

MusiCTM: How CTM composes music

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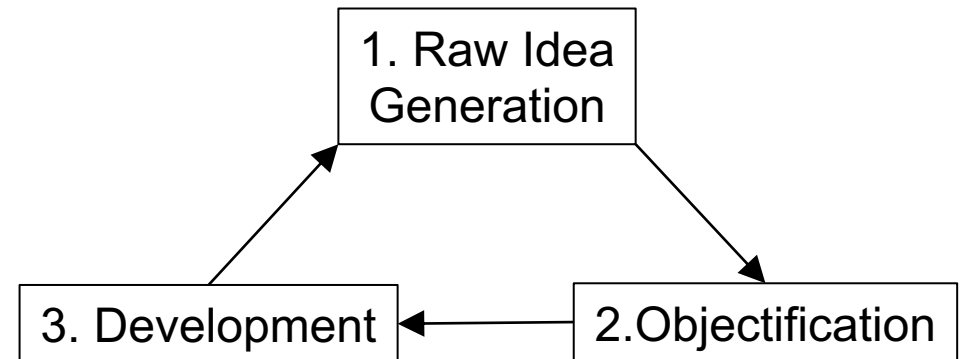
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Motivation

- Creativity is a powerful advantage for human beings, whereby something somehow **new** and somehow **valuable** is formed.
 - Scientific-technological inventions: vaccination, smartphone, ...
 - Humanistic creations: literary work, paintings, **musical composition**, ...
 - Theorem proving: new theorems, new theories, ...
 -
- Explain the role of consciousness (and unconsciousness) in the mechanism of creativity in the CTM model.

Three-phase formulation¹

1. Come up with a raw auditory idea, in the shape of captivating fragments;
2. Learn and express the idea in a concrete form, and places it in the memory;
3. Consider the development, i.e., what phrase should follow, then goto 1.



¹ C. M. Aranosian, *Imagination, Cognition and Personality* **1981**, 1, 67.

Phase 1 – Raw Idea Generating

- The raw idea comes from **unconsciousness**.
 - Associative thinking¹
 - Links between LTM
- Only in certain mind state can the idea be perceived.
 - Flow state²
 - The weight of the generator LTM dominates.

¹ M. M. Vaughan, *Music Educators Journal* **1973**, 59, 35.

² M. S. Davis, M. Csikszentmihalyi, *Contemporary Sociology* **1977**, 6, 197.

Associative thinking

- Come up with a raw idea when experiencing other events.
- Synesthesia: a perceptual phenomenon in which stimulation of one sense leads to another sense.
 - Cross-activation¹
 - Disinhibited feedback²
- Dedicated regions of brain → LTMs
- Interactions between regions → Links between LTMs

Both involve interactions among
the dedicated region of the brain

SYNESTHESIA

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¹ V. Ramachandran, E. Hubbard, *Journal of Consciousness Studies* **2001**, 8, 3.

² P. G. Grossenbacher, C. T. Lovelace, *Trends in Cognitive Sciences* **2001**, 5, 36.

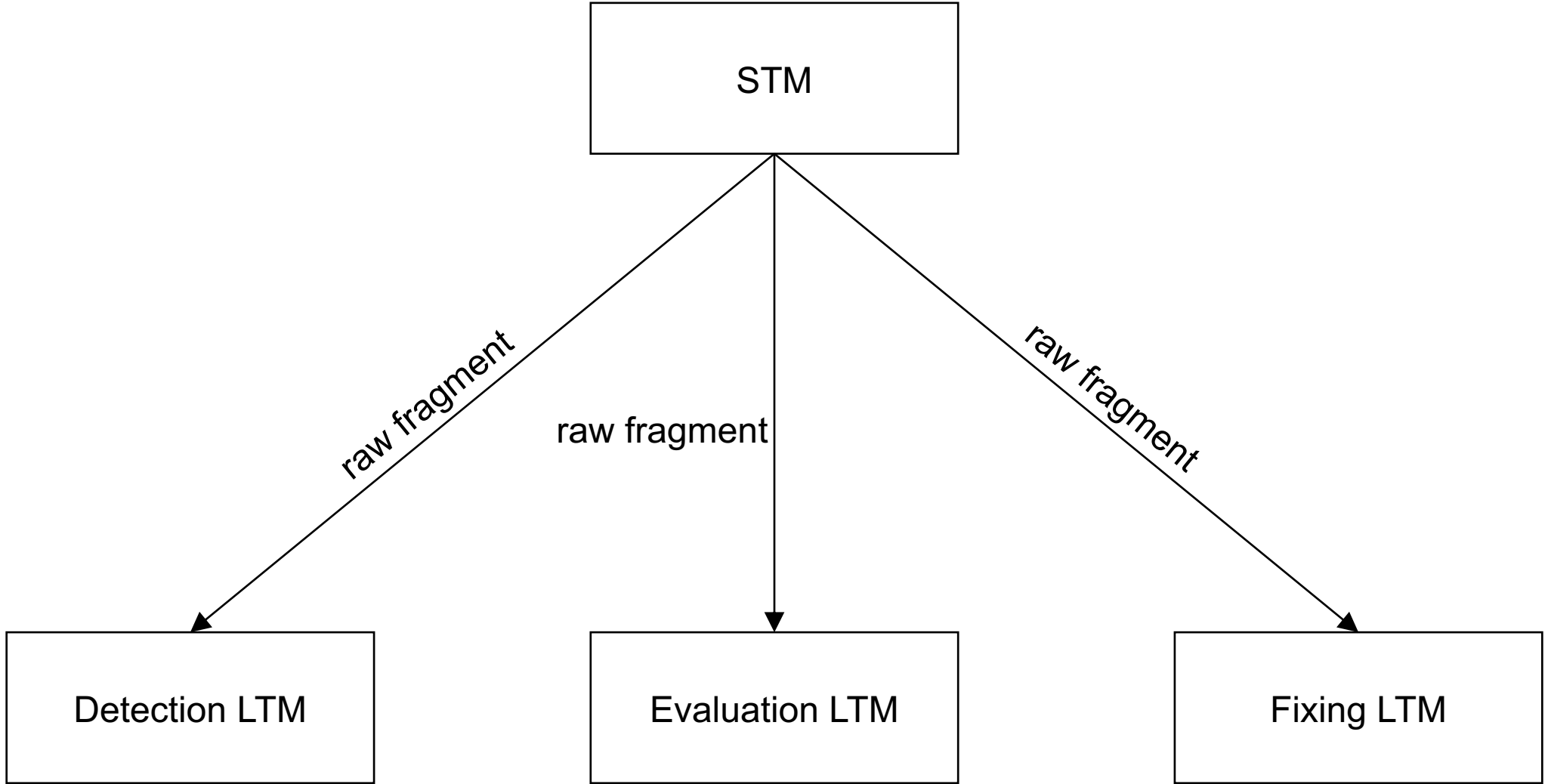
Flow state

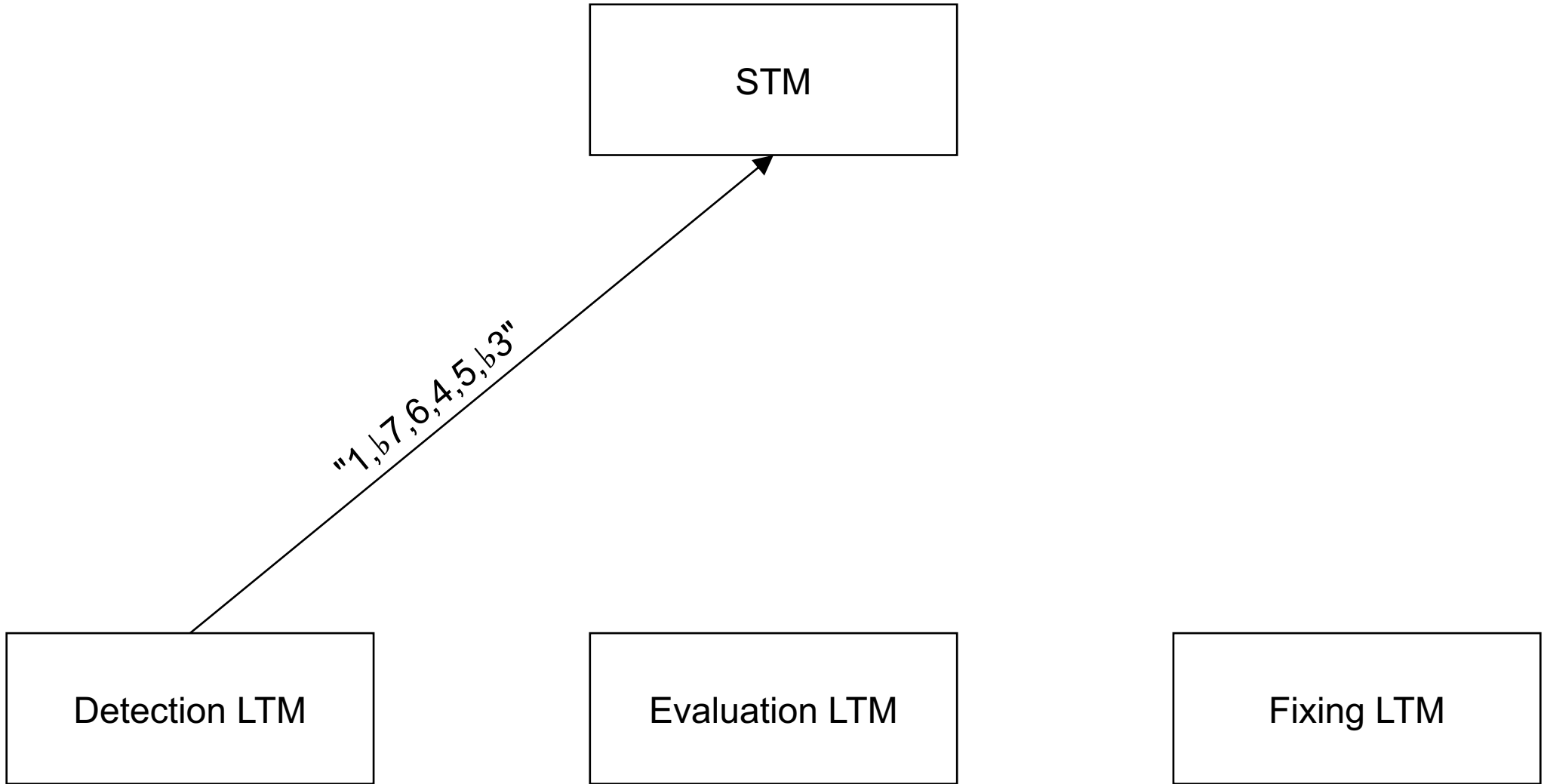
- The weight of the “raw idea” may be too small to reach STM.
- Flow state: energized focus, full involvement, enjoyment.
 - Proved to promote musical creativity¹.
- Flow state of CTM:
 - Specific LTMs communicate repeatedly with the STM and their weights **dominate**.
 - The weights of LTMs with conflicting or opposite functions are diminished.

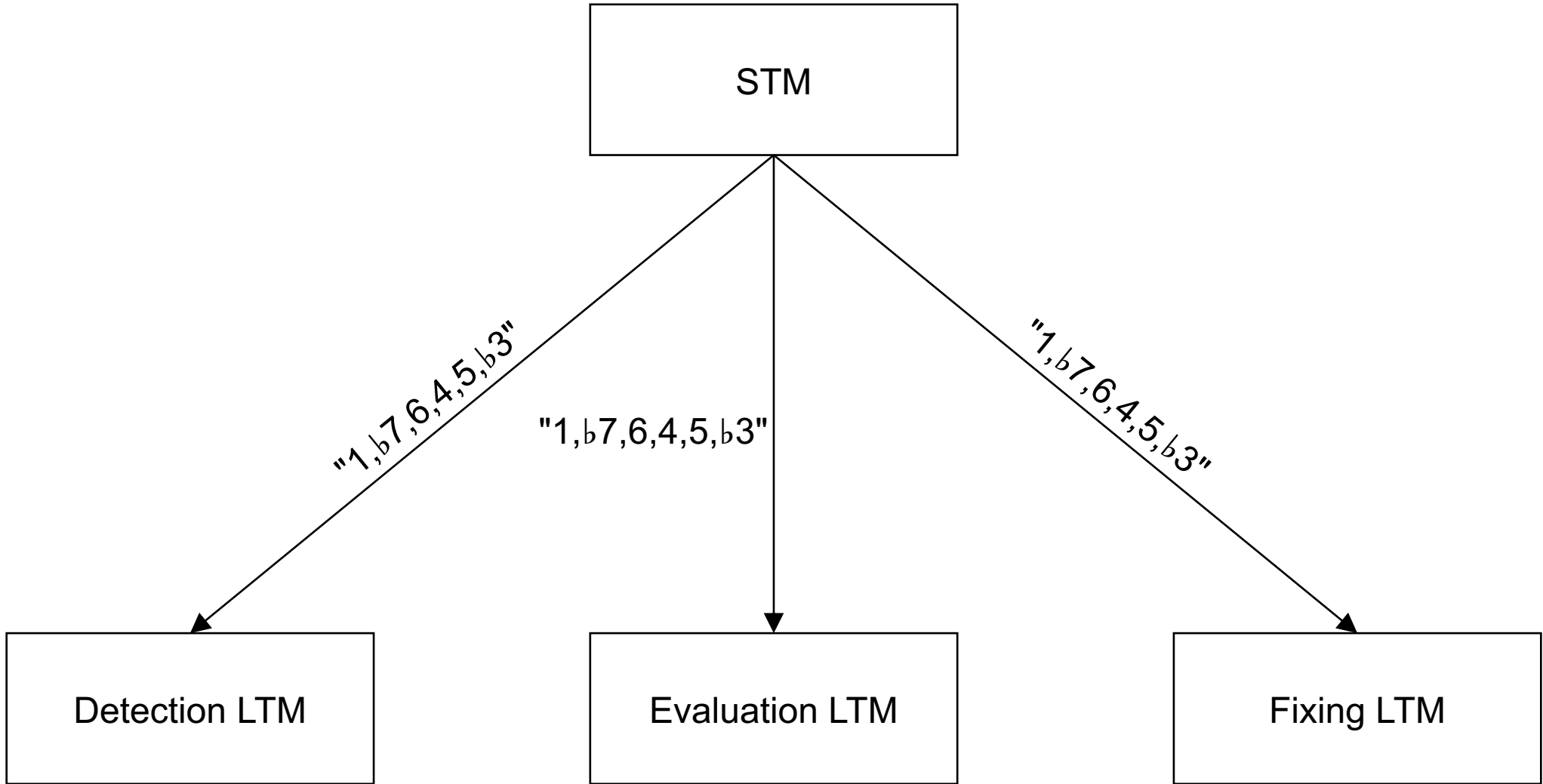
¹ R. MacDonald, C. Byrne, L. Carlton, *Psychology of Music* **2006**, 34, 292.

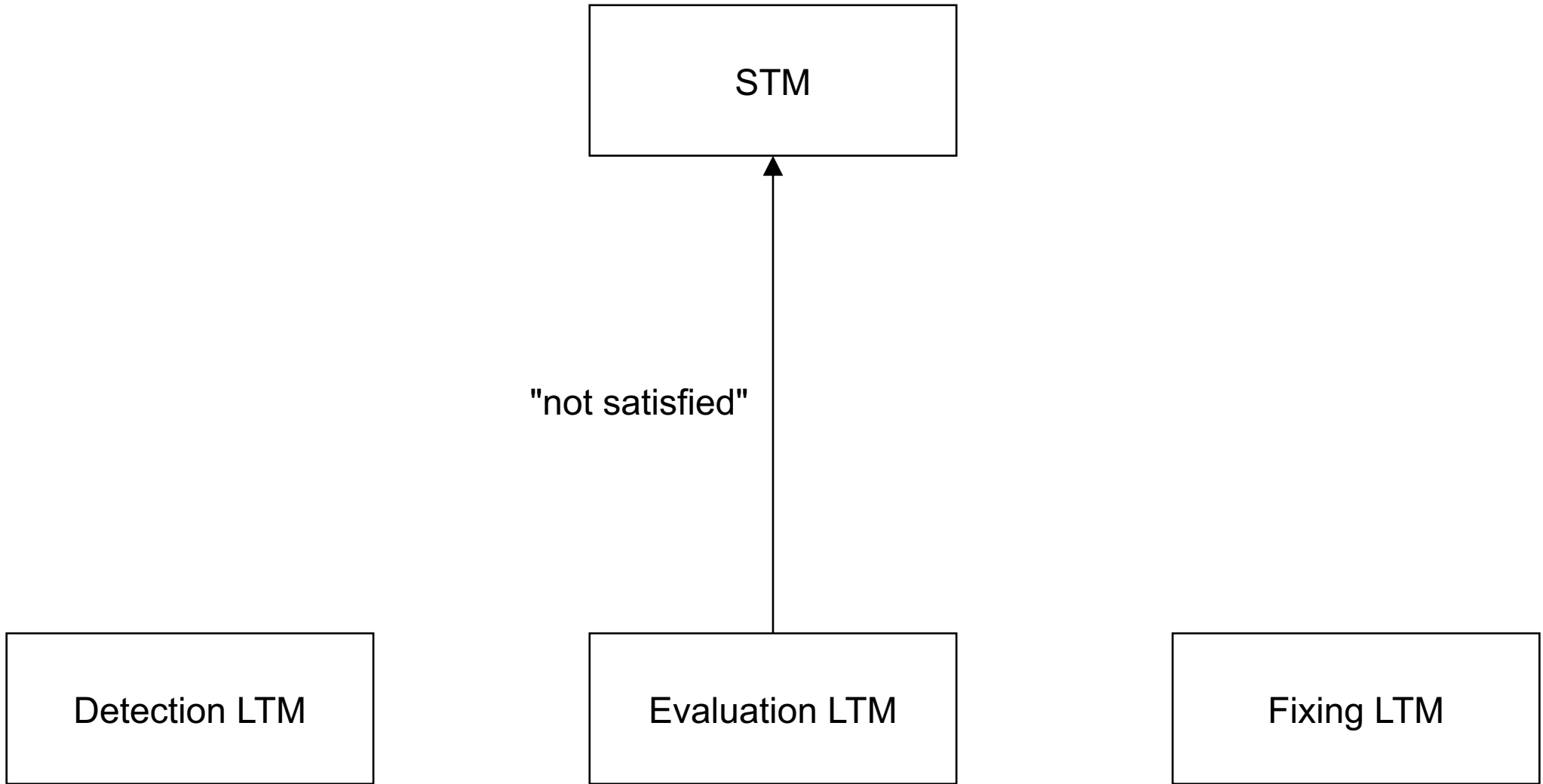
Phase 2 – Objectification

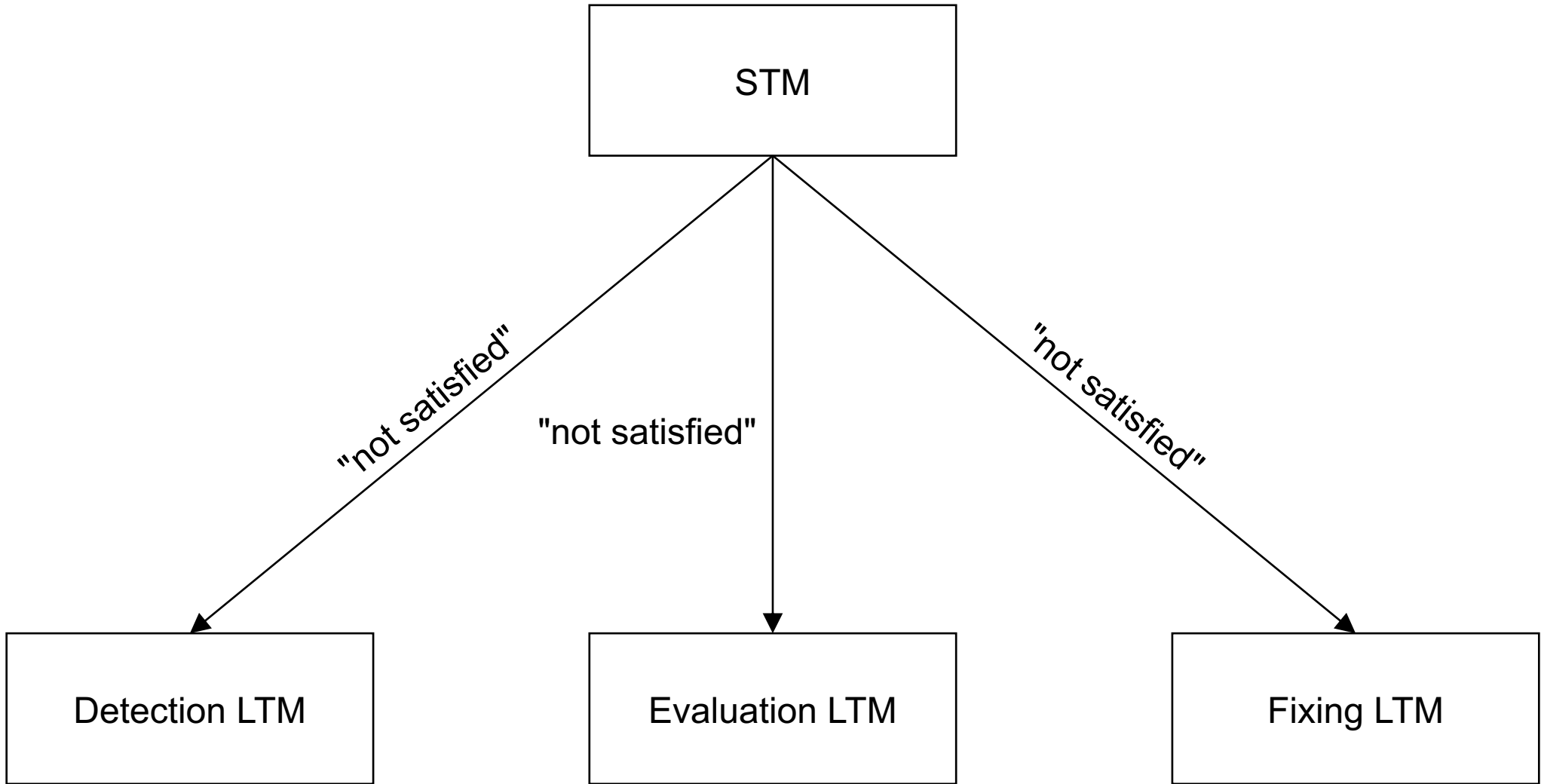
- Detection LTM, evaluation LTM, fixing LTM.
- STM broadcasts the fragment, then detection LTM generates a list of notes (delivered to STM);
- Loop:
 - STM broadcasts the list;
 - Evaluation LTM decides whether “satisfied” (delivered to STM);
 - Fixing LTM puts the list on its memory;
 - STM broadcasts evaluation LTM’s message;
 - If “satisfied” then return “success”;
 - If $T > 5$ (or something) then return “failed”;
 - Fixing LTM generates a fixed list (delivered to STM);
 - $T = T + 1$.

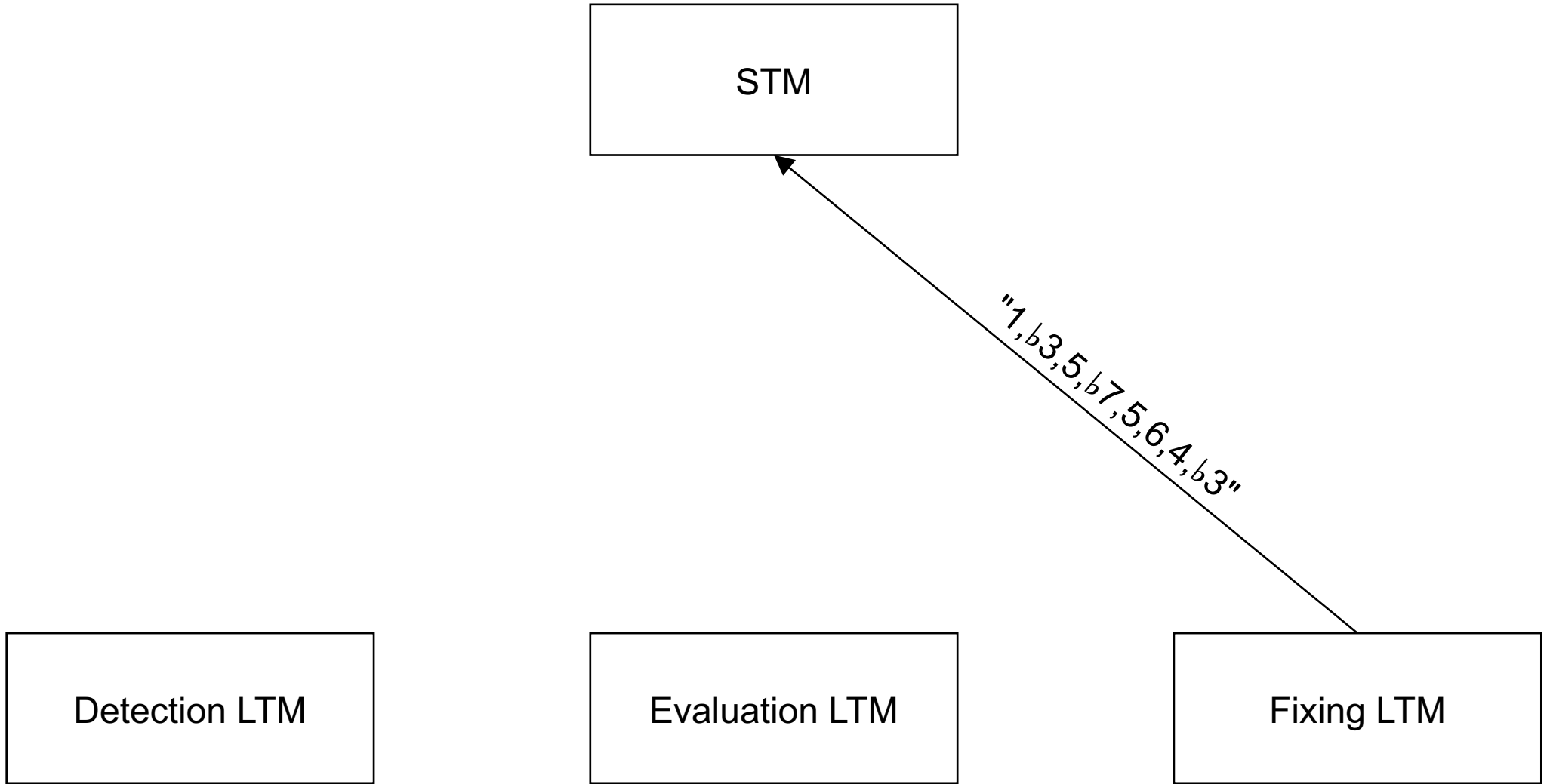


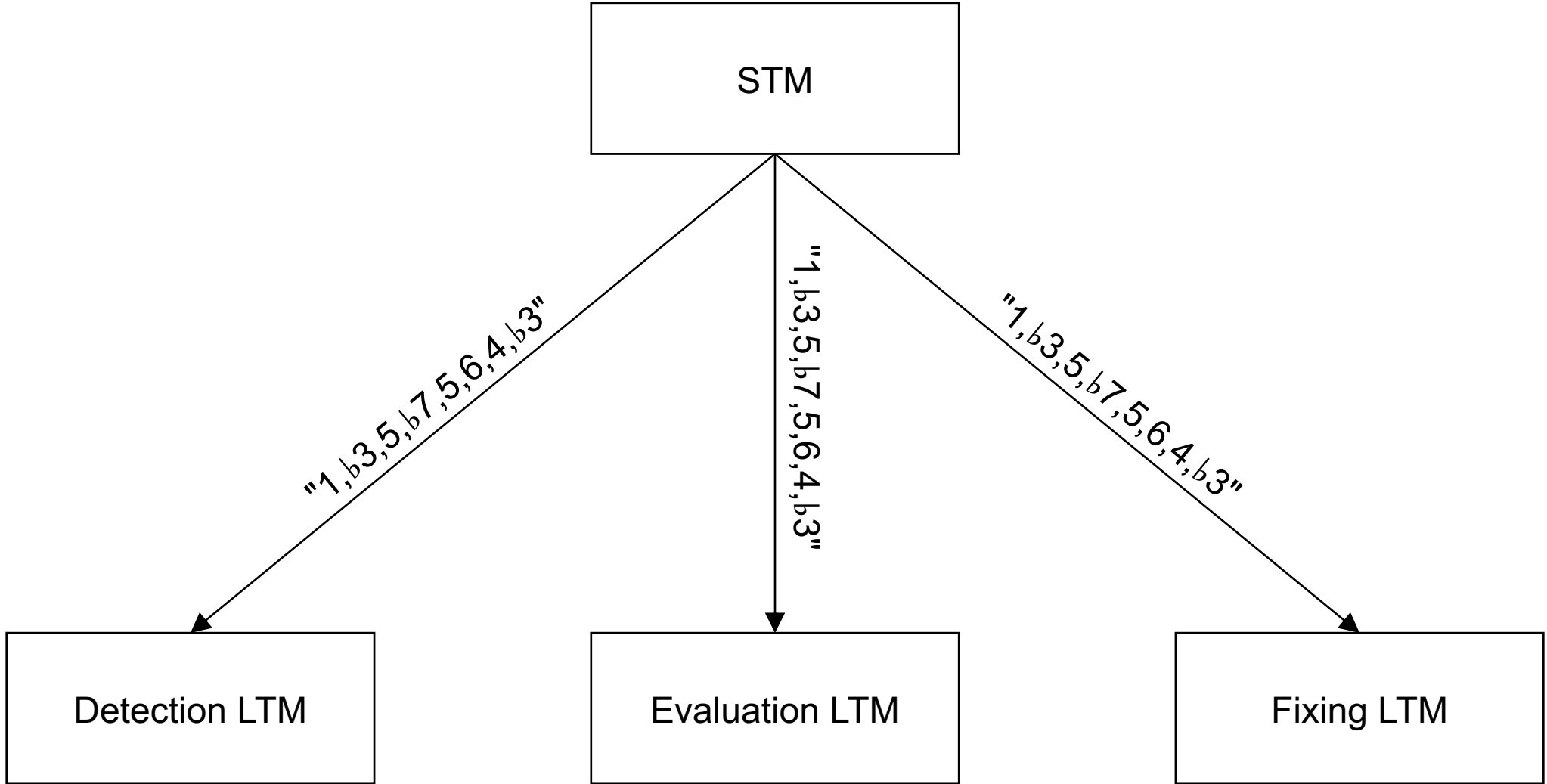


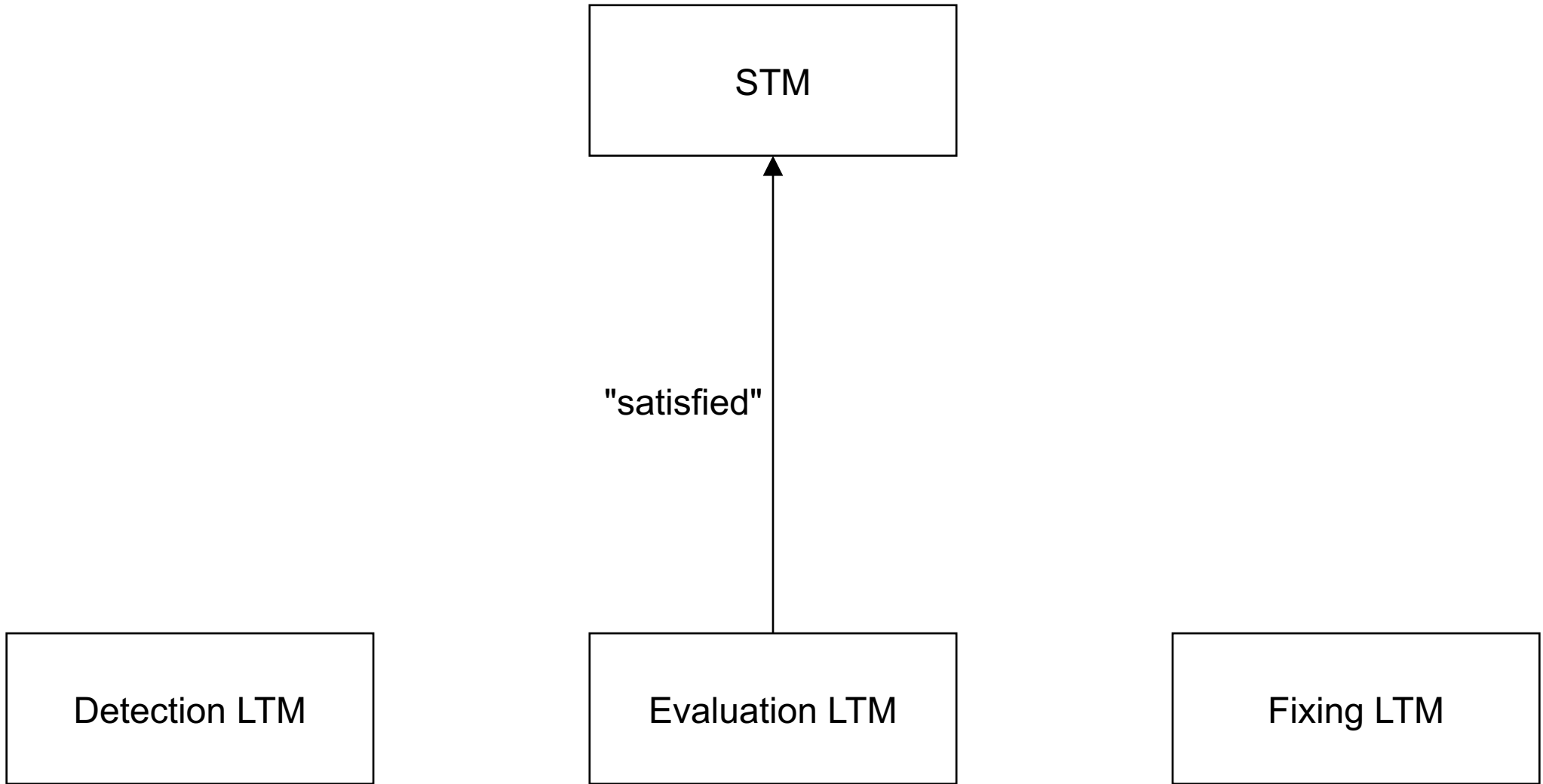












Phase 3 – Development

- The STM broadcasts the note sequence;
- LTMs with different development techniques react:
 - each produces a chunk containing the development (gist) and its likelihood (weight);
- The winner of the Up-Tree competition gets into the STM.

Discussion: composing vs. improvising

- Composing:
 - Decide to **retain** permanently what created, may reuse, refine, and combine them into larger compositions.
- Improvising:
 - Develop **immediately** and have to anticipate the development.
 - Have no attention (STM) to retain what created.
 - Phase 2 is de-emphasized and even skipped.

Discussion: human vs. machine

- Associative thinking with complex *unconscious* links.
- *Conscious* evaluation.

Thanks!