THE EFFORT MODELS and GRAVITATIONAL MODEL

Clarifications and update

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With updates on the social situatedness of the EMs and risk assessment

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Why this presentation?

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

To help **dispel misconceptions** about the Effort Models

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

The best reference which provides more comprehensive information on the Effort Models and on their use in discussing tactics and strategies is  
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 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 ‘Efforts’ which could easily be identified as ‘functions’ by students and trainers

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

M – Short Term Memory (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’)

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

A: Available processing capacity

Note: mathematical notation used very loosely, by convention
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
  \textit{Require (virtually) no attentional resources, very fast}
- Controlled operations
  \textit{Require attentional resources, much slower}

\textbf{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 \textit{coordination Effort C} to the Model
Historical Background (3) – Is interpreting ‘automatic’?

Conceptually 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: each has controlled components

Contrary to commonly held belief in the interpreting community at the time regarding A language

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
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:
   \[ R(L) \leq LA \]
   \[ R(M) \leq MA \]
   \[ R(P) \leq PA \]
   (PC/AR allotted to each Effort enough to complete their respective tasks)
If one of the conditions is not met

One/several Efforts cannot perform adequately so:

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 EOIs to occur not because the interpreters’ insufficient knowledge of the working languages or the topics or 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**
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.
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**
  See inter alia Gile, 1999 in _Hermes_ with replications by Matsuoka, 2001;
  Barsan, 2012; Mankauskienė, 2018; Gile, 2011.
_Many studies on problem triggers_, the effect of pause lengthening on EOIs (Barranco-Droege, 2015), brain imaging (Koshkin et al., 2018)
  Plus 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 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

Comprehension phase: L + M + NP + C

NP: Note Production

Reformulation phase: NR + SR + P + C

NR: Note Reading    SR: Speech Reconstruction from Memory

Strong cognitive pressure during comprehension phase
not during reformulation phase

Actually, much cognitive cooperation, as opposed to competition, during reform.

Because of cognitive and mechanical aspects of note-taking during compr.

Comprehension phase is origin of most EOs
not of Infelicities

So note-taking is important
Other Effort Models

Sight Translation

R + M + P + C

R: Reading Effort

Note: P is particularly difficult because of the visual presence of the ST and resulting risk of interference.
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, sometimes more difficult
Explaining problems with 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*

\[ \text{Sim} = \text{L} + \text{M} + \text{P} + \text{SMS} + \text{OID} + \text{C} \]

*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, efforts*. 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


Gile Clarifications Effort Models
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 in 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 words/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
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.)

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
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: the basis of the EM: introspection + a few general concepts from cognitive psychology

Not a particular 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 part of the Reception Effort and of the Production Effort as well. It would therefore not make sense to postulate a distinct WM Effort.

*M* corresponds to a functional 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.

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

Focusing on brushing one’s teeth
Does not mean that one disregards the need to wash one’s hands
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.
Future developments of the Effort Models? (1)

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,
perhaps other functional Efforts will need to be incorporated,
for instance if interpreting involves *manipulations of screen, keyboard and other non-automatic man-machine interactions*

*(beyond the traditional volume control, on/off/mute control and perhaps language channel changes)*
Future developments of the Effort Models? (2)

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

perhaps other Efforts linked to these environments should be incorporated. e.g. if interpreters need to constantly pay attention to what role they should play in a mediated face-to-face interaction

*(community interpreting)*

or to physical threats

*(interpreting in armed conflict areas)*

In all these cases, the Effort Models could only claim to account for cognitive components of the interpreter’s behavior

Perhaps in combination with other components (e.g. affective components) if they were found to be difficult to disentangle from cognitive components,

Leaving room for other explanatory components
Future developments of the Effort Models? (3)

Another direction for development in the same mindset:
more detailed scrutiny of existing Efforts

For instance, one might seek to identify components of existing Efforts which require much processing capacity.

This could include

• Production of signed language Translation equivalents for certain terms in spoken language which do not exist as lexicalized signs in the SL
• More fundamentally, the role of spatial memory in SLI production
• Reading finger-spelled words
• Homophones in Japanese speech comprehension
Future developments of the Effort Models? (4)

In terms of research:

They have proved useful as a general framework
And have helped generate holistic research questions and hypotheses

   About problem triggers
   About tactics and strategies
   About language-specific aspects of interpreting

... 

But they were not designed for detailed cognitive or linguistic exploration
It would be nice to be able to quantify cognitive load in each Effort
Especially online, with particular stimuli
But appropriate methods and experimental/naturalistic setups are not available yet
A few references (1)


