Alternating conjuncts: the *to*… *to* construction in Russian and its crosslinguistic counterparts

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1. Introduction

- TO-TO constructions (existing in Russian, some other Slavic languages, Greek, French, etc.):
  - formed by attaching a quantifier-like element (*to* in Russian) to each conjunct (there can be more than two conjuncts, and they can be of virtually any syntactic type);
  - require that there be an alternating sequence of events introduced by the conjuncts.

(1) Maša **to** poët, **to** tancuet.
Masha TO sings TO dances
'≈ Masha is alternately singing and dancing.'

- Some of the elements used in TO-TO constructions cross-linguistically:
  - Russian, Ukrainian: *to* (originally a demonstrative, 'that');
  - Bosnian/Croatian/Serbian: *čas* ('moment'), *sad* ('now') (Dunja Veselinović, p.c.);
  - Greek: *mia* ('a/one.FEM.SG', possibly from 'one time') (Maria Kouneli, p.c.);
  - French: *tantôt* (temporal adverbial with various uses) (Philippe Schlenker, p.c.)

- Two major challenges:
  - division of labor: identifying the components of the complex meaning encoded in TO-TO constructions and their sources (semantics, pragmatics, world knowledge);
  - compositionality: figuring out how those components of meaning come together compositionally.

2. Comparing TO-TO constructions to other coordinate constructions involving temporal quantification

- Idea: comparing TO-TO constructions to similar coordinate constructions containing different means of temporal quantification can inform us about what the elementary inferences are and possibly where they come from.

- Comparison set: various quantifiers are attached to each of the conjuncts (NB: the target construction is embedded in the restrictor of a universal quantifier to control for scalar implicatures (Chierchia 2004)):

(2) Na každom lyžnom kurorte, kotoryj posešajut…
on each ski resort which visit.IPFV.PRS.3PL
a. **inogda** amerikanskie, (a) / (* i) **inogda** nemeckie
sometimes American CONJ-ADV and sometimes German
b. **kogda** amerikanskie, (a) / (* i) **kogda** nemeckie
WHEN American CONJ-ADV and WHEN German
c. **to** amerikanskie, (a) / (* i) **to** nemeckie turisty
TO American CONJ-ADV and TO German tourists
d. **xotja by odnaždy** amerikanskie, (* a) / (i) **xotja by odnaždy** nemeckie
at least once American CONJ-ADV and at least once German
… turisty, ljudi sčastlivy.
tourists people happy

'≈ At each ski resort that (2)a,b is sometimes visited by American, (and) sometimes by German tourists / (2)c is alternately visited by American and German tourists / (2)d has been at least once visited by American, (and) at least once by German tourists, people are happy.'

- A more natural word order for (2)d:

(3) Na каждом лыжном kurorte, kotoryj **xotja by odnaždy** posetili
on each ski resort which at least once visit.PFV.PAST.PL
amerikanskie, (i) **xotja by odnaždy** nemeckie turisty, ljudi sčastlivy.
American and at least once German tourists people happy

- Separate events inference:
  - (2)a–c come with an inference that for a ski resort to satisfy the restrictor there have to be separate events of American and German tourists visiting it (i.e. ski resorts that are only visited by American and German tourists coming together are excluded);
    - NB: no ban on additional events of American and German tourists visiting together
  - (2)d triggers no such inference (a single event of American and German tourists visiting a ski resort together is enough for that ski resort to satisfy the restrictor).

- Compatibility with overt conjunctions:
  - (2)a–c are all compatible with the adversative (contrastive) conjunction *a*, but not the standard one *i* (NB: similar facts hold for BCS (Dunja Veselinović, p.c.));
  - in (2)d it's the other way round.

- Multiple event inference:
  - (2)a–c come with an inference that there are multiple instances of each event introduced by the conjuncts;
  - (2)d doesn't;
  - interaction with aspect: sentences like (2)a–c are incompatible with (bona fide) Perfective, while (2)d is incompatible with (bona fide) Imperfective.

- Distinctions among (2)a–c (subtle); potential points of divergence:
  - whether events of contrasting kinds need to be temporally disjoint, i.e. no total temporal overlap allowed (weak non-overlap inference; (2)a–c: yes);
  - whether no temporal overlap at all is permitted among such events (strong non-overlap inference: (2)a,b: no; (2)c: ??maybe);
  - how the events need to be arranged temporally ((2)a: no requirement; (2)b: randomly distributed, i.e. 'anti-order' requirement; (2)c: alternating sequence).

- Table 1 summarizes the data:

Constructions / Facts	at least once X, at least once Y	sometimes X, sometimes Y	WHEN X, WHEN Y	TO X, TO Y
Inferences				
Existential	✓	✓	✓	✓
Separate events	✗	✓	✓	✓
Multiple events	✗	✓	✓	✓
Weak non-overlap	✗	✓	✓	✓
Strong non-overlap	✗	✗	✗	??
Alternating sequence	✗	✗	✗	✓
Compatibility with connectives				
i ('and')	✓	✗	✗	✗
a (adversative)	✗	✓	✓	✓
Aspect				
Perfective	✓	✗	✗	✗
Imperfective	✗	✓	✓	✓

Table 1. Coordinate constructions with various temporal quantifiers attached to each conjunct

Upshot:
- We need to capture the separate events inference and temporal non-overlap condition in 'sometimes X, sometimes Y', 'WHEN X, WHEN Y', 'TO X, TO Y' (as opposed to the 'at least once X, at least once Y') and relate it to the contrastive nature of those constructions.
- We need to account for the requirements imposed on the temporal arrangement of events by 'WHEN X, WHEN Y' and 'TO X, TO Y', i.e. we need to introduce the notion of ordering of the things we quantify over.

3. Sketching an analysis (extensional)

3.1.A note on the framework

- I adopt the version of event semantics developed in (Champollion 2015):
  - The existential closure is built into the semantics of predicates; a verb like *rain* comes to denote a predicate that is true of any set that contains a raining event:

(4) $[\![\text{rain}]\!] = \lambda f_{vt}.\exists e[\textbf{rain}(e) \wedge f(e)]$

- Possible modification: decompose Champollion's <*vt*,*t*> predicate into the standard Neo-Davidsonian *vt* predicate (e.g. *rain* in (5)) and an operator *vt*SET in (6) that (i) lifts the type of the predicate, (ii) introduces existential quantification:

(5) $[\![\text{rain}]\!] = \lambda e.\textbf{rain}(e)$
(6) $[\![vt\text{SET}]\!] = \lambda f_{vt}\lambda f'_{vt}.\exists e[f(e) \wedge f'(e)]$

- A sentence-level closure operator in (7) applies at the CP level and in simple cases asserts that the predicate is true of the set of all events:

(7) $[\![\text{closure}]\!] = \lambda e.\textbf{true}$
(8) $[\![\text{it is raining}]\!] = [\![\text{rain}]\!]([\![[\text{closure}]]\!]) = \exists e[\textbf{rain}(e)]$

– All predicate arguments and modifiers are uniformly of the type <<*vt*,*t*>,<*vt*,*t*>>, for example:

(9) [[quickly]] = $\lambda V_{<vt,t>}\lambda f_{vt}.V(\lambda e.\textbf{quickly}(e) \wedge f(e))$

3.2.Deriving the separate event and the weak temporal non-overlap inference

Idea: 'sometimes X, sometimes Y', 'WHEN X, WHEN Y', 'TO X, TO Y' all contain a silent focus-sensitive exhaustivity operator *Exh*, whose semantics is similar (but not identical) to that of *only*, while 'at least once X, at least once Y' doesn't.

Question: where does *Exh* apply?

- Let us consider two possible options and the results they give for a sentence like (10):

(10) Inogda dožd', (a) inogda sneg.
sometimes rain CONJ-ADV sometimes snow
'Sometimes it rains, (and) sometimes it snows.'

Option 1. *Exh* applies at the level of event quantification (no other event predicate from the appropriate alternative set is true of this event, e.g. '≈ There is an event which is only a raining event (e.g. and not a snowing event)').

- Implementation:
  - The *Exh* operator in (11) applies to Neo-Davidsonian predicates (i.e. before *vt*SET):

(11) $[[Exh_{event}]]^{Alt} = \lambda f_{vt}\lambda e.f(e) \wedge \neg\exists f'[f' \in Alt \wedge f'(e)]$
(Alt is the appropriate alternative set; for a relatively recent discussion on how exactly focus alternatives are generated see (Katzir 2013))

  - If we take 'sometimes' to introduce existential quantification over runtimes of events, we get the following result for (10) (ignoring tense and aspect):

(12) $[[(10)]]^{Alt} = \exists i[\exists e[\textbf{rain}(e) \wedge \neg\exists f'[f' \in Alt \wedge f'(e)] \wedge \tau(e) = i]] \wedge \exists i'[\exists e[\textbf{snow}(e) \wedge \neg\exists f'[f' \in Alt \wedge f'(e)] \wedge \tau(e) = i']]$
≈ There is a time interval which is a runtime for an event which is only a raining event, and there is a time interval which is a runtime for an event which is only a snowing event.
(τ is the trace function that maps events to their runtimes (Lasersohn 1988))

- Option 1 derives the separate events inference, but not the weak temporal non-overlap one.
  - The weak non-overlap inference could in some cases be attributed to a bias in which events that perfectly overlap temporally tend to be perceived as a single event, which results in a seeming violation of the condition imposed by *Exh*, but the scenario in (2) arguably helps distinguish between the two cases, and the weak non-overlap inference persists regardless.

Option 2. *Exh* applies at the level of temporal quantification (no other event from the appropriate alternative set has this time interval as its runtime, e.g. '≈ There is a time interval which is only a runtime of a raining event (e.g. and not of a snowing event)').

- Implementation:
  - The *Exh* operator in (13) applies to a <*vt*,*t*> event predicate and creates a predicate of time intervals; 'sometimes' only introduces an existential quantifier (but then what happens when there is no *Exh* operator?):

    (13) $[\![\text{Exh}_{\text{temp}}]\!]^{\text{Alt}} = \lambda V_{<vt,t>}\lambda i\lambda f_{vt}.V(\lambda e.f(e) \wedge \tau(e) = i) \wedge \neg\exists V'[V' \in \text{Alt} \wedge V'(\lambda e.\tau(e) = i)]$

  - Alternative: build the exhaustivity requirement into temporal quantifiers (thus, creating a lot of — presumably, undesirable — lexical ambiguity):

    (14) $[\![\text{sometimes}_{\text{Exh}}]\!]^{\text{Alt}} = \lambda V_{<vt,t>}\lambda f_{vt}.\exists i[V(\lambda e.f(e) \wedge \tau(e) = i) \wedge \neg\exists V'[V' \in \text{Alt} \wedge V'(\lambda e.\tau(e) = i)]]$

  - In either case, the anticipated result for a sentence like (10) is as follows:

    (15) $[\![(10)]\!]^{\text{Alt}} = \exists i[\exists e[\textbf{rain}(e) \wedge \tau(e) = i] \wedge \neg\exists V'[V' \in \text{Alt} \wedge \tau(e) = i]] \wedge \exists i'[\exists e[\textbf{snow}(e) \wedge \tau(e) = i'] \wedge \neg\exists V'[V' \in \text{Alt} \wedge \tau(e) = i']]$
    ≈ There is a time interval which is only a runtime for a raining event, and there is a time interval which is only a runtime for a snowing event.

- Option 2 derives the separate event inference and the weak temporal non-overlap inference, but allows partial temporal overlap.

Upshot:
- Introducing *Exh* at the level of event quantification derives the separate events inference, but not the weak temporal non-overlap one (you need additional assumptions and/or a separate mechanism).
- Introducing *Exh* at the level of temporal quantification derives both the separate events inference and the weak non-overlap one (but requires some non-standard commitments about how temporal quantification happens).

3.3.Ordering events

Possible direction: distributivity-based approach. The property of containing at least one time interval that is a runtime for an event of each kind is distributed over parts of a cover of an implicit or explicitly provided time interval. Different arrangements are derived by manipulating properties of the covers involved, and temporal quantifiers are sensitive to these properties.

- Implementation:
  - The parts of the Sorting Key are determined via contextually provided covers (Champollion 2010; Gillon 1987) (partitions whose parts can overlap):

    (16) **Cov**(C, x) $\stackrel{\text{def}}{=} \bigoplus C = x$
    (*C* is a cover of a mereological object *x* iff *C* is a set of parts of *x* whose sum is *x*.)

  - Example: within Option 2 above, the sentence in (17) will have the truth conditions in (18) (I omit the technical details of getting to these truth conditions compositionally):

    (17) Kogda dožd', kogda sneg.
    WHEN rain WHEN snow
    '≈ Sometimes it is raining and sometimes it is snowing (snowing and raining events are randomly distributed in time).'

(18) $[\![(17)]\!]^{T,C}$ = **Cov**(C,T) ∧ ∀i[i ∈ C → ∃i_1∃i_2[i_1 ≤ i ∧ i_2 ≤ i ∧ ∃e[**rain**(e) ∧ τ(e) = i_1] ∧ ¬∃V'[V' ∈ Alt ∧ V'(λe.τ(e) = i_1)] ∧ ∃e[**snow**(e) ∧ τ(e) = i_2] ∧ ¬∃V'[V' ∈ Alt ∧ V'(λe.τ(e) = i_2)]]]
≈ A salient time interval is split into parts in a salient way, and each of those parts contains a time interval which is only a runtime of a raining event and a time interval which is only a runtime of a snowing event.

- No additional requirements are imposed on the cover in (18); e.g. the parts of the cover can overlap (you can count a single event twice), they can also be disjoint (the events can be arranged in any order). Introducing further restrictions on the cover involved can give us in particular the alternation inference for TO-TO constructions. Those constraints on the structure of covers can be built into lexical entries of temporal quantifiers (e.g. as felicity conditions).
- Potential problem: the distributivity-based approach as it is isn't sufficiently explanatory.

Appendix A. Deriving the strong non-overlap inference (challenges)

- NB: it is unclear how robust this inference is in the first place (more fine-grained empirical work is needed), but let us for now assume it is real.
- Potential directions:
  - tweaking the conditions imposed on the parts of the cover (e.g. the most brute-force option would be to hardcode the requirement that i_1 doesn't overlap with i_2);
  - tweaking the conditions imposed on time intervals by the *Exh* operator within Option 2 (e.g. by using the notion of containment rather than identity).
- In either case, one has to make use of the notion of maximal self-connected events (discussed under various names in (Fintel 2004; Kratzer 2014; Portner 2009)); otherwise, the truth conditions will systematically end up being too weak for predicates that have the subinterval property.
- Another direction is to abandon the distributivity-based approach and instead simply require that there is a sequence of time intervals that has a certain properties (along the line of the second entry for *alternately* in (Champollion 2015, (62)). However, this approach:
  - still needs some tweaking, either at the level of the requirements imposed on the sequence or at the level of the *Exh* operator, so that to allow gaps between the adjacent runtimes of events;
  - needs adjusting so that it could handle cases of more than two conjuncts;
  - doesn't readily generalize to cases when the TO-TO construction is used in unmistakably distributive environments, e.g.:

(19) Po utram ja p'ju to kofe, to čaj.
PO-DISTR mornings.DAT I drink.IPFV.PRS.1SG TO coffee TO tea
'≈ In the mornings I alternately drink coffee and tea. (The most salient reading: each morning I only drink one of the two, and in total my coffee and tea drinking events form a — not necessarily strict — alternating sequence.)'

Appendix B. Extending the analysis to another type of coordinate constructions

- Parts of the analysis should extend naturally to IPB-IPB constructions (IPB = indeterminate pronoun base) of the kind already illustrated in (2)b for the temporal domain, which also exist in the locative and individual domain (similar constructions exist in Greek (Maria Kouneli, p.c.) and Hungarian (Anna Szabolcsi, p.c.)):

(20) **Gde** sneg, **gde** grjaz'.
WHERE snow WHERE mud
'In some areas there is snow, in some areas there is mud.'
(Patches of snow and mud are randomly distributed throughout some salient area of space; no total overlap of all snow and mud patches permitted.)

(21) **Kto** el, **kto** pil.
WHO ate.IPFV.SG.MASC WHO drank.IPFV.SG.MASC
'Some [people] were eating, some were drinking.'
(Within a salient set some people were eating and some people were drinking, everyone (?) was doing either of the two, but it's not the case that everyone was doing both.)

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