Understanding working memory

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Based on "Alan Baddeley´s model"

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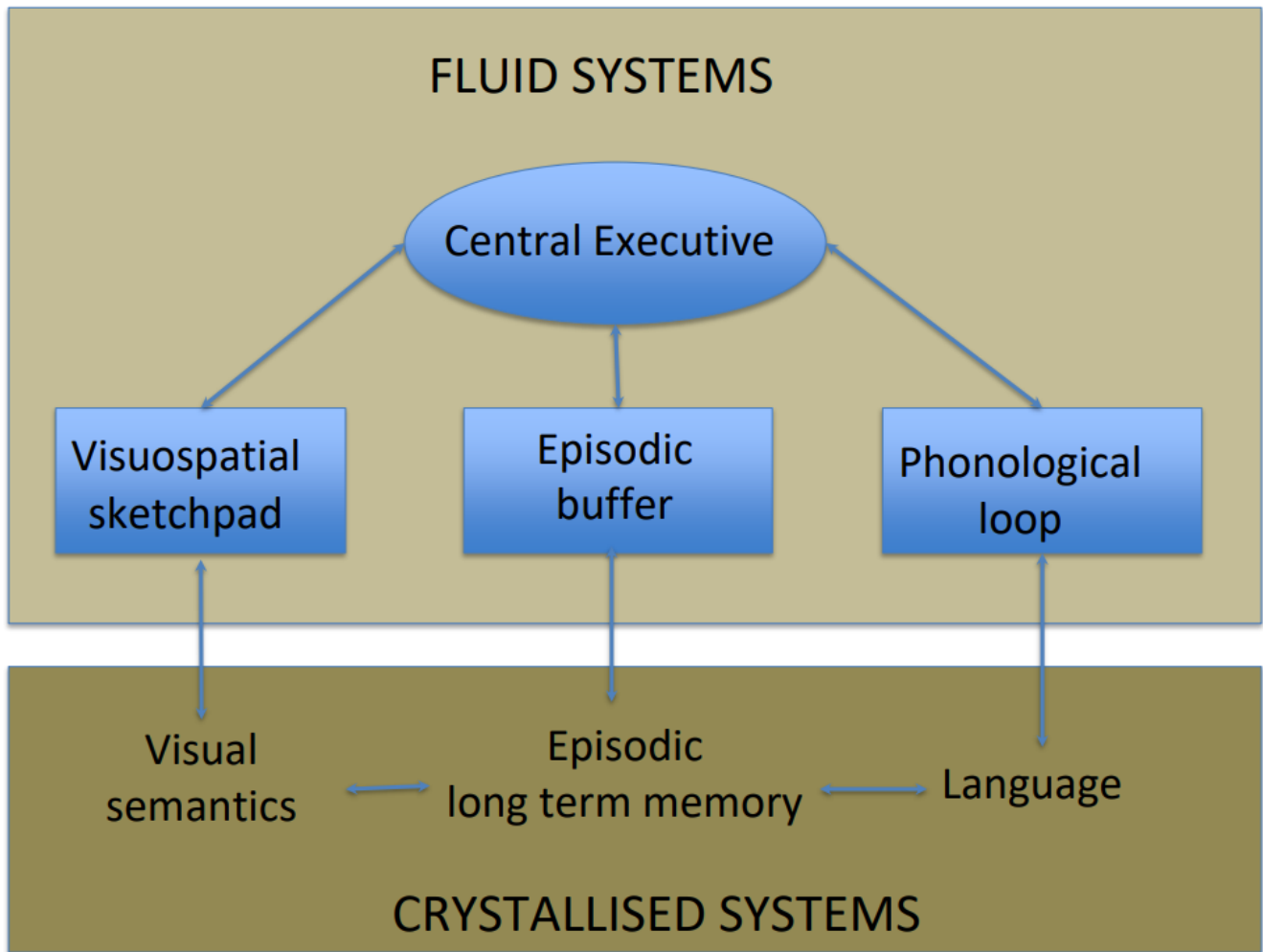Emeritus Professor
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Orienting

• By reading and going through these slides You
will learn, step by step, the main features and
components of the Alan Baddeley's "Model of
Working Memory (WM)"

FLUID SYSTEMS, fluid intelligence is:
• Complex human ability that allows us to adapt our
thinking to a new cognitive problem or situation. It is
critical for wide variety of cognitive tasks and
for learning something new
CRYSTALLISED SYSTEMS, crystallized intelligence is:
• What we already know and can do, knowledge,
vocabulary, semantics, all the knowledge that we
have in our Long Term store or Memory (LTM).

FLUID SYSTEMS

Central Executive

Visuospatial sketchpad

Episodic buffer

Phonological loop

Visual semantics

Episodic long term memory

Language

CRYSTALLISED SYSTEMS

Phonological loop

Is the storage system for speech-based
information (possibly acoustic information as
well)
• This system, it is not "clever", it has no capacity
for controlling attention or decision —making
• It is merely a temporary storage for heard
information, particularly speech
• "It represents the storage system responsible for
"phonological short-term memory" — the ability to
remember small amounts of heard information
over short periods of time.

Two subcomponents of phonological loop

The phonological store:
• Is the area of the system in which speech material
is held for short limited periods of time (around 2

seconds) – "memory trace", "trace decay" – rapid fading of the trace
Articulatory rehearsal mechanism:
• we use it for recite the information in the phonological store (e.g. repeating the phone number) –re-entering the information back to the phonological store.

Articulatory rehearsal mechanism is used also for "phonological/verbal coding or recoding"
• In this process information presented in visual form (printed words, printed letters/numbers, pictures) can be converted into speech
• It can be done only if the visual information has a verbal label (e.g. picture of a "house", labeled as "house")
• Verbal coding helps us to remember
• Phonological/verbal coding of visual material is carried out in the articulatory rehearsal mechanism – "named" or "labelled".
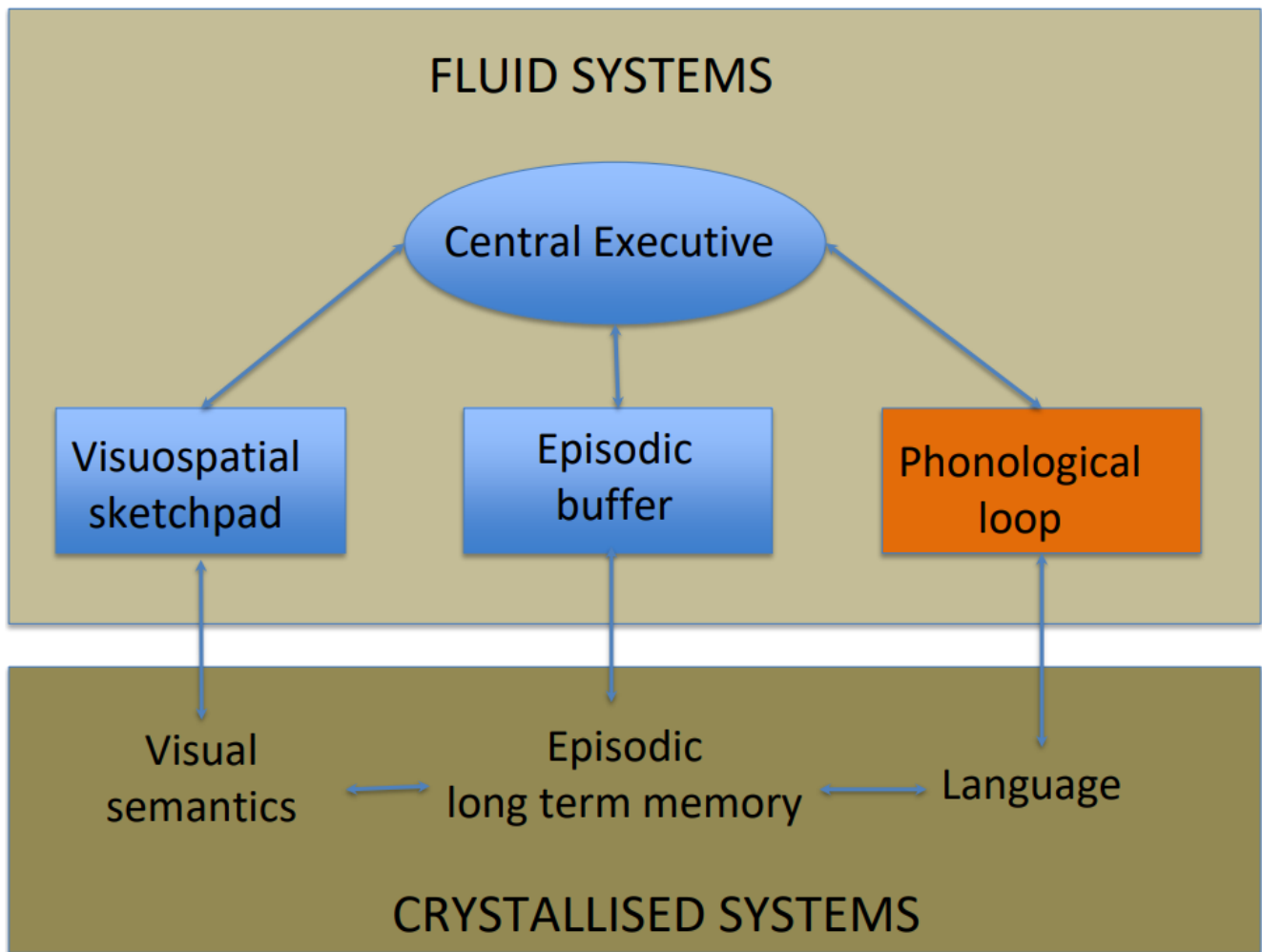
The visuospatial sketchpad

Is the component for holding visual and spatial (and kinesthetic) information for short periods of time, so that we can use it in thinking, remembering and processing tasks.
• Component of the memory system for supporting "visuospatial short-term memory"

Visuospatial sketchpad deal with three types of information

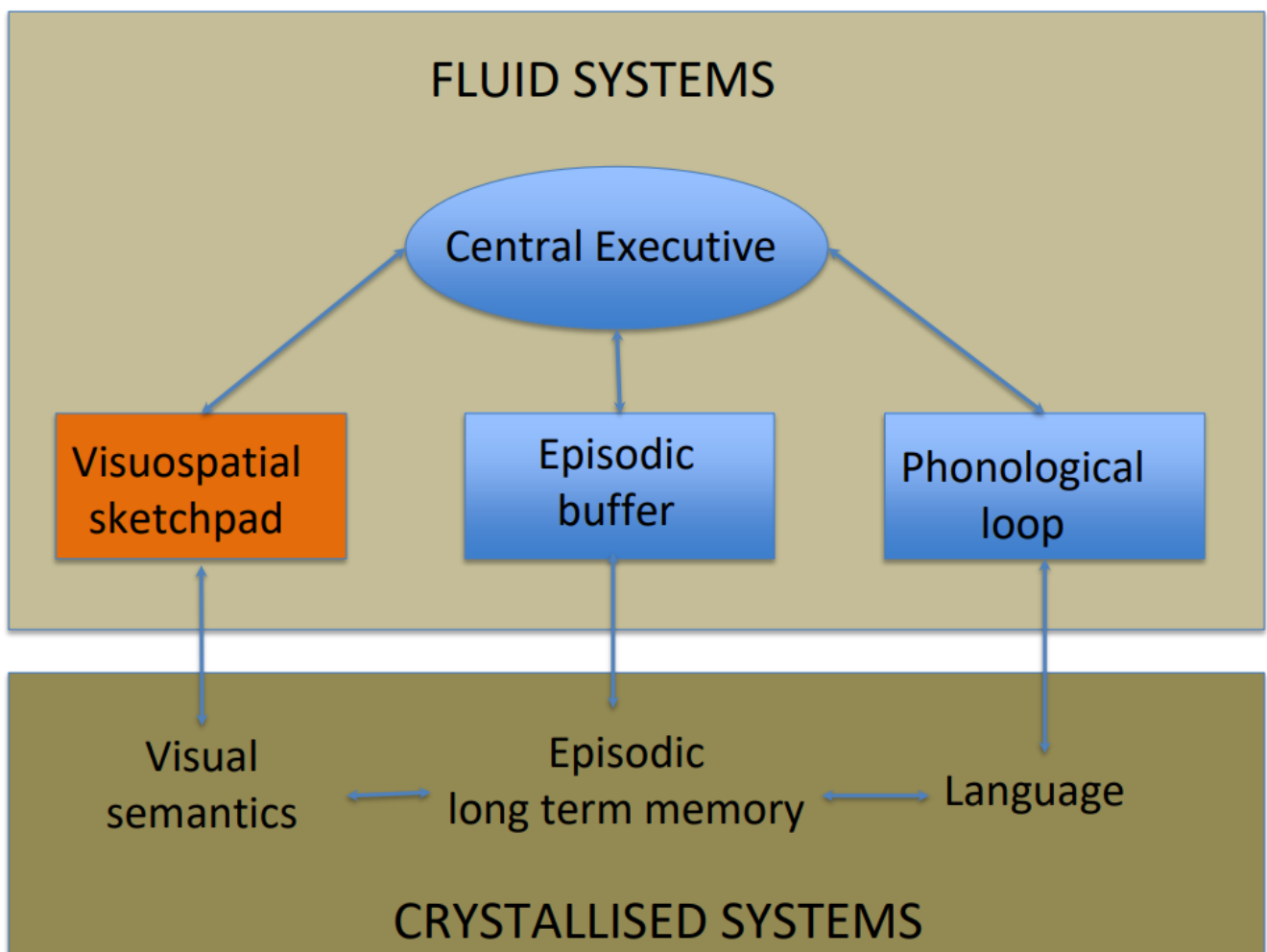# Visuospatial sketchpad deal with three types of information

VISUAL	SPATIAL	KINAESTHETIC
"WHAT?"	"WHERE?"	"HOW IT FEELS?"

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The central executive

• Is the overall attention control of working memory systems
• It has no capacity for storage – it is only responsible for the control and allocation of attention
• Central executive is "Focusing, dividing and switching attention"
• The link between various working memory components and long-term memory is through "episodic buffer".
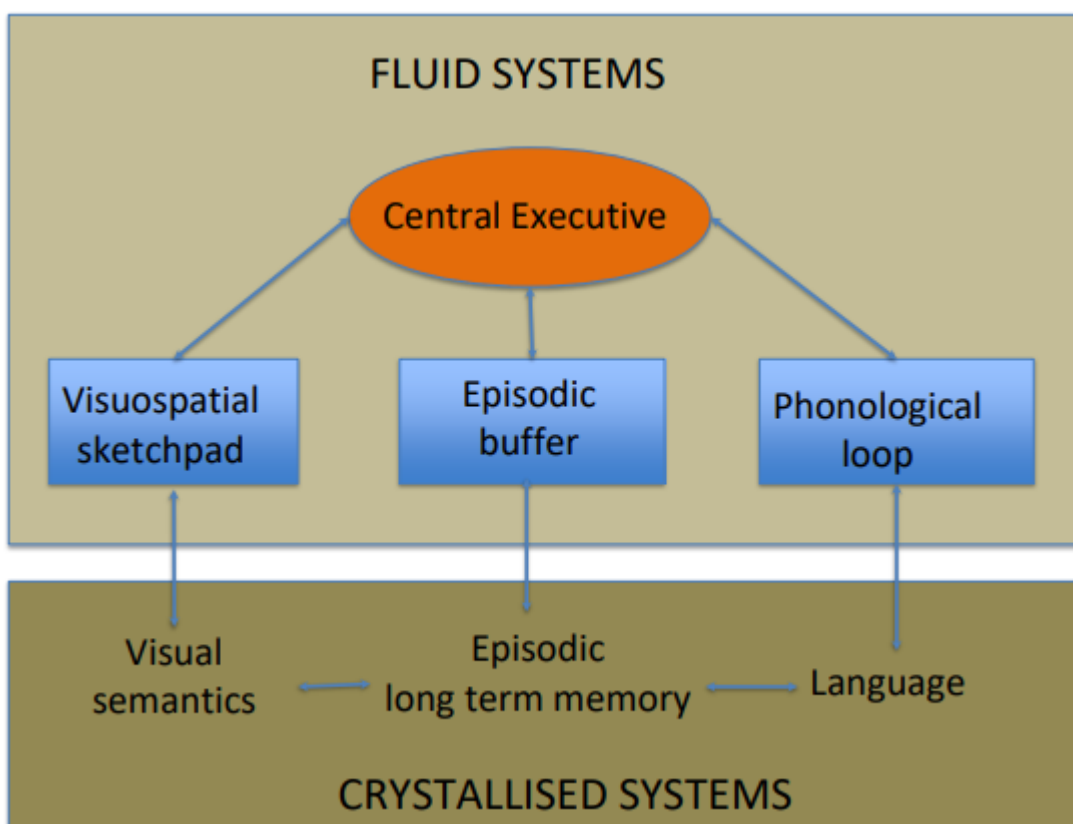
The episodic buffer

The most recent addition to the working memory model (Baddley, 2000)
• It is "multimodal temporary store" – not just store information from one modality (e.g. auditory, visual, kinaestethic) but information from many different modalities
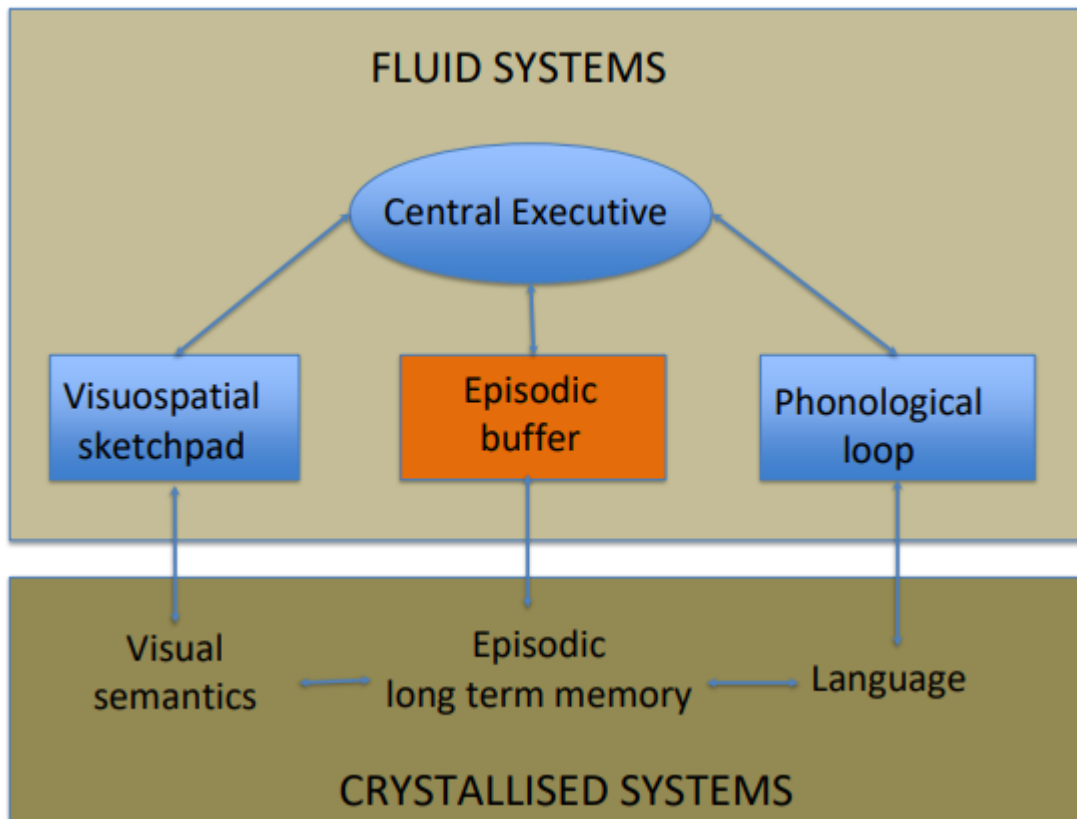• It "binds" together information from different sources within the working memory system.

• It joins multimodal information into a coherent memory episode
• The capacity of the episodic buffer is not clearly specified – the more the information can be bound together in a coherent fashion, the greater the capacity of the episodic buffer ("chunking").

"… a temporary storage system that is able to combine information from the loops, the sketchpad, long-term memory. Or indeed from perceptual input, into a coherent" episode" (Baddeley, 2007).

• Episodic buffer can act as a "backup store" to supplement the phonological loop or visuospatial sketchpad, as well as providing a link to long-term memory e.g. we can remember easier sentences and paragraphs than single words or we remember better the list of words than non-words.

Summary – Episodic buffer:
• (1) Allows long-term memory knowledge to be utilized in the working memory system.

• (2) Offers extra storage mechanism to back up other storage mechanisms.
• (3) blends together or "binds" information from different sources/modalities into a coherent memory experience.

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Development of the Working Memory

Already the infants are showing WM in their actions. At the age of 6 months the child can remember where the person is hiding about 2 seconds and this ability develops about 2 sec/month during the first year.

Baddley's model can be used to describe WN from the age 4-5 years onwards. There is individual variation e.g. in span tasks (e.g. about 4-9 in Corsi task).

• All components of the WM are developing equally about to 14-15 years of age The relationships between the components are quite stable.