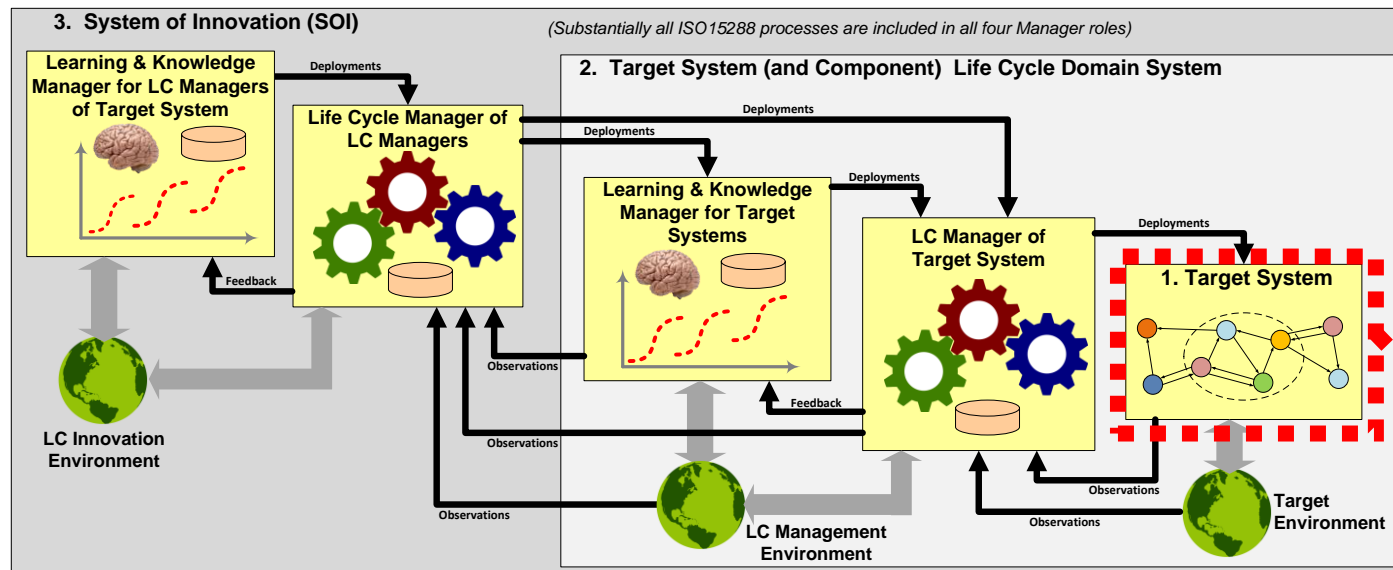


Using a Musical Story to Illustrate Three System Foundation Elements In an Integrated Framework



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Purpose and Background

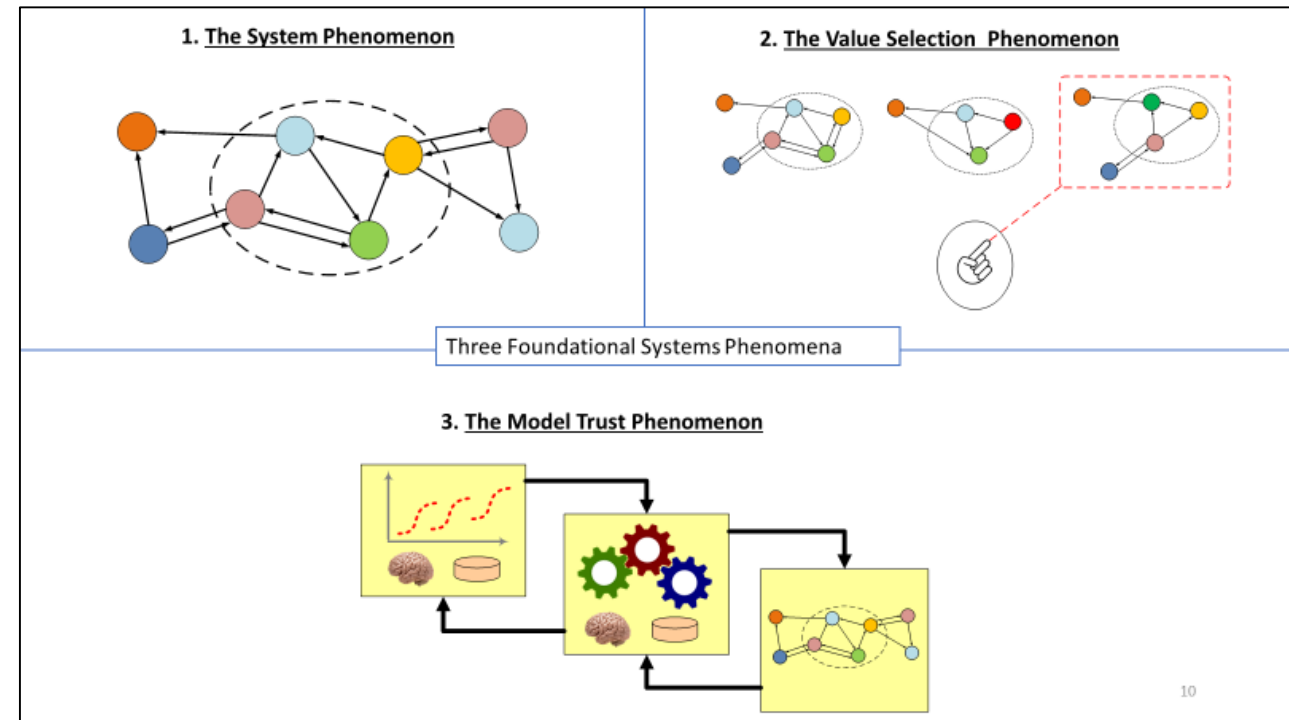
- Following the 01.27.2020 INCOSE Fellows meeting, Jack Ring asked Bill Schindel the question below, about early draft material¹ that Bill showed Jack from that meeting, in support of the *INCOSE Vision 2035* publication's "Theoretical Foundations" section update:
 - Jack's question: *“. . . presume you are sitting in the front row of a concert by the NY Philharmonic conducted by Leonard Bernstein. What are you seeing, hearing, feeling, and how did those occur?”*
 - Subsequent clarification by Jack: *“I am interested in the S, S1, S2, etc. map you would populate.”*
- This question offered the opportunity to illustrate the related concepts in a novel context helping to communicate and test the related ideas.

(1) See item (1) in References section.

Purpose of the Three Phenomena and the integrating ASELCM Pattern framework

Three systems foundations phenomena are being described in the conceptual source material¹ for the *INCOSE Vision 2035* update to its Theoretical Foundations section:

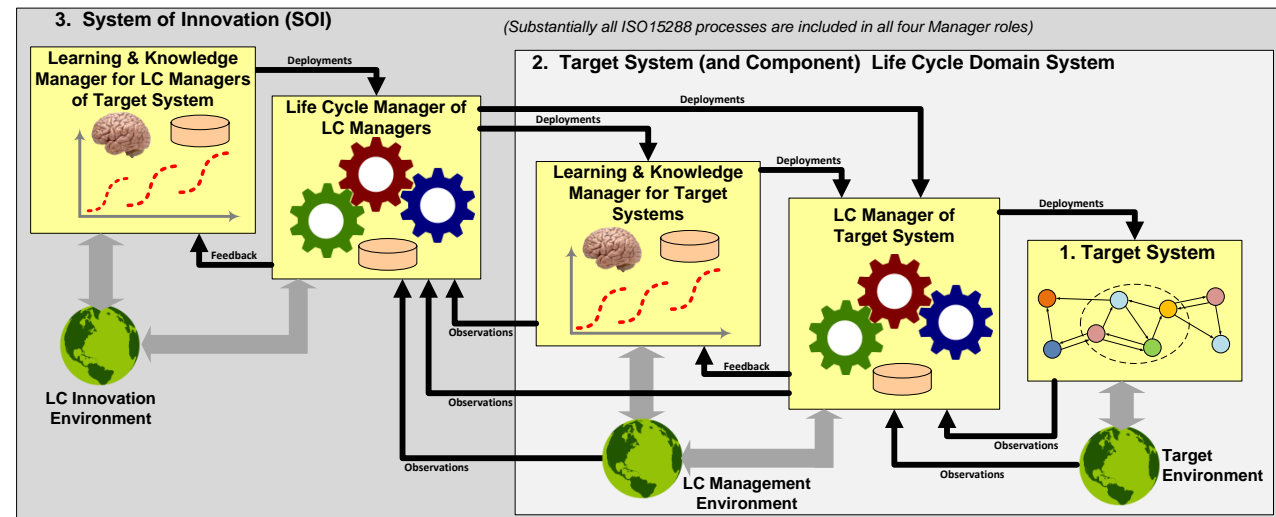
- A. The Systems Phenomenon
- B. The Value Selection Phenomenon
- C. The Model Trust Phenomenon



(1) See item (1) in References section.

Purpose of the Three Phenomena and the integrating ASELCM Pattern framework

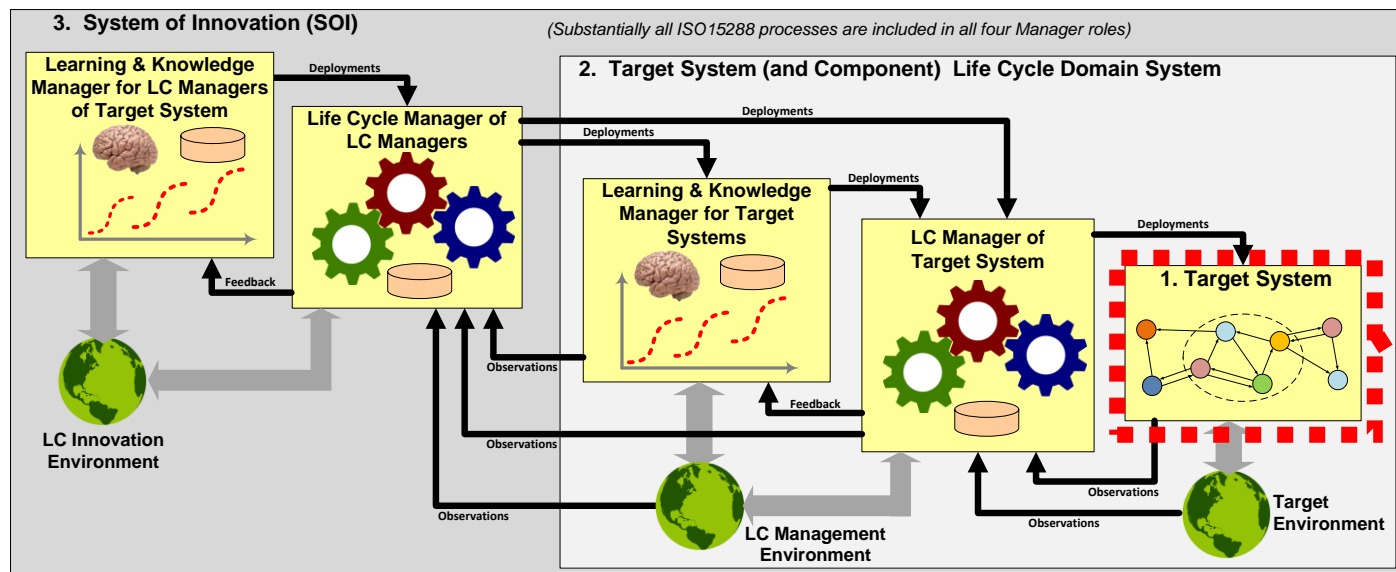
- Those three phenomena in turn support an integrated framework, the INCOSE ASELCM Pattern¹.
- The purpose of the ASELCM Pattern is to emphasize learning by the life cycle (LC) management systems (human and otherwise) and ongoing use of both learned and new information by those LC management systems.
- These views do not contradict (in fact, they integrate) the paradigm of ISO15288 life cycle management processes—ASELCM is just a different view emphasizing learning and use of learned versus new information.



(1) See item (1) in References section.

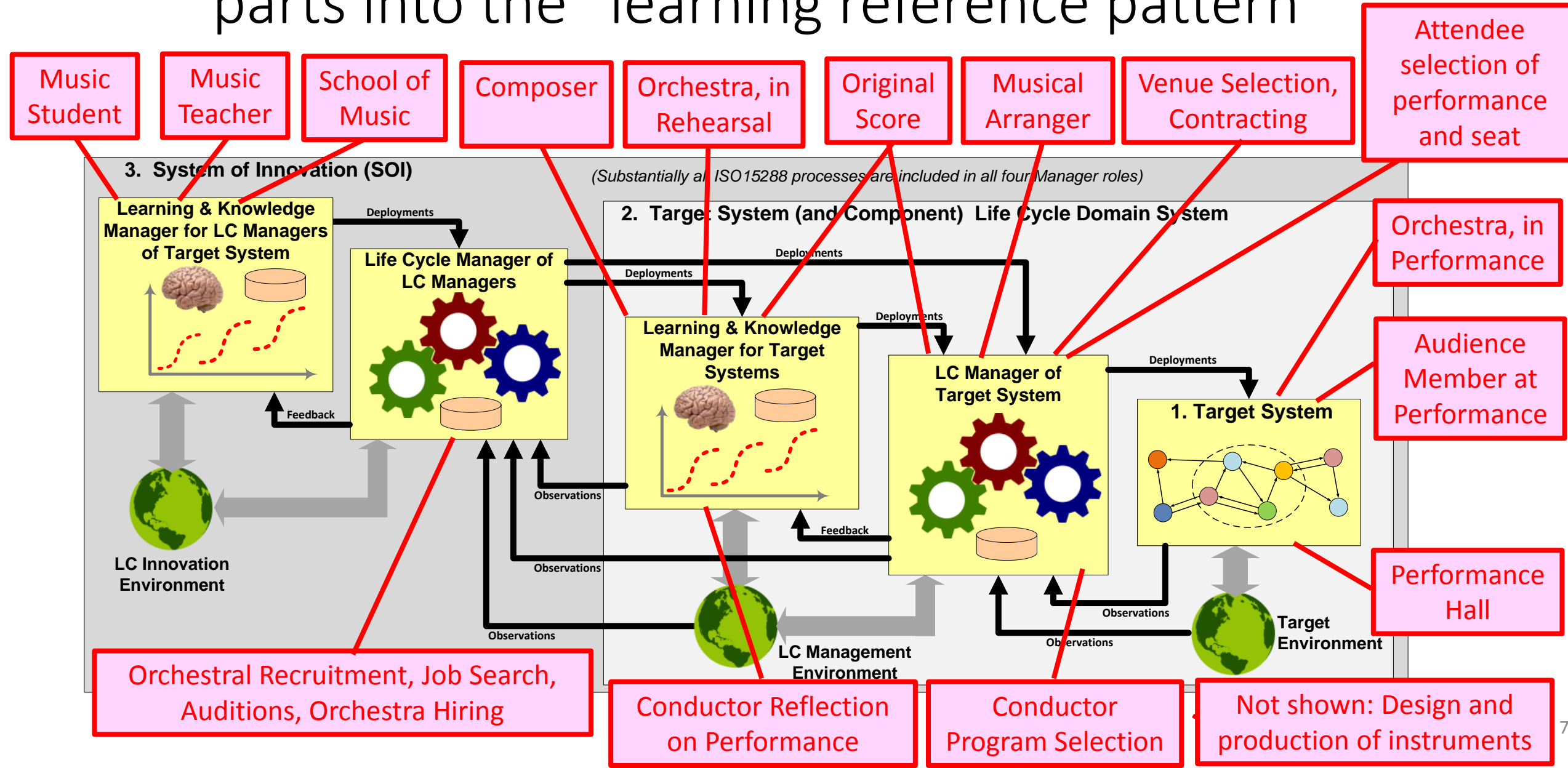
Illustrative allocations of the musical story into the integrating ASELCM Pattern, using the three foundational phenomena

- For purposes of this illustration, and based on the questions posed, we will assume that the symphony orchestra in a performance is part of System 1—the Target System which is being “managed”
- We will also assume that the performance audience is a part of System 1, and that the concert hall is part of System 1.
- The aesthetic experiences of the audience during the performance are of particular interest as outcomes.

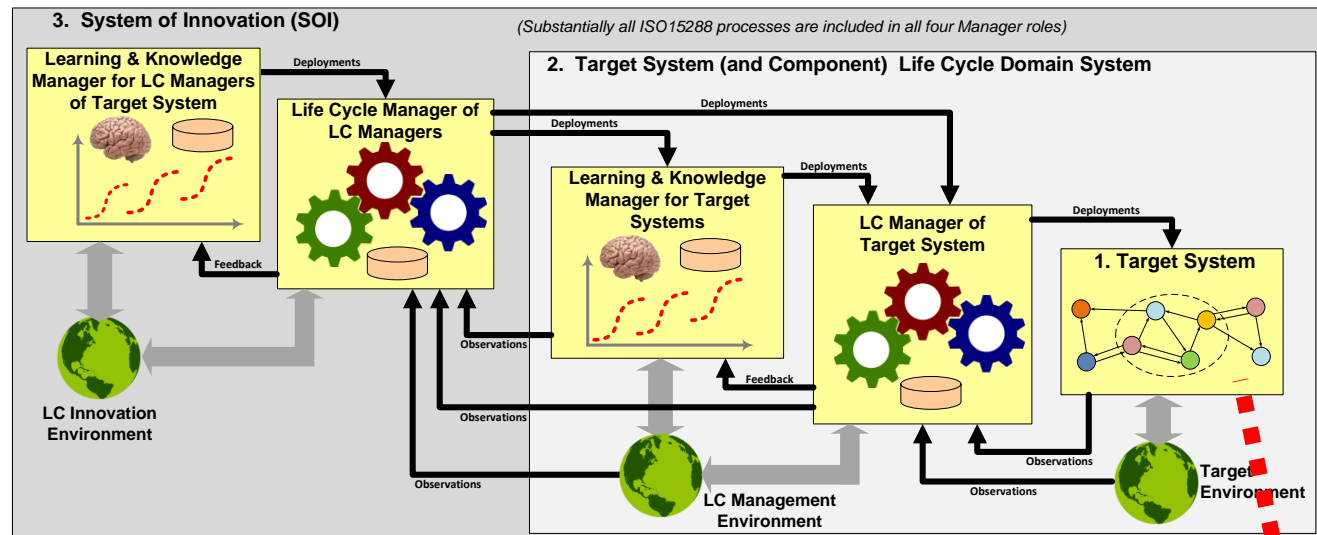


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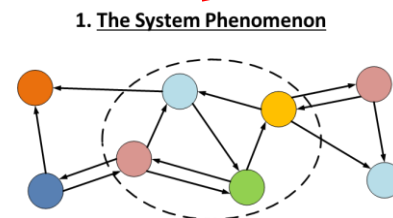
Illustrative allocations of the musical story parts into the “learning reference pattern”



- The System Phenomenon¹ is the observable phenomenon through which emergent properties of a system occur as a consequence of interactions of its components or subsystems.
- The System Phenomenon can appear in ASELCM System 1 (the Target System) during its interactions as part of the life cycle of that system in its environment(s).

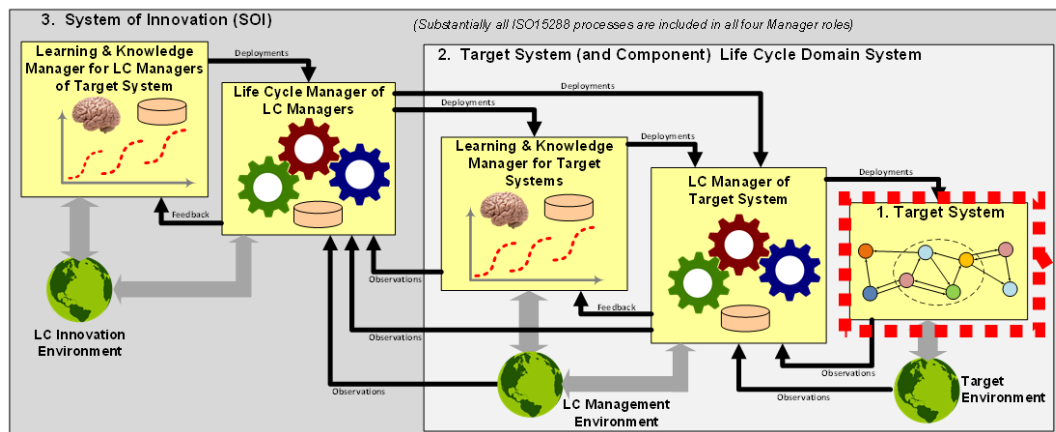


- What aspects of System 1 does The System Phenomenon describe?



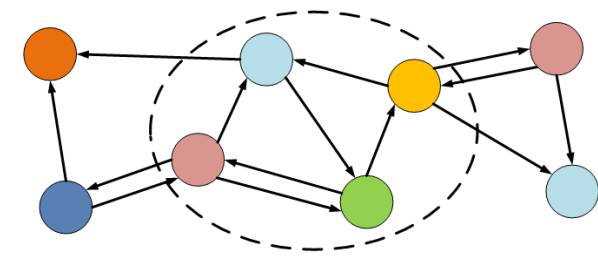
A. If I am an Audience Member at Performance, then by virtue of (at least) visual and audible external (to me) interaction of my sensory subsystems and the Performing Orchestra system, as well as my internal cognitive interactions, . . .

- I experience seeing a handsome scene of well-dressed musicians and recognized famous conductor, polished instruments, in a surrounding visual stage setting that is attractive, all recognized and interpreted by me against earlier learned or genetically inherited patterns of norms for those visuals, as well as noting exceptions from those patterns.
- I experience hearing a combined musical performance by multiple instruments/players, which are recognized and interpreted by me in individual as well as combined and inter-related audible components that are recognized and interpreted by me against earlier learned or genetically inherited patterns of norms for those musical elements (West Side Story? Rhapsody in Blue? Rite of Spring?), as well as noting exceptions from those patterns.
- Up to this point, quite a lot of the above would also be true if you replaced me in my seat with a non-human listening critter, maybe a songbird.



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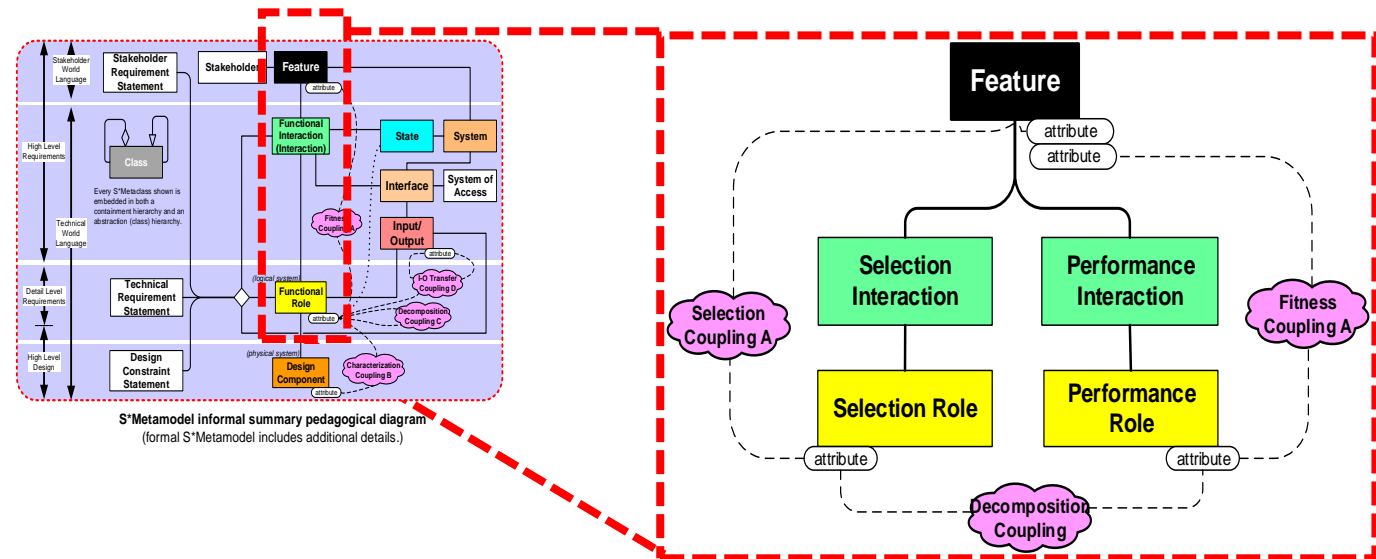
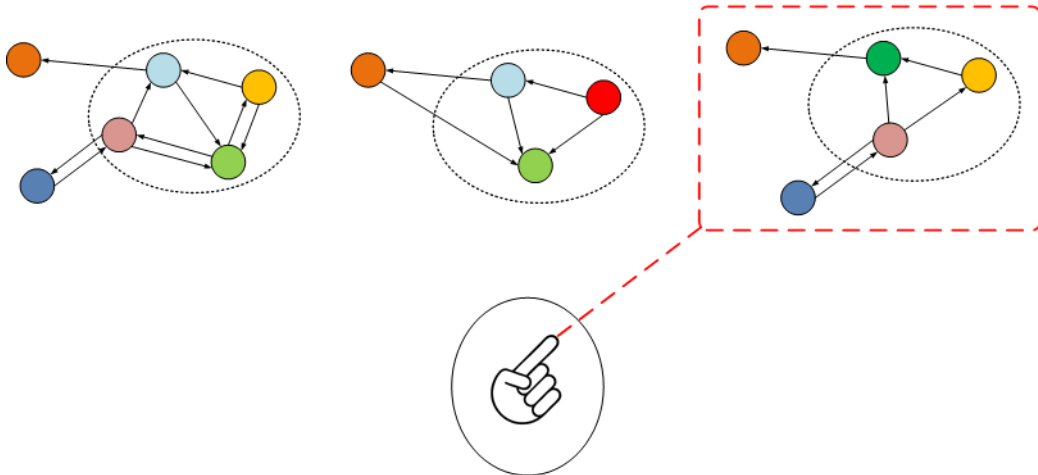
1. The System Phenomenon



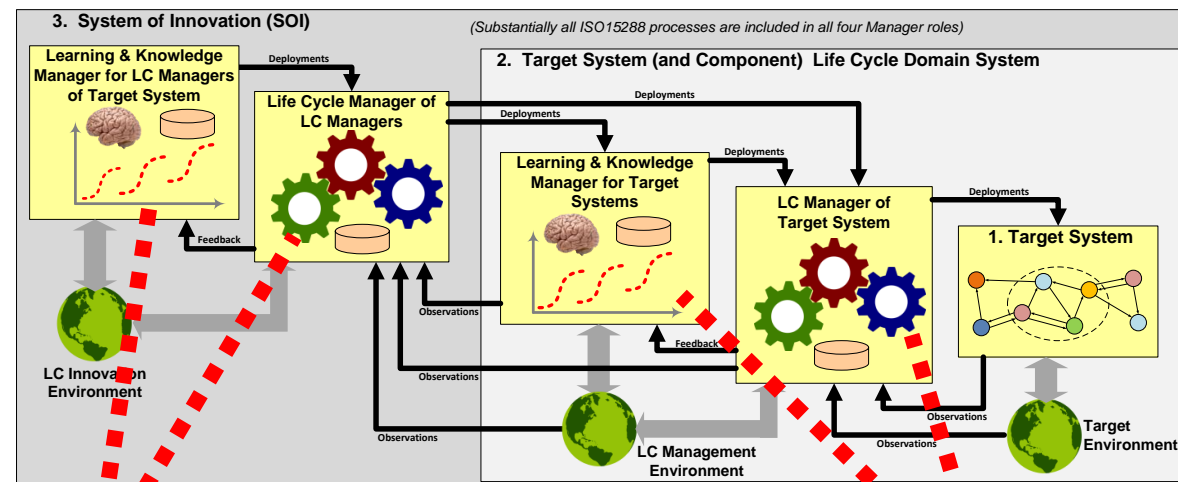
B. But, as a human with a lot of other earlier experiences that laid down additional higher level mental patterns about life experiences of my own, as well as other stories, and by virtue of interactions internal to my cognitive systems, . . .

- I also activate internally, because of the basic patterns encountered in (A), those higher level learned patterns which are in some way associated with the lower level ones recognized in (A), wherein the music now reminds me of higher level abstractions or more complex past experiences, including challenges, growing up, tragedies and triumphs, good and bad weather, beautiful and frightening things, and other patterns built from my own as well as culturally absorbed experiences, and . . .
- As those high level patterns are activated, some of the internal signals activated include more globally distributed chemical signals that are experienced as pleasure, surprise, sadness, joy, dislike, love, hate, or disappointment that I overpaid for the ticket.
- Earlier occurrences of these caused me to Select this Performance when I bought the ticket.

2. The Value Selection Phenomenon

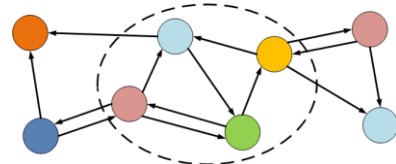


- Other instances of The System Phenomenon also appear in ASELCM System 2--the system that includes the “engineering” of System 1, as well as all other aspects of life cycle management of System 1.
- Other instances of The System Phenomenon also appear in ASELCM System 3--the system that includes the “engineering” of System 2, as well as all other aspects of life cycle management of System 2.



1. The System Phenomenon

Emergent aspects of System 3



1. The System Phenomenon

Emergent aspects of System 2



Two special cases of the System Phenomenon are:

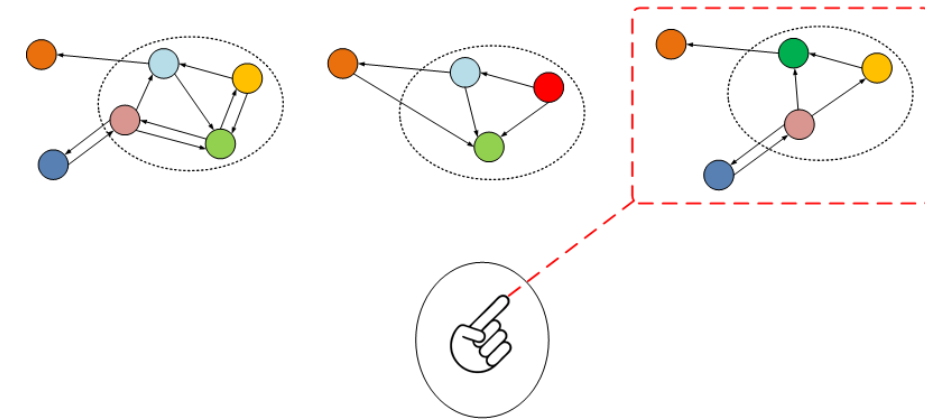
- The Value Selection Phenomenon: Value becomes explicitly observable through instance occurrences of Selection, whether in System 1, 2, or 3). Music Story Examples:

- Audience Member selects performance and buys ticket (S2)
- Conductor selects composition for performance (S2)
- Orchestra selects and hires candidate musician (S3)

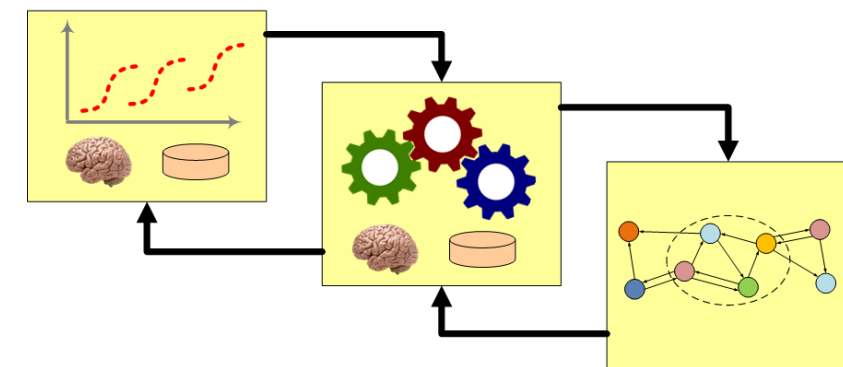
- The Model Trust Phenomenon: Common group trust in a learned model becomes explicitly observable as behavior of groups acting on such a model (whether in System 1, 2, or 3). Music Story Examples:

- Orchestra plays Score (model) together in performance (S1)

2. The Value Selection Phenomenon

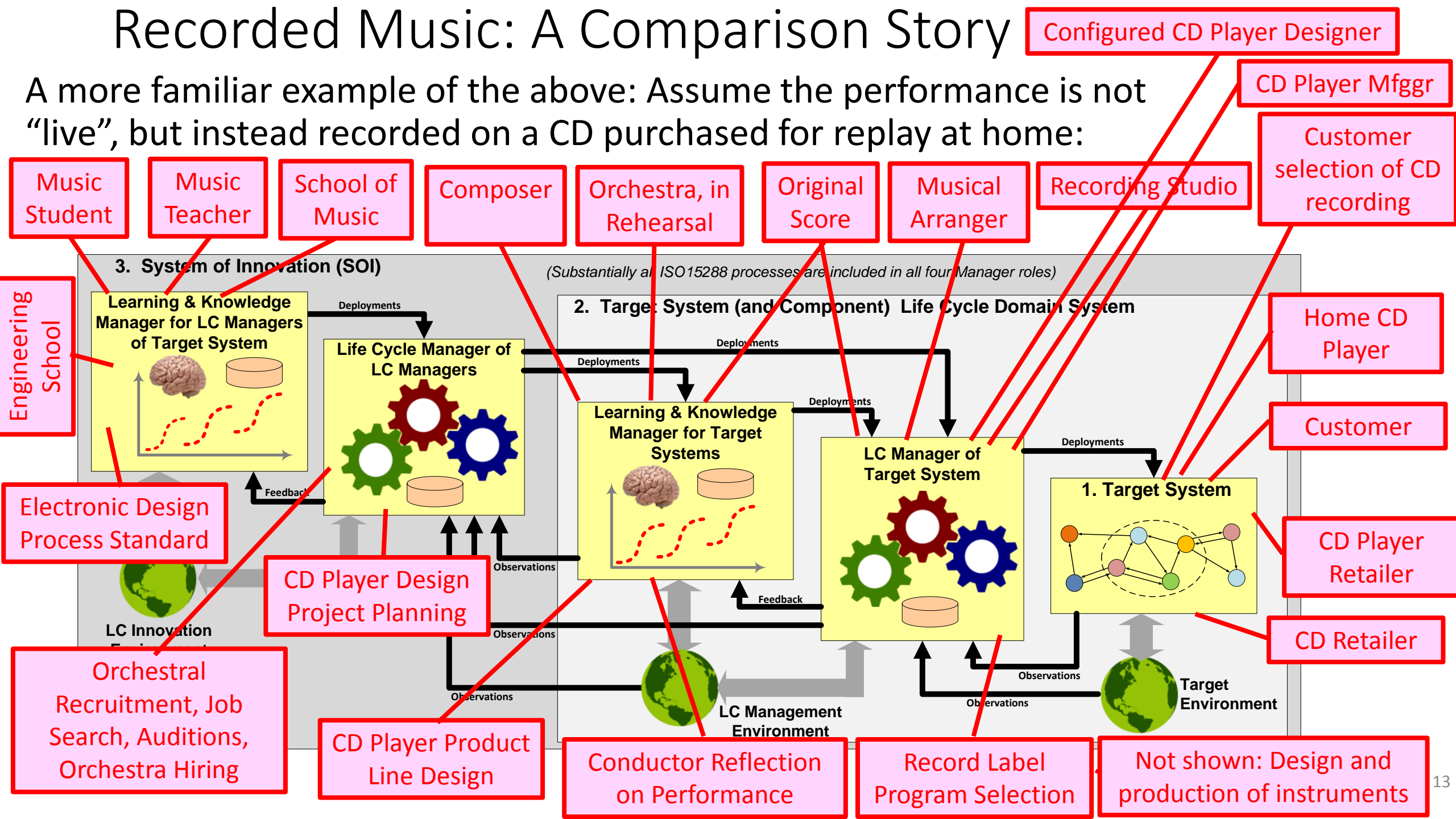


3. The Model Trust Phenomenon



Recorded Music: A Comparison Story

A more familiar example of the above: Assume the performance is not "live", but instead recorded on a CD purchased for replay at home:



The “How” and “Why” Parts

- Since the original question included “how did those occur?”, we supplement slides 9 and 10 with these comments on how instances of the three Phenomena represent several types of causality.²
- Borrowing (with liberties) from Aristotle’s “four causes”³ :
 - The (shared) Model Trust Phenomenon represents interactions of musicians with their musical score (model) and conductor; this is akin to Formal (model) Cause and includes degree of alignment across the orchestra.
 - The System Phenomenon represents the interaction of musicians with their instruments, akin to Efficient Cause.
 - The System Phenomenon also represents interaction of the musical instruments with the audience, through production, transmission, hearing, and interpretation of musical sound, including listener-internal interactions described earlier (slides 9 and 10); this is akin to Material Cause.
 - The Value Selection Phenomenon represents perceived value/fitness for purpose, using S*Features associated with the above S*Performance Interactions, with value expressed through observable selection by the composer and musical audience, akin to Final Cause.

(2) See item (2) in References section.

(3) See item (3) in References section.

Additional Interest in the Musical Story: Autonomous Learning System

- The musical aesthetic and emotional (feelings) aspects of the original question made for interesting interpretation challenge dimensions.
- But, there is also another reason to be interested in the original question:
 - In the live performance case, the musicians (and conductor) are not “automatons” (like, say, the CD player is);
 - Those humans are themselves closed loop learning subsystems, and every time they play a performance of the same musical it will be somewhat different (hopefully better, but certainly different);
 - This seems a great deal like the problem of “AI” or other learning autonomous systems that currently is the subject of engineering community concerns about what the systems engineering cycle means for this type of system.
 - So, “polishing” the above Musical Performance Story further may be worthwhile, to better understand the autonomous systems challenges and solutions, by comparison.

References

1. “SE Foundation Elements: Discussion Inputs to *INCOSE Vision 2035* Theoretical Foundations Section”, Jan, 2020, retrieve from:
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https://www.omgwiki.org/MBSE/lib/exe/fetch.php?media=mbse:patterns:systems_of_innovation--the_emergence_of_purpose_v1.3.6.pdf
3. Russell, B., *A History of Western Philosophy*, New York: Simon & Schuster, 1945.