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:

- Gile, Daniel. 2009. *Basic Concepts and Models for Interpreter and Translator Training* (revised edition). Amsterdam/Philadelphia: John Benjamins.
- Gile, Daniel. 2020. Forty years of Effort Models of Interpreting. Looking back, looking ahead. https://www.researchgate.net/publication/344427247_Forty_years_of_Effort_Models_of_Interpreting_looking_back_looking_ahead
- Gile, Daniel. 2021. The Effort Models of Interpreting as a Didactic Construct. In Muñoz Martín, Ricardo; SUN, Sanjun & LI, Defeng (eds). *Advances in Cognitive Translation Studies*. Singapore: Springer Nature. 139-160.

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* (*EOI*s) 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 as 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'*)

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

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

SIM = L + M + P + C
R(SIM) = R(L) + R(M) + R(P) + R(C) → 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:

$$R(L) \leq LA$$

$$R(M) \leq MA$$

$$R(P) \leq PA$$

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

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 EOIs*** 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

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; Mankauskienė, 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
- N***o 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 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

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

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*

see for instance **Bélanger** 1995/2015, **Pointurier-Pournin** 2014 and **Del Vecchio, Cadarelli, De Simone, Petitta**. 2015. Interacting with Participants Outside of Interpretation. In **Nicodemus, Brenda & Keith Cagle** (eds). 2015. *Signed Language Interpretation and Translation Research. Selected Papers from the First International Symposium*. Washington, DC.: Gallaudet University Press. 24-48.

*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.

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

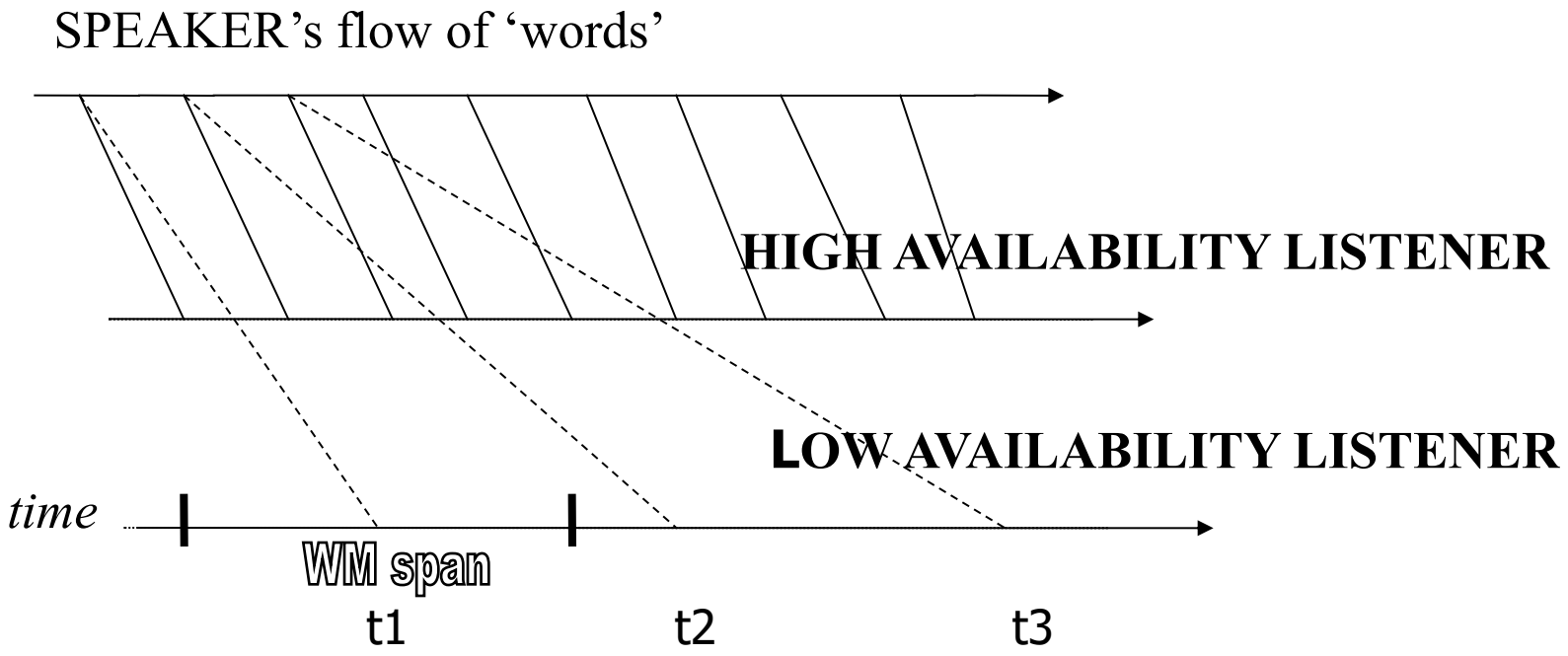
Big problem in simultaneous and in consecutive

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

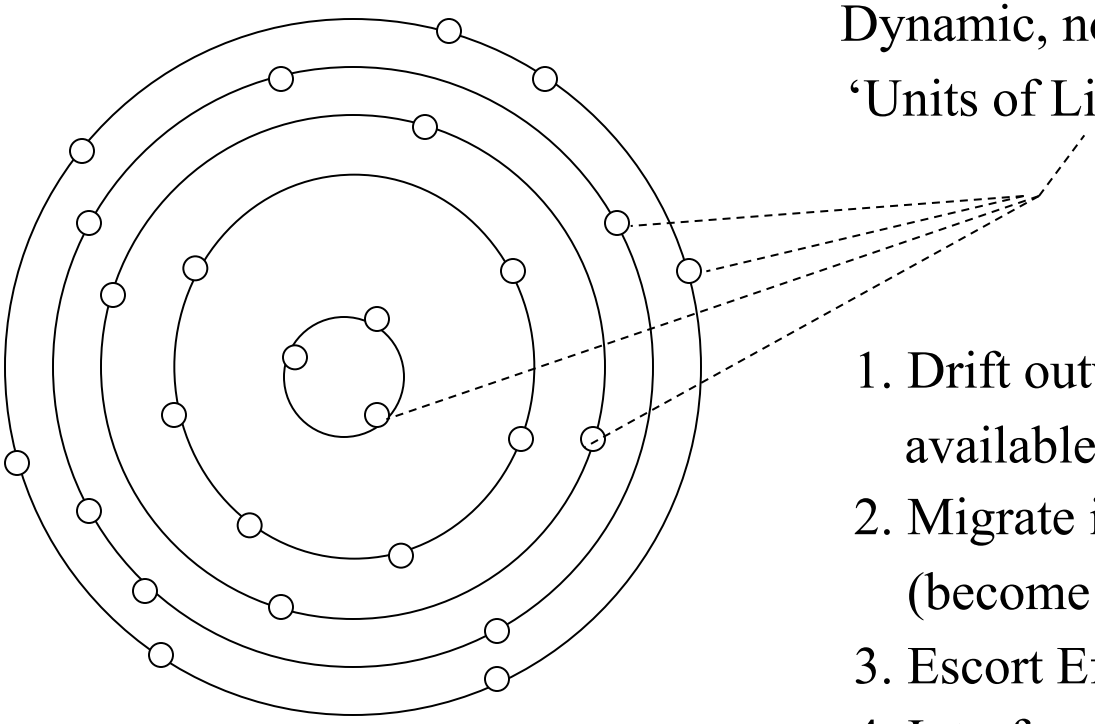
At t2, speaker is uttering 7th word, HAL has finished processing 6 words – LAL has finished processing 2 words, and must keep 5 words in WM.

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

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 (1)

Anthony Pym has proposed risk assessment as an alternative, or perhaps as an addition 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, or when fighting linguistic interference by deliberately avoiding target speech words and syntax morphologically similar to those of the source language in the source speech.

In some situations that need to be explored, non-trivial risk assessment can indeed be a powerful explanation of interpreting behavior

But when, in a text published in 2008, Pym attempts to explain the fact that in two successive simultaneous interpretations of the same speech in an experimental study, interpreters made some errors and omissions the first time, and corrected some while making new errors the second time, this is an example of risk management and they focused on “high risk” (high stakes?) items, the claim is unconvincing:

The Effort Models and risk assessment (2)

- It is not clear why this purely experimental setting with no real communication involves differential risks/stakes for speech items
- It is not clear that the items that were corrected the second time are indeed high-risk/stakes. Pym's classification of "high risk"/"low risk" is very speculative
- Even if such a classification were accepted and the items interpreted erroneously or omitted the second time were "low risk", why were the interpreters not able to interpret them correctly the second time after having interpreted them correctly the first time?

Cognitive saturation and carry-over effects remain a more plausible explanation.

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*

*(Mentioned in the September 2020 update of this PowerPoint presentation, in Gile, Daniel. 2020. Forty years of Effort Models of Interpreting. Looking back, looking ahead. https://www.researchgate.net/publication/344427247_Forty_years_of_Effort_Models_of_Interpreting_looking_back_looking_ahead , and in Gile, Daniel. 2021. The Effort Models of Interpreting as a Didactic Construct. In Muñoz Martín, Ricardo; SUN, Sanjun & LI, Defeng (eds). Advances in Cognitive Translation Studies. Singapore: Springer Nature. 139-160.)

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