THE EFFORT MODELS and GRAVITATIONAL MODEL

Clarifications and update

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Why this presentation?

To **update** people interested in the Effort Models (EMs) on developments

To help **dispel misconceptions**

This presentation will be periodically updated  
But does not replace full papers on the same topic

More comprehensive information on the EMs and on their use in discussing tactics and strategies is found in:

The Effort Models: What for?

As a student of conference interpreting, and later as a practitioner, teacher and researcher, noticed:

- **Language quality deteriorations in students’ performance in class**
- Marked **fluctuations in other aspects of students’ performance** throughout the training period
- **Numerous errors, omissions and infelicities (EOIs)** in target speeches of experienced interpreters

**Wished to understand the reasons**
**Wished to help students if possible, and at least explain**

The Effort Models and Gravitational Model, as well as the Tightrope Hypothesis, are the main resulting constructs

They were **not designed as research tools**, though they turned out to be considered useful by theoreticians and empirical researchers as well
Historical background (1) – Early 1980s

Intuitive, introspection-based conceptual structuring of simultaneous interpreting as a set of (behavioral) ‘Efforts’ which could easily be identified as ‘functions’ by students and trainers.

LA – Listening and Analysis (of source speech) – later renamed R (Reception) to account for interpreting from signed languages.

M – Short Term Memory Effort (not based on psychological construct of Working Memory though strongly related to this construct – see explanation later).

P – Production (of target speech), including self-monitoring.

All competing for limited processing capacity (also called ‘attentional resources’).

\[ \text{Sim} = \text{LA} + \text{M} + \text{P} \leq \text{A} \]

A: Available processing capacity

*Note: mathematical notation used very loosely, by convention*
Why is there no ‘Translation’/‘Conversion’ Effort in the EMs? (1)

It is generally accepted that good interpreting relies mostly on the reformulation of ‘messages’ on the basis of perceived meaning and intentions as represented mentally in a substantially ‘deverbalized’ form, (as stressed by the ‘Paris School’ – e.g. Seleskovitch & Lederer)

Interpreting also involves a substantial amount of ‘transcoding’, i.e. language-to-language conversion, most efficient when based on repeated associations in context between source-language words/names/collocations and target-language ‘equivalents’

Such ‘translinguistic equivalences’ presumably play an important role in alleviating cognitive pressure because of their automatic or near-automatic nature (see relevant slides later in this presentation)

Why do the EMs not include this ‘Translation’ or ‘Conversion’ Effort?
Why is there no ‘Translation’/‘Conversion’ Effort in the EMs? (2)

One reason is didactic: Having adopted the view of Interpretive Theory (the “Paris School”) that interpreting is best when it relies on analysis, mental representation and reformulation of the mental representation, not linguistic transcoding, wanted to avoid giving too much salience to this pathway of interpreting

Second reason: transcoding can be conceptualized as part of Production, saw no need to make a distinction in the models between meaning-based production and language-equivalences-based production especially since the EMs focus on cognitive load and effort…

(‘Cognitive load’ referring to the amount of effort required to perform a cognitive task, and ‘cognitive effort’ to the effort actually invested in performing the task – see Gile and Lei, 2020))

… and that such transcoding ends up being quasi-automatic, and thus requires virtually no attentional resources

Had the EMs been designed as cognitive models for research into interpreting cognition, transcoding would have been part of them
Historical background (2) – Automatic and controlled operations

Soon (still early 80s) **started exploring cognitive psychology and psycholinguistics literature**, and found out about the existence of a classification:

- Automated operations
  
  *Require (virtually) no attentional resources, very fast*

- Controlled operations
  
  *Require attentional resources, much slower*

**Controlled operations become gradually ‘automated’ when repeated**

Also found out that cognitive psychologists believe that attentional resources (‘processing capacity) are limited at any time in humans and that a ‘coordination’ function (‘executive’ function), which also uses up attentional resources, is important when managing cognitive activities.

Added the *coordination Effort C* to the Model
Historical Background (3) – Is interpreting ‘automatic’?

 Tested my intuitive construct’s fit with this knowledge: are listening and analysis, short-term storage of information and retrieval of information, speech production controlled or automatic?

 Outcome:

 Contrary to commonly held belief in the interpreting community at the time regarding A languages each has controlled components

 Which meant that the intuitive construct made (general) sense in terms of cognitive psychological thinking

 \[ \text{SIM} = L + M + P + C \]

 \[ R(\text{SIM}) = R(L) + R(M) + R(P) + R(C) \rightarrow \text{TOTAL R} \]

 \( R \) stands for attentional resource requirements

 The + signs do not mean arithmetic addition, but some additive effect

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Conditions for successful simultaneous

1. Sufficient available attentional resources/PC (Overall condition)
   At any time:
   \[ R(L) + R(M) + R(P) + R(C) \rightarrow \text{Total } R \leq A \]
   (Total available PC is sufficient to cover the ‘sum’ of needs)

2. PC management condition (Interpreter’s tactics and strategies)
   At any time:
   \[ R(L) \leq LA \]
   \[ R(M) \leq MA \]
   \[ R(P) \leq PA \]

Note: availability of resources varies, and depends inter alia on motivation.
In some cases, it cannot be ruled out that if interpreters really tried hard, they
would have enough attentional resources to perform an Effort
successfully, but they gave up on the task (also see explanations of the
Tightrope Hypothesis)
See for instance retrospective comments in Gumul’s work

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If at least one of the conditions is not met

One/ several Efforts cannot perform adequately, which can lead to:

**Incomplete/incorrect comprehension** of the source speech

*and/or*

**Incorrect/clumsy target speech**

*and/or*

**Incomplete/incorrect storage/retrieval of information**

from short-term memory

*and/or*

**Slowing down** of one or several Efforts’ performance and **chain reactions**

All of these can result in **Errors, Omissions and/or Infelicities (EOIs)**

*Infelicities: clumsy language, not quite incorrect*
The Tightrope Hypothesis (1)

What makes this analysis useful is the associated *Tightrope Hypothesis*:

Interpreters tend to work *close enough to cognitive saturation* for *many EOI*s to occur
not because of the interpreters’ insufficient knowledge of the working languages or topics,
not because of insufficient technical skills
but because

*Attentional resources required to perform adequately were not available for a particular comprehension, memory storage or retrieval or production task at a time when they were needed*

This includes cases where the interpreters might have found the resources if they tried hard, but gave up trying

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The Tightrope hypothesis (2)

_Tightrope hypothesis: “Interpreters tend to work close to saturation”_

The nature of this hypothesis is _often misunderstood_ (e.g. Seeber, 2011)
It was formulated as holistic and intuitive, in the same mindset as the EMs.
It was not designed for explorations of cognitive architecture and interactions.

_“No empirical support for the Tightrope Hypothesis”? Not true_

- _Massive anecdotal evidence_
- _Empirical evidence to support it as a general explanation of EOIs_
  e.g. Gile, 1999 in _Hermes_ with replications by Matisiak, 2001; Wallmach, 2004;
  Barsan, 2012; Mankauskienè, 2018; Gile, 2011; SHAO and CHAI, 2020.

_Many studies on problem triggers_, the effect of pause lengthening on EOIs
  (Barranco-Droege, 2015), brain imaging (Koshkin et al., 2018; Gumul, 2018;
  Zachová, 2019 – see studies listed in _CIRIN Bulletins_ at www.cirinandgile.com
- _No alternative explanation offered for the large number of EOIs observed_

But there is definitively insufficient empirical testing and evidence to
explore it further with respect to what exactly is saturated, when and how,
what modules/ components in a particular cognitive theory/architecture
are affected and how.
Other Effort Models

(‘long’) Consecutive interpreting (with notes)

Comprehension phase: \( L + M + NP + C \)

\( NP: \) Note Production

Reformulation phase: \( NR + SR + P + C \)

\( NR: \) Note Reading \quad \( SR: \) Speech Reconstruction from Memory

Strong cognitive pressure during comprehension phase
less during reformulation phase

Actually, during reformulation, much cognitive cooperation,
as opposed to competition during the comprehension phase.

Because of cognitive and mechanical aspects of note-taking during
comprehension:

Comprehension phase is origin of most EOs
not of Infelicities

So note-taking is important

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Other Effort Models

Sight Translation

\[ R + M + P + C \]

*R: Reading Effort*

At first sight, Sight Translation seems easier than simultaneous or consecutive because the information is there to see at any time, but

*P is particularly difficult in sight translation because of the permanent visual presence of the ST and the resulting risk of linguistic interference from the source language*

So on balance, it seems to be just as difficult, at least for beginners who have not yet mastered the skill of mentally taking some distance from linguistic forms and retaining a highly deverbalized mental representation of what they say
Other Effort Models

Simultaneous with text

\[ L + R + M + P + C \]

*L: Listening Effort  R: Reading Effort*

Interpreter helped by text

if missed something

numbers, names

Especially if time for preparation

But one more Effort to coordinate (reading)

and often dense speeches, read fast

Sometimes easier than simultaneous without text,

for instance when the speaker has a strong accent

or when the speech contains many names and numbers

sometimes more difficult

Especially when the speaker deviates often from the text
Simultaneous with text vs. ‘simultaneous’

Nowadays, in many interpreting assignments, Speakers use PowerPoint presentations and other images and texts on screen

Does the distinction between ‘simultaneous’ and ‘simultaneous with text’ still make sense?

In simultaneous with text, the speaker reads out the speech from a text, which the interpreter has in the booth
In ordinary simultaneous (‘without text’), a *small proportion of the speech* corresponds to written text, which is displayed on screen

It makes sense to maintain the distinction, while drawing the students’ attention to the possibility of some parts of speeches ‘without text’ being very similar to speeches ‘with text’
Explaining problems in terms of Effort Models

Problems are more likely to occur:

1. When PC requirements increase
   - *Speech density*
   - *Noise, Signal distortion (including unusual accent, prosody, grammar)*
     - *Short-term memory overload*

2. When mismanagement of attention
   - *Too much or too little attention devoted to an Effort*
     - *EVS too long or too short*
   - *Sub-optimal tactic selection resulting in cognitive interference*
     - *Sub-optimal note-taking in consecutive*

3. In vulnerable segments
   *Short words, homophones*
Simultaneous from a spoken language into a signed language*

Sim = L + M + P + SMS + OID + C

*The EM for simultaneous was adapted by a number of signed language interpreters over the years. The Model presented here is largely based on the work done with/by Sophie Pointurier-Pournin. 2014. L’interprétation en Langue des Signes Française : contraintes, tactiques, effots. Unpublished doctoral dissertation, Université Paris 3 Sorbonne Nouvelle.

SMS: Self-Management in Space
OID: Online Interaction with the Deaf

SMS: Spatial positioning, distance to the speaker, angles to optimize comprehension of the source speech and transmission to Deaf users of the Target speech

OID: Attending to the signing by Deaf users of the Target speech, some of which is ‘internal’ and some of which is addressed to the interpreter

The gravitational model of language availability: Initial awareness

Plain ‘knowledge’ of words, rules of grammar etc.? Other dimension to language mastery?

- Sometimes you ‘know’ a word, but have difficulty retrieving it from memory, or ‘know’ a rule of grammar, style etc., but it takes some time and effort to apply it (‘tip of the tongue’ phenomenon)
- Sometimes you understand a foreign language when it is spoken slowly, but not when it is spoken faster

The time it takes to find/understand a word/linguistic structure is correlated with the ‘effort’ this requires

‘Language availability’: The (conceptual) variable which measures this time/effort
Low availability in production

Low availability slows down production
Hesitation pauses

Not a major problem in everyday conversation

Not necessarily problematic in consecutive

Highly problematic in simultaneous

because
If speech production is too slow
Interpreter lags behind speaker
Needs to store too much information in short term memory
and ultimately “loses” information
Low availability in comprehension

Low availability slows down the processing of incoming signal

Big problem in simultaneous and in consecutive

Can result

Not in slower comprehension

but in non-comprehension

(when working memory is saturated)
At t1, high availability listener (HAL) has finished processing more than 2 words and keeps one in WM – low availability listener (LAL) has finished processing 1 word.

At t2, speaker is uttering 7th word, HAL has finished processing 6 words – LAL has finished processing 2 words, and must keep 5 words in WM.

At t3, LAL is probably saturated.
GRAVITATIONAL MODEL OF LANGUAGE AVAILABILITY

A visual representation of availability

By convention: the closer to center, the more available

Dynamic, not static
‘Units of Linguistic Knowledge’:

1. Drift outwards (become less available) if not used
2. Migrate inwards if used (become more available)
3. Escort Effect
4. Interference Effect
One visual representation for many ‘systems’/states of availability

If tried to **map a person’s state of availability** for any language:

There can be **differences from one minute to the next**
*(for instance when a newly acquired technical term – or sign in a sign language – has just been used several times)*

The map would be **different**:

- For **production** (one’s idiolect) vs. **comprehension** (other speakers of the same language’s idiolects and sociolects),
- For **written vs. spoken** language
- In sign languages, for **reading vs. producing fingerspelling** etc.

The single map with concentric circles is a gross simplification
Only used for visual, intuitive support
A ‘trans-linguistic correspondences’ gravitational model

The gravitational model can be used to map availability of production/comprehension in single languages, but also to map the availability of trans-linguistic correspondences i.e. SL-TL correspondences

Essentially for lexical units (terms, names) and formulas (idioms, greetings, etc.) But also for collocations, clauses

The existence of such highly available correspondences can be assumed to reduce markedly PC requirements for Production

The fundamental laws of:
- lower availability when rarely used (outward migration)
- higher availability when used frequently (inward migration)

apply as they apply to the single language mappings

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Conceptual use of the Effort Models and Gravitational Model

These Models have been used – *inter alia* – to:

- *Explain recurrent difficulties* in interpreting
  Including errors, omissions and infelicities affecting ‘easy’ speech segments

- *Discuss tactics* (decisions with immediate goals)
  and *strategies* (decisions with less immediate goals, including preparation
  of conferences and working on one’s language availability) – see Gile 2009

- *Discuss language specificity* in interpreting

- *Discuss directionality*

- *Discuss learning processes and methods*

- *Discuss the relative difficulty of various types of interpreting*

- *Discuss note-taking tactics*

- *Discuss students’ evolution*

- *In research: Generate hypotheses for empirical research, explain
  empirical findings, serve as a basis for further theorizing*
The Effort Models and cognitive psychology (1)

A reminder: EMs based on introspection + a few general concepts from cognitive psychology

They are not a cognitive theory about:
- Processes and/or cognitive architectures
- Working Memory
- Executive Functions
- depth/stages of processing during comprehension
- ‘direct’, ‘automatic’ trans-linguistic correspondences vs. conceptual mediation
- the existence of a single pool of attentional resources vs. distinct pools

What the EMs say:

*for the purpose of*
- explaining many recurrent phenomena in interpreting
- discussing strategies and tactics, including didactic and professional options,

*it is useful to think of interpreting as comprising functional ‘Efforts’ which compete with each other in terms of available’ processing capacity*
The Effort Models and cognitive psychology (2)

*M (Short Term Memory Effort) is not the same as Working Memory (WM)*

WM is also part of the Reception Effort and of the Production Effort. It would therefore not make sense to postulate a distinct WM Effort.

*M corresponds to a functional, behavioral view often with tactical/strategic components (should the interpreter wait or not?) though admittedly, once information is selected for storage or retrieval, WM comes in centrally.*

While the **Coordination Effort** is sometimes misunderstood as another name for the ‘Central Executive’ in Baddeley’s WM model, it is meant to have a far wider scope in the EMs.
The Effort Models and cognitive psychology (3)

More generally

the Models were *designed for the classroom*

*In relative independence of new cognitive theories and models* as long as
developments *do not contradict its basic assumptions* – *which is the case to*

*the best of my knowledge:*

- the (overall) *non-automaticity* of the Efforts
- the *finite* nature of human attentional resources
- the ability of humans to *allocate* at least part of their attention to specific tasks
- the *competition* between Efforts for available attentional resources
*even if some also draw on distinct pools besides a common pool* (e.g. de Groot, 2015)

But *cognitive psychology and psycholinguistics remain fundamental reference disciplines* for the Effort Models
The social situatedness of the Effort Models (1)

Some authors have claimed that the EMs are cognitive only and disregard human (social and psychological) situations. Not true. See Chapters 2, 3 and 8 (inter alia) of Basic Concepts and Models.

Decisions on
- what information should be rendered in the target speech,
- with what priority and in what form (see example later),
- what information should be omitted,
- what information should be added (explanations, requests for clarification)

are based on communication situations, on ethical considerations and on codes of conduct.

See the discussion of ‘laws’ underlying the selection of tactics in Chapter 8.

Seeking maximum information recovery
Seeking maximum effect in a certain direction
Self-protection etc.
The social situatedness of the Effort Models (2)

Examples from signed language interpreting

Interpreters may decide they need to not only translate hearing speakers’ speeches, but also report on the speakers and on events in the room for the benefit of Deaf users of their service – this has a cognitive cost, if only because of the time it takes and the associated risk of WM saturation (see Pournin 2014).

Interpreters may decide to reformulate a concept in an iconic way through ‘scene setting’ rather than fingerspell it, because they believe their Deaf clients will reject fingerspelling as an intrusion of the language of the Hearing, even if fingerspelling takes less time and has a lower cognitive cost.
The social situatedness of the Effort Models (3)

The focus of the EM is cognitive, but this does not mean other aspects of interpreting are ignored

Stressing teeth brushing
Does not mean that one disregards the need to wash one’s hands for the sake of hygiene and health
The Effort Models and risk assessment

Some authors have proposed risk assessment as an alternative to cognitive considerations to explain interpreting behavior.

*Risk assessment is intrinsically part of the discussion of interpreting tactics* Inter alia when referring to avoidance of cognitive interference as one of the laws underlying the selection of tactics.

In some situations, risk assessment can indeed be a powerful explanation of interpreting behavior.

In many others, cognitive considerations, with a small role played by risk assessment related to cognitive issues, are probably a better alternative as regards their explanatory and predictive power.
Recent and future developments of the Effort Models: HMI

The Effort Models: functional representations of components of interpreting that require significant attentional resources

*Developed for students*

Found useful by students (Kleibs, 2018)

Its natural development will be easiest if it follows the same mindset

Initially developed for spoken language conference interpreting adapted to some extent to signed language interpreting, for a given period (roughly 1970s to 2010s)

With changing technology and working environments, other functional Efforts may become relevant:

when interpreting involves *manipulations of screen, keyboard and other non-automatic human-machine interactions* (beyond the traditional volume control, on/off/mute control and perhaps language channel changes)

**SI: R + M + P + HMI + C** (Human-Machine Interaction)
Remote Interpreting from two sites

At this time, when two simultaneous interpreters interpret the same speaker taking turns using the Zoom platform (direct experience on August 4, 2020)*:
- While interpreting, the two interpreters could not listen to each other
- They used a synchronized timer to tell them when the passive interpreter would have to take over from the active interpreter
  But because of EVS, they could not be sure that the active interpreter had finished interpreting the last sentence at the time indicated by the timer for turn-taking, and the passive interpreter had to wait a bit in order not to speak at the same time as the active interpreter. This lag could lead to cognitive overload.

SI: R + M + P + C + TT  (Turn-taking Effort)

* I am indebted to Rika YOSHIDA and Keitaro MORITA for the information
High social/psychological stakes pressure situations

Also, considering interpreting in settings beyond conference interpreting, be it in spoken into spoken languages or in a combination with signed languages

If interpreters need to constantly pay attention to what role they should play in a particularly sensitive mediated face-to-face interaction and what reformulation decisions are most appropriate psychologically and socially

(e.g. some situations in community interpreting, diplomatic/political interpreting)

SI: R + M + P + C + HSC
HSC: Human and social considerations Effort

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A few references (1)


A few references (2)


