29th Annual **INCOSE**
international symposium

Orlando, FL, USA
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IDI
Innovative Decisions, Inc.

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Innovation in the Spirit of Design Thinking

Innovation

Innovation is about creating new value, not about creating new things

IDI's **ID-ate** Innovation Process

Innovation can address all aspects of an organization's value creation process: *products, processes, services, technologies, distribution channels, and business models*
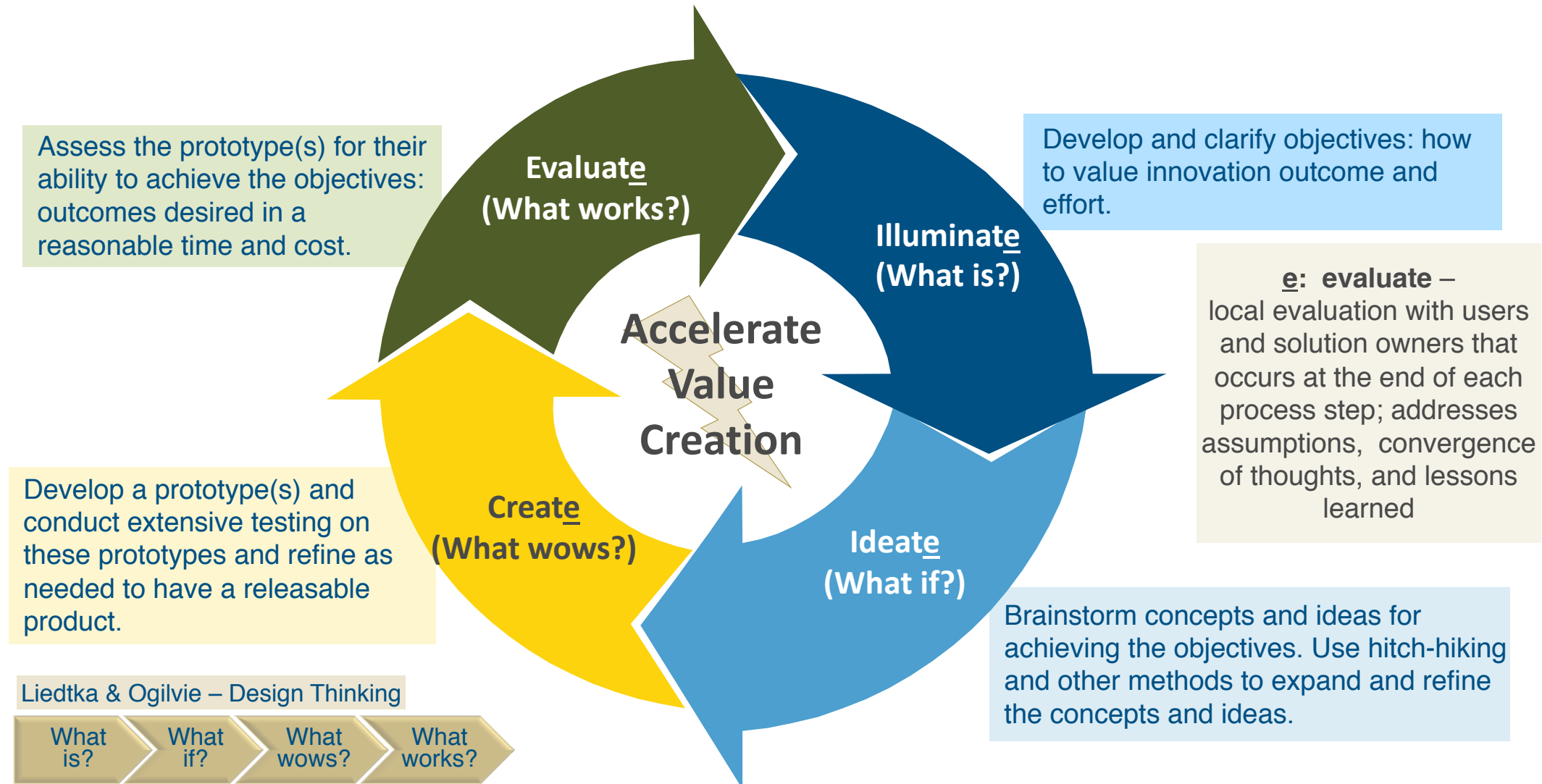
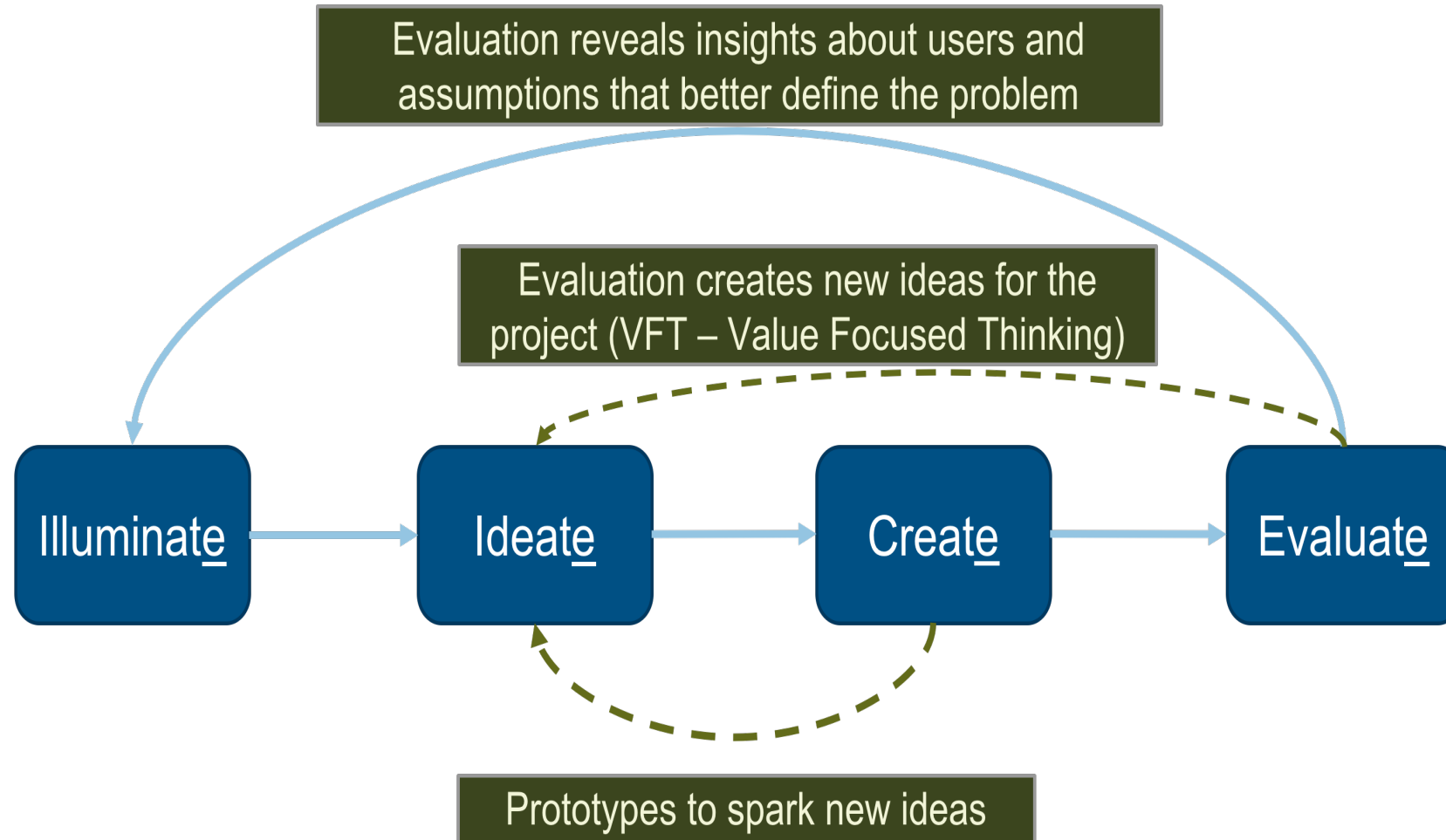# Agenda

ID-ate

Case Study

Conclusions

IDI's ID-ate Process

Assess the prototype(s) for their ability to achieve the objectives: outcomes desired in a reasonable time and cost.

Evaluate (What works?)

Develop and clarify objectives: how to value innovation outcome and effort.

Illuminate (What is?)

Accelerate Value Creation

e: evaluate – local evaluation with users and solution owners that occurs at the end of each process step; addresses assumptions, convergence of thoughts, and lessons learned

Develop a prototype(s) and conduct extensive testing on these prototypes and refine as needed to have a releasable product.

Create (What wows?)

Ideate (What if?)

Brainstorm concepts and ideas for achieving the objectives. Use hitch-hiking and other methods to expand and refine the concepts and ideas.

Liedtka & Ogilvie – Design Thinking

What is? → What if? → What wows? → What works?

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Systems Engineering Detail on Steps

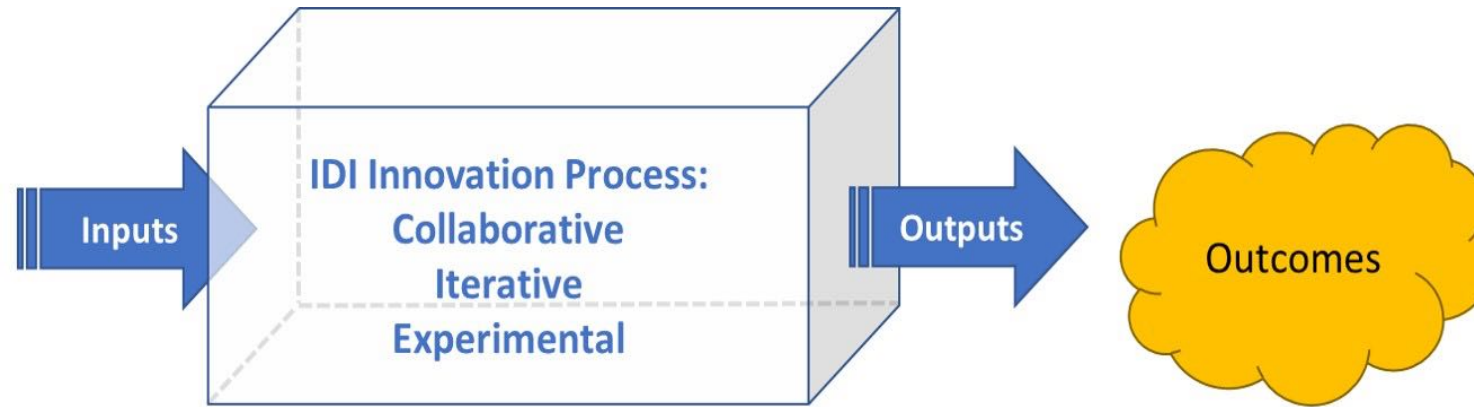| ID-ate Steps	Questions	Methods
Illuminate	Use Cases? Context Issues? Stakeholders? Time Horizon?	Brainstorming on problem, 5 whys, key assumptions, journey mapping, root-cause analysis, stakeholder issues matrix, decision hierarchies
Ideate	Solution concepts? Minimum viable product? Is there a non-material solution?	Brainstorming on solutions, affinity diagramming, SAMPER, Morphological box (strategy table)
Create	How many solutions to prototype? Which prototype(s) to build?	Physical and software prototypes
Evaluate	Which prototype(s) are promising? What are weaknesses of each?	Multiple Objectives Decision Analysis, Value Focused Thinking

ID-ate Iteration and Feedback

Evaluation reveals insights about users and assumptions that better define the problem

Evaluation creates new ideas for the project (VFT – Value Focused Thinking)

Illuminate → Ideate → Create → Evaluate

Prototypes to spark new ideas

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Innovation Metrics

IDI Innovation Process: Collaborative Iterative Experimental

Inputs → Outputs → Outcomes

Metrics	Inputs	Process	Outputs	Outcomes
	Quality and Quantity of: People Information Resources ($) Source of idea pool (internal/ external)	Cost per attempt Time per success Time per failure Engagement level of participants Project completion rate Time horizon coverage (near-, mid-, long-term)	Innovation rate (p(success)) – should not be too high or too low Training impact on people participating Patent filings	Return on investment over many innovation efforts Lessons learned from failures (value of continuous improvement) User adoption rate Sales/revenue from new offerings

ID-ate Case Study

IDI's development of a conversational non-player character (NPC) for the U.S. Army's Simulation and Training Technology Center (STTC) in 2012-13.
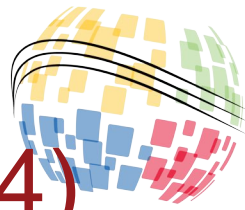

The Enhanced Dynamic Geo-Social Environment (EDGE) is a virtual training environment that was developed by STTC. EDGE is designed to be a scalable and extensible virtual training environment (built in the UNREAL Game Engine).
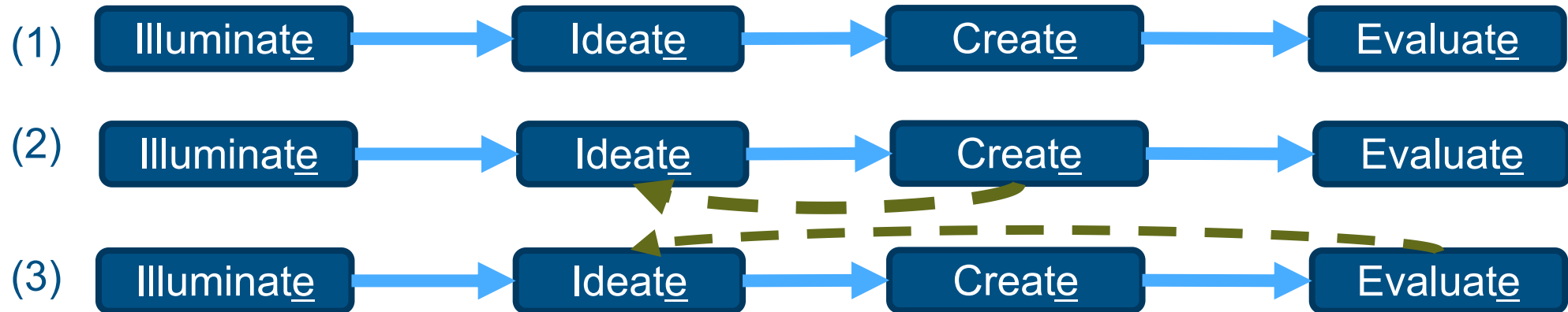
Conversational NPC Needs & Requirements

- EDGE is focused on critical thinking skills related to cultural understanding by implementing a non-determinant virtual training environment
- Trainees are tasked with interviewing local residents (NPCs) in order to obtain information of military value
- NPC facilitates unpredictable, complex, human-computer conversational interactions in virtual environments
- NPC engages in free form, text-based chat with the trainees
- NPC responds truthfully if the trainee builds positive rapport
- NPC responds evasively if the rapport is neutral and deceitfully or end the conversation if the trainee develops negative rapport
- NPC varies responses to limit the ability of trainees to memorize a positive solution
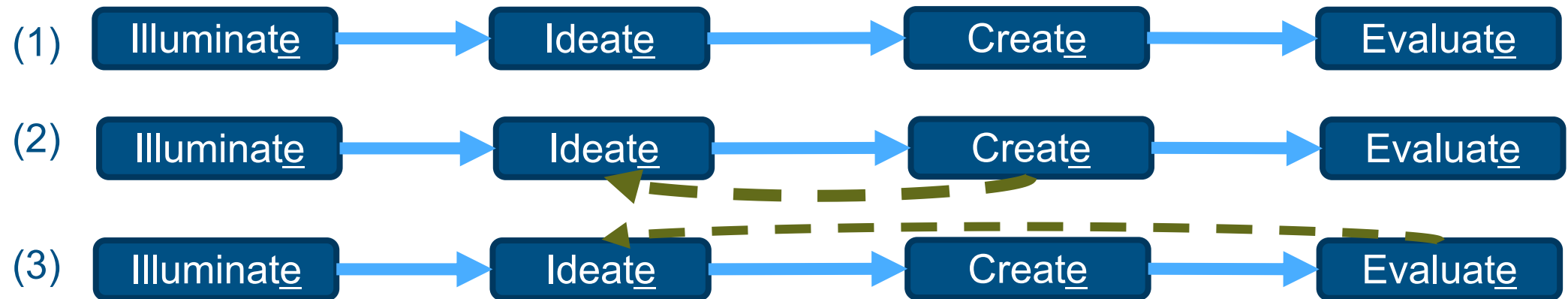
(1) Illuminate → Ideate → Create → Evaluate

(2) Illuminate → Ideate → Create → Evaluate

(3) Illuminate → Ideate → Create → Evaluate

Phase 0: proposal preparation (1)	Non-deterministic, life-like interaction (text, not voice); multiple characters; realistic villager reactions to trainee mistakes	Use our Dynamic Decision Network (DDN) concept, add personalities via a Bayesian network		
Phase 1: getting started (2)	Review customer needs with the team	Create simple cases to explore (4 inputs & 3 outputs, 10 inputs – 8 outputs, 25 inputs – 15 outputs)	Define logic rules in Excel for simple examples (4 inputs & 3 outputs, 10 inputs – 8 outputs, 25 inputs – 15 outputs)	Determined that we had reached the point where we needed to create a DDN model

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(1) Illuminate → Ideate → Create → Evaluate

(2) Illuminate → Ideate → Create → Evaluate

(3) Illuminate → Ideate → Create → Evaluate

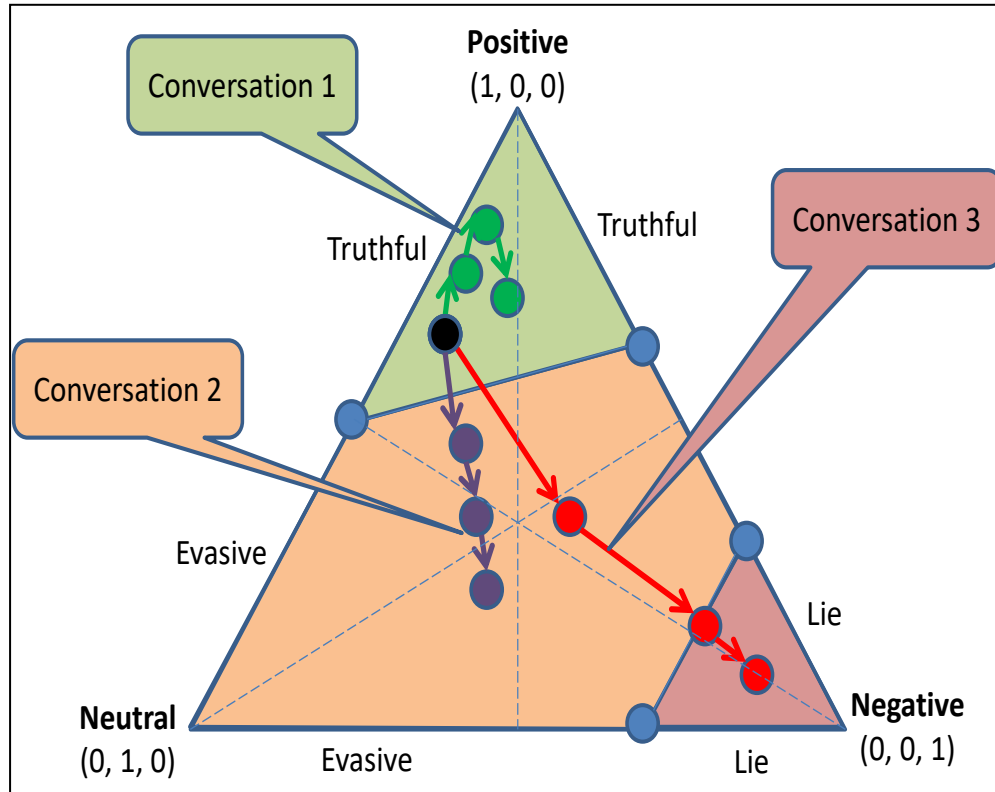|	Illuminate	Ideate	Create	Evaluate
Phase 2: getting automated. (2)		Insert a DDN for villager deciding to tell truth, be evasive or tell a lie in front of logic for selecting right response given DDN conclusion	Build DDN in Netica and integrate with Excel via VBA (test many iterations)	Need a DB structure for each character based on knowledge categories, Need a visualization for testing DDN
Phase 3: tackling the first new challenges (2)	Knowledge engineering with client determined the need for greetings, pleasantries and farewells	Created a range of possible data structures, brainstormed visualization ideas and a statement classifier	Added ideas to Netica/Excel prototype Realized the triangular visualization display would also benefit trainee feedback	Determined that we needed a robust way to ascertaining the key topic for each trainee statement

Visualization of Rapport over Time

Triangle is a probability space for 3 states, with an overlaid decision policy space

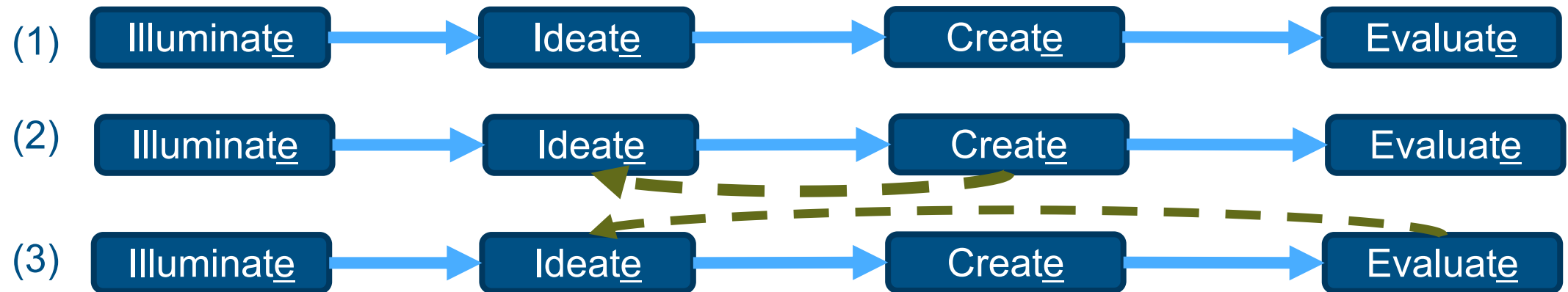| Conversation 1	Conversation 2	Conversation 3
Trainee: Hello.	Trainee: Who is Rayhan Karimov?	Trainee: What was it like during the Soviet rule?
Mayar: Salam.	Mayar: I've heard his name before but don't know much about him.	Mayar: You are clearly not from around here. Let's not talk about that.
Trainee: How are you, sir?	Trainee: Do you know Sajida Karimova?	Trainee: Well there seems to be a lot of poverty.
Mayar: I'm fine, thanks.	Mayar: I've heard of her, but I'm not sure who she is.	Mayar: Speaking of such things is not polite, I do not want to talk about it.
Trainee: Who is Rayhan Karimov?	Trainee: Do you know where she lives?	Trainee: Who is Rayhan Karimov?
Mayar: Rayhan Karimov is the local medicine man.	Mayar: I've seen her around town, but I don't know much about her.	Mayar: Rayhan Karimov owns the electrical shop.

(1) Illuminate → Ideate → Create → Evaluate

(2) Illuminate → Ideate → Create → Evaluate

(3) Illuminate → Ideate → Create → Evaluate

	Illuminate	Ideate	Create	Evaluate
Phase 4: helping with software integration (2)	Customer needs changed; we must integrate our software into their environment (UNREAL game engine, Java)	Addressed need to find key topic and gravitated toward a hierarchical topic tree, Conducted research on rapport for personality models	Designed and tested topic trees in Excel Designed and tested rapport in Netica Designed software for UNREAL game engine	Testing found complex sentences and pronouns to be causes of errors
Phase 5: doing the final testing (3)	Customer changed DB tool for UNREAL game engine	Evaluated parsers for selecting sentence elements and relationships	Test Java Open Source and Stanford parsers, selected Java Open Source, Integrated our software with UNREAL game engine & Java	Conducted several rounds of V&V

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(1) Illuminate → Ideate → Create → Evaluate

(2) Illuminate → Ideate → Create → Evaluate

(3) Illuminate → Ideate → Create → Evaluate

Phase 6: making the last adjustments. (2)	Customer expressed a need for DB editing capability for adjusting the specification of our characters	Developed and did quick tests on DB editing capabilities	Developed prototype for partial editing of each character Made numerous changes to implementation	

ID-ate Metrics for Case Study

Metric Topics	Metrics	Estimates	Discussion
Inputs	People Quantity	10 Total, 4 full time equivalent	Needed for diverse skills
	People Quality	7 senior, 3 junior	Needed for budget & time
	Dollars	$1,000,000	Reasonable for us, much lower than competitor would need
	Information Quality	Limited in timing and quality	Major surprises regarding software responsibilities, minor surprise about details needed in trainee statements
Process	**Cost per effort**	**$1,000,000**	High for us, about right for the task
	Cost per phase	$160,000 average; $80-240k range	About average for us
	Time per effort	**13 months**	Needed for this effort
	Time per phase	**1-3 months**	Average for innovations
	Engagement level of staff	High priority for all	Needed for innovations
	Time span coverage	Mid - 13 months	Single project
Outputs	**Number of innovations**	**3 key innovations**	**DDN application with rapport; visualization; topic tree**
	Staff training level	Training for all	Biggest impact on junior staff
	Patents	None	Did not pursue
Outcomes	Return on investment	Limited	EDGE program ended; conversion to other training-specific applications unsuccessful
	Lessons learned	Many	**Iteration improves innovations and commitment of staff**

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Conclusions

- This case study is one of many demonstrated successes of ID-ate.

- We are interested in sharing our ideas and processes – let us know if you would like to collaborate.

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