is simply controlled contrast—revealing latent variables without aiming for absolute laboratory sterilization. Ultimately, the HMP is a methodological correction. It helps researchers distinguish between stimuli that look identical on camera but offer entirely different physical affordances to the speaker. When earlier corpora are revisited through this lens, certain morphosyntactic alternations—previously attributed to speaker variability or discourse fluctuation—become interpretable as responses to unrecorded resistance conditions. The so-called "missing physics" of elicitation thus emerges as a latent variable in corpus interpretability. What is at stake is not the replacement of visual protocols, but their supplementation: unless physical constraints are rendered systematically contrastive, a dimension of grammatical conditioning remains structurally underdetermined within the documentary record. High-definition video stabilises optical evidence, but its epistemological reach is limited for force-dynamic variables (Franchetto 2006). Where the licensing of roots or constructions hinges on resistance, a purely visual ecology produces visual conflation (Talmy 1985; Haviland 2006). Accordingly, haptic parameters must be integrated into the elicitation environment to ensure methodological rigor. The HMP is therefore proposed not as an empirical finding but as a methodological correction. Its immediate value lies in making materially conditioned contrasts observable, comparable, and archivally transparent. In the present chapter, this value is demonstrated through force-sensitive domains because they make the evidential role of resistance especially visible. This should not be taken to imply that the framework is intrinsically restricted to those domains. More generally, the HMP provides a way of asking whether

contrasts that appear linguistically unstable, optional, or speaker-specific may in fact depend on unrecorded properties of the elicitation setting.

4. Material constraints in morphosyntax: Case studies

Data note. The discussion in Sections 4.1–4.4 is intended as a methodological proof of concept rather than as a balanced cross-linguistic comparison. Unless otherwise indicated, the examples from Sakha, Telengit, and Cilician Arabic are drawn from the author's field notes and exploratory elicitation sessions. They are used here to show where materially calibrated stimuli can make linguistically relevant contrasts more observable and more archivally accountable, not to provide exhaustive grammatical descriptions of the languages concerned.

4.1. Spatial volume, kinematic envelope, and posture geometry

Standard visual elicitation protocols typically rely on schematic line drawings or geometric abstractions (e.g., "stick figures") to elicit posture descriptions. While 2D representations can optically encode volume through perspective, they suppress key physical variables of the encounter—especially haptic feedback, mass distribution, and tissue compliance. In the material considered here, posture descriptions are sensitive to such non-visual affordances as well as to visible geometry. In the Telengit data, sitting events suggest a lexical contrast linked to differences in body volume and posture configuration. When a larger-bodied sitter adopts a seated posture, abdominal and thigh mass can constrain neutral joint angles and favor either a rounded geometry (+Volume) or a base-expansion strategy (+Stability). In the material discussed here, such configurations make converbs like bolčoy-yp and alčay-yp (or taltay-yp) plausible modifiers of the posture verb otur- ('sit'):

(2a) Semis kiži bolčoy-yp kal-gan otur-dy-Ø.
fat person become_spherical-CVB AUX-PTCP sit-PST-3SG
'The fat person sat down rounded (bulging like a sphere).'

(2b) Semis kiži alčay-yp kal-gan otur-dy-Ø.
fat person splay_legs-CVB AUX-PTCP sit-PST-3SG
'The fat person sat with legs splayed wide (due to tissue obstruction).'

These converbs are less natural with low-volume subjects. Where the requisite spatial envelope is absent, speakers may instead prefer a different converbial root describing a folded, angular posture:

(2c) Aryk kiži korčoy-yp kal-gan otur-dy-Ø.
thin person hunch_curl-CVB AUX-PTCP sit-PST-3SG
'The thin person sat hunched/curled up.'

Exploratory elicitation with Sakha-speaking participants suggests that the resultative auxiliary construction (e.g., -yp kal-gan) can be used to frame

the posture as a sustained state rather than a momentary action. A related contrast is visible in the Sakha material as well, though the larger-bodied case appears more readily in descriptive phrasing than in a single dedicated converb, while nıkyıy-an olor-or (‘sits with the head drawn into the shoulders / curls inward while sitting’) remains a clearer low-volume form. Within a parametric 3D-printing paradigm, the key methodological point is that visual geometry should be separated from latent physical properties. Changing only the internal infill of an articulated mannequin chiefly alters mass, not the external kinematic envelope; to elicit interference-based forms like alčay, the stimulus would need either a modified outer shell or modular “tissue” attachments. Otherwise, the relevant biomechanical interference remains under-specified.

4.2. Fracture mechanics, material compliance, and result entailment (Sakha and Cilician Arabic)

When standard visual stimuli depict the destruction of an object, they typically provide only the optical trajectory of separation. Verbs of destruction, however, often encode internal fracture mechanics—the structural reaction of a material to applied stress. Standard elicitation protocols can also import framing bias when the prompt itself presupposes an active/transitive event (e.g., Russian когда ломаем, ‘when we break it’), making transitive roots more likely regardless of the material event. Haptic elicitation does not eliminate this problem, but it can reduce reliance on translation prompts by letting speakers respond to the material behavior of the object itself. In the Sakha material considered here, spontaneous material failure can be expressed both by relatively general intransitives and by more specific forms. For the contrasts discussed here, the more specific set is analytically the most useful, surfacing either as a simple intransitive or with the completive auxiliary bar- (‘go’):

(3a) Taas xamparıy-da-Ø.
stone break.into.pieces-PST-3SG
‘The stone shattered/broke into pieces (isotropic brittle failure).’

(3b) Et tırıt-a bar-da-Ø.
meat tear-CVB AUX.COMPL-PST-3SG
‘The meat tore apart/shredded (yielding compliance).’

(3c) Mas tostu bar-da-Ø.
wood snap.ADV AUX.COMPL-PST-3SG
‘The wood snapped/broke with a crack (anisotropic fibrous failure).’

Cilician Arabic appears to stratify deformation along a similar axis of material compliance. In the material considered here, brittle destruction of a rigid branch favors kasar (‘break’), tensile separation of pliable matter favors qba' (‘pluck/tear’), and viscoplastic deformation favors the mediopassive in-ma'as (‘get squashed/mashed’). Physical elicitation can also help clarify the relation between telicity and result entailment. In these data, speakers resisted

cancellation framings built directly on brittle-fracture predicates, suggesting that kasar and its Form VII counterpart in-kasar are relatively strong result predicates. When resistance must be expressed without an achieved break, speakers instead separate the force/manner verb (ḍarab, 'to hit/strike') from the unattained telic outcome:

(4) Ḍarab-t=o bas mā in-kasar-Ø.
hit.PFV-1SG=3SG.M.OBJ but NEG MID-break.PFV-3SG.M
'I hit it (applied force), but it didn't break (refusal to yield).'
(*Kasar-t=o bas mā in-kasar-Ø)

By integrating additive manufacturing, these material differences can at least be made more explicit and reproducible. A rigid PLA print may approximate brittle failure, whereas TPU is more likely to model elastic deformation than the kind of permanent yielding targeted here. To elicit forms associated with squashing or mashing, the stimulus may need to incorporate a more clearly viscoplastic material, such as polymer clay or another deformable insert. Without an object whose mechanical profile is specified and archivable, the conditions governing result entailment remain difficult to reconstruct from the recording alone.

4.3. Surface friction (μ) and grip affordances

The physics of the external surface—especially friction and grip affordances—can reorganise the lexicalisation of handling predicates. Changing the surface texturing of a parametrically designed stimulus alters how readily it slides, catches, or can be held securely. In Cilician Arabic, a controlled slide with manageable traction favors zaḥlaq-a, whereas a sudden lubricated slip (e.g., wet soap shooting from the hand) favors faḥlaṣ-a. Grip affordances also matter. A rigid object may support a neutral cylindrical hold (msik-t=o, 'I held it'); a minute, solid object may support a precision pincer grip (niqqay-t, 'I precisely picked/selected'). If that rigid volume is replaced by a yielding or granular mass (e.g., heavily hydrated dough or wet sand), speakers may instead prefer a form like kabbaš-t=o, associated here with a conformable power grip:

(5a) Niqqay-t l-ḥajar.
pick_precisely.PFV-1SG DEF-stone
'I picked/selected the stone (precision pincer grip).'

(5b) Kabbaš-t=o.
clutch_squeeze.PFV-1SG=3SG.M.OBJ
'I clutched/squeezed it (conformable power grip for viscoplastic/granular matter).'

4.4. Acoustic-haptic coupling: Impact ideophones (Sakha and Cilician Arabic)

The transduction of kinetic energy into auditory-haptic feedback provides an equally productive domain for sound symbolism. Cross-linguistic research demonstrates that ideophones act as cross-modal transducers, mapping auditory features onto internal density, structural damping, and fluid mechanics (Dingemanse 2012). In the Sakha material considered here, impact ideophones track broad differences in material behavior and impact profile rather than sound alone. For the present contrast, the most defensible pair is lüs for the dull fall of a heavy rigid object and pal for the wet splat of a soft, saturated mass. The field observations reported here are consistent with an acoustic-material mapping of this kind:

(6a) Kürbe taas "lüs" gın-a tüs-te-Ø.
stone.block IDEO:heavy.thud do-CVB fall-PST-3SG
‘The stone block fell with a heavy dull thud.’

(6b) Inax saağa "pal" gın-a tüs-te-Ø.
cow.dung IDEO:splat do-CVB fall-PST-3SG
‘The cow dung fell with a wet splat.’ (pal, overdamped viscoelastic dissipation).

Cilician Arabic closely parallels this acoustic-material mapping. A rigid, high-frequency impact is robustly encoded as ṭāq (ṭili'-Ø ḥiss ṭāq, 'a "tak" sound rose up'). When a heavy, fully saturated substance impacts a surface, the complex fluid mechanics and resulting viscous spread are cross-modally mapped onto heavy labial consonants: labbāḥ (l-waḥīl wāqi'-Ø labbāḥ, 'the mud falls with a splat').

5. Archiving the Autographic: A Metadata Protocol for Material Stimuli

For material constraints to be analytically useful, they must be integrated into ordinary archival practice. However, this should not overwhelm fieldworkers with metadata bloat. We simply need a compact extension for materially calibrated stimuli. I therefore propose a baseline meta-documentary profile for parametrically designed stimuli. Drawing conceptually on Goodman’s (1968) distinction between allographic specification and autographic instantiation, this framework is structured across two primary vectors:

Digital Specification (Design): The underlying geometric files (e.g., .stl, .obj). The deposit should state who may access, reprint, or modify the design under CARE-guided community permissions, preventing culturally sensitive files from becoming “runaway objects” (Carroll et al. 2020, pp. 6-7). While exhaustive physical testing in the field is unrealistic, archiving this digital blueprint should be a minimal standard for future researchers.

Material Instantiation and Physical Condition: The basic fabrication variables that determined the object’s behaviour (e.g., material type like PLA

vs. TPU, infill density) and a brief note on its state during the session. Recording wear, looseness, or repairs helps distinguish genuine grammatical patterning from stimulus drift across sessions.

Archiving this metadata keeps the stimulus auditable. It allows later analysts to ask whether a morphosyntactic gap reflects a boundary of the grammar or simply the absence—or later erosion—of the physical trigger on which the contrast depended.

5.1. Limitations and future directions

Three limitations should be stated explicitly. First, the cases discussed here are exploratory and are not presented as balanced cross-linguistic datasets. Second, an HMP seeks controlled contrast rather than perfect isolation, since altering one material parameter may also affect other perceptual dimensions. Third, the present chapter demonstrates the framework in force-sensitive domains, but the framework itself is not claimed to be limited to them; its extension to other elicitation domains remains to be established empirically, domain by domain. Future work should compare matched visual and materially calibrated stimuli, report fabrication variables systematically, and test whether comparable effects recur across sessions, speakers, materials, and grammatical domains.

6. Conclusion: Toward a Haptically Aware Documentary Praxis

This chapter proposes a limited extension to documentary practice. When grammatical contrasts depend on non-visual properties of an event, the elicitation record should preserve the relevant material conditions alongside audio and video. Visible form alone does not always capture the resistance, fit, compliance, or friction that can make particular contrasts available in interaction. The cases from Sakha, Telengit, and Cilician Arabic are offered as proof-of-concept examples of both the problem and one possible response.

Although the examples discussed here come from force-sensitive domains, the methodological point is broader. Whenever linguistic contrasts depend on parameterizable features of the elicitation environment, those features should be documented rather than left implicit. Additive manufacturing provides one practical way of doing so, because it allows researchers to reproduce stimuli whose friction, compliance, mass distribution, and fit can be varied in controlled ways. Used within community-governed, CARE-aligned archival practice, such stimuli can complement naturalistic corpora by making materially relevant aspects of the event more explicit, comparable, and recoverable.

This is not an argument for replacing naturalistic documentation or for reducing linguistic meaning to physical variables. It is an argument for preserving the material conditions that shape speakers' construals of events when those conditions matter for grammatical choice. If language documentation aims to preserve a durable record of meaning in use, then

archives must retain enough of the elicitation environment to make the linguistic record interpretable.

Abbreviations: ADV adverbial, AUX auxiliary, COMPL completive, CVB converb, DEF definite, FACT factual, IDEO ideophone, M masculine, MID middle, NEG negation, OBJ object, PFV perfective, PST past, PTCP participle, SG singular.

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