



National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

Training resilient decision-making with a serious game

How effective is this resilience
intervention?

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Content of this presentation

Resilience

Developing the Resilience Serious Game

Method to evaluate the effectiveness

Results

Future



Resilience

- Normative safety: following rules & procedures
 - Known/expected situations
 - ‘Compliance’
- Resilience:
 - Unknown/unforeseen situations
 - Improve safety in uncertainty

But:

How can we train people to be more resilient?



Resilience serious game

- Developed by the Dutch National Institute for Public Health and the Environment (RIVM)
- Based on scientific research on how to deal with uncertainties in working situations
- User involvement: Co-creation with safety practitioners
- Practical tool to train resilient decision-making to improve (occupational) safety
- By practicing decision-making in unforeseen/uncertain situations
- Used in a training-situation



The Resilience Serious Game



Want to know more about the game?

Bellamy L.J., Chambon M., Van Guldener, V. (2018). Getting resilience into safety programs using simple tools - a research background and practical implementation. *Reliability Engineering & System Safety*, 172, 171-184.



The Resilience Serious Game

Goal: reduce uncertainty and time pressure in a realistic dilemma (case study)

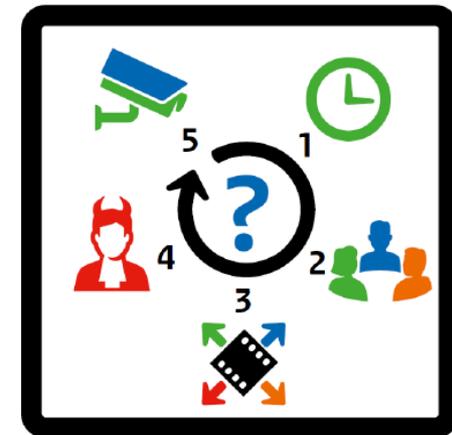
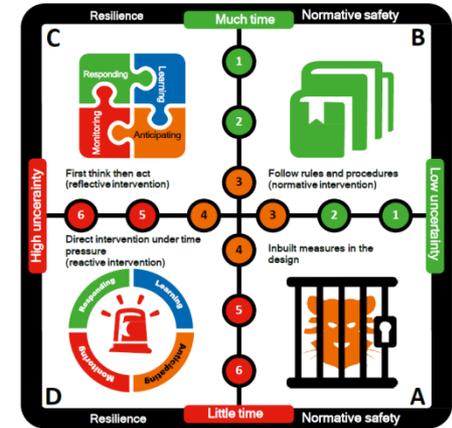
Four key elements

- The Resilience Safety quadrants
- The Resilience 5-step process
- The Resilience Story cards
- The Resilience Storyboard



STORYBOARD

	TID	ONZekerheid	Opties	Jobs	ORGANISATIE RESILIENCE KWALITEITEN	PERSOONLIJKE RESILIENCE KWALITEITEN	VALKUREN	TOTAAL SCORE
0								0
1								1
2								2
3								3
BESLISMOMENT 1: KIES EEN OPTIE, VUL DE KWADRANTEN IN								
4								4
BESLISMOMENT 2: KIES EEN OPTIE, VUL DE KWADRANTEN IN								
5								5
MONITORING PLAN, VUL DE KWADRANTEN IN								





Evaluating the Resilience Serious Game

- Measuring effectiveness of the game
- Using Kirkpatrick's theoretical framework (1994)* to evaluate training programs
- Four levels:
 1. Reaction
 2. Learning
 3. Behavior
 4. Results

* Kirkpatrick D.L. (1994). Evaluating training programs: the four levels. San Francisco: Berrett-Koehler. 978-1-881052-49-4



Evaluating the Resilience Serious Game

- Measuring effectiveness of the game
- Using Kirkpatrick's theoretical framework (1994)* to evaluate training programs
- Four levels:
 1. Reaction: how do participants feel about the game? Do they think it is relevant for their job, do they like the game?
 2. Learning: how much do the participants learn from the game? Do they gain knowledge, skills, attitudes, trust and commitment?
 3. Behavior
 4. Results

* Kirkpatrick D,L. (1994). Evaluating training programs: the four levels. San Francisco: Berrett-Koehler. 978-1-881052-49-4



Method

- Five companies (38 participants)
- Game is played once (supervised by a trainer)

- Effectiveness: participants have a positive reaction to the game (level 1) and have learned from the game (level 2)

- Methodology:
 - Pre- and post-measurements
 - self-assessment with questionnaire (partially derived from the TORC-game*)
 - participant-generated word list
 - Observations by the researcher
 - Feedback from participants

*Van der Beek D, Veldhuis G, Van der Vorm J, Grøtan TO, Wærø I, Macchi L. (2016). D5.1 TORC Impact Assessment, Framework, Methodology and Validation Roadmap TNO 2016 R10988 | Final report 26 July 2016.



Questionnaire and word list

Questionnaire before the game

- Used to test the attitudes of the participants regarding serious games and on the job training
- Questions about experiences with and opinions about serious games and on the job training

Questionnaire after the game

Questions about:

- Attitude towards serious games and on the job training (same questions as before the game)
- The content of the game
- Reaction to and learning from the game (Kirkpatrick levels 1 and 2)

Word list: second measure of the learning effect

- Before and after the game, 5 minutes to write down words
- "What words do you think of for safety in unexpected/unforeseen situations?"
- Expectation: more words associated with resilience after the game



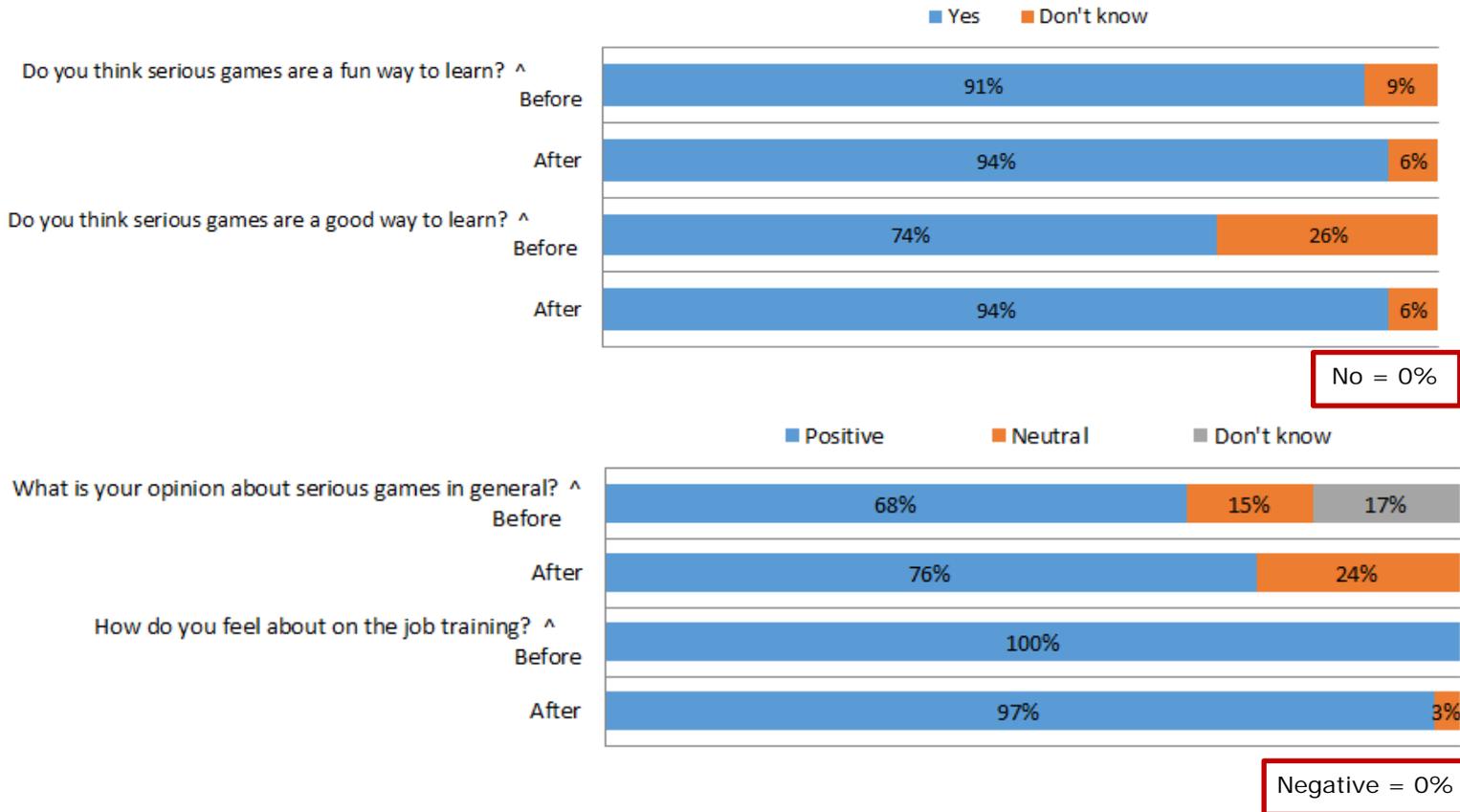
Results

Participants questionnaires:

- 34 respondents
- 71% male
- Mean age: 38 (SD: 11)
- 38% operational employee, 15% supervisor, 9% manager
(others did not want to state their job level or had another job)
- Mean number of years at the company: 8 (SD: 8)



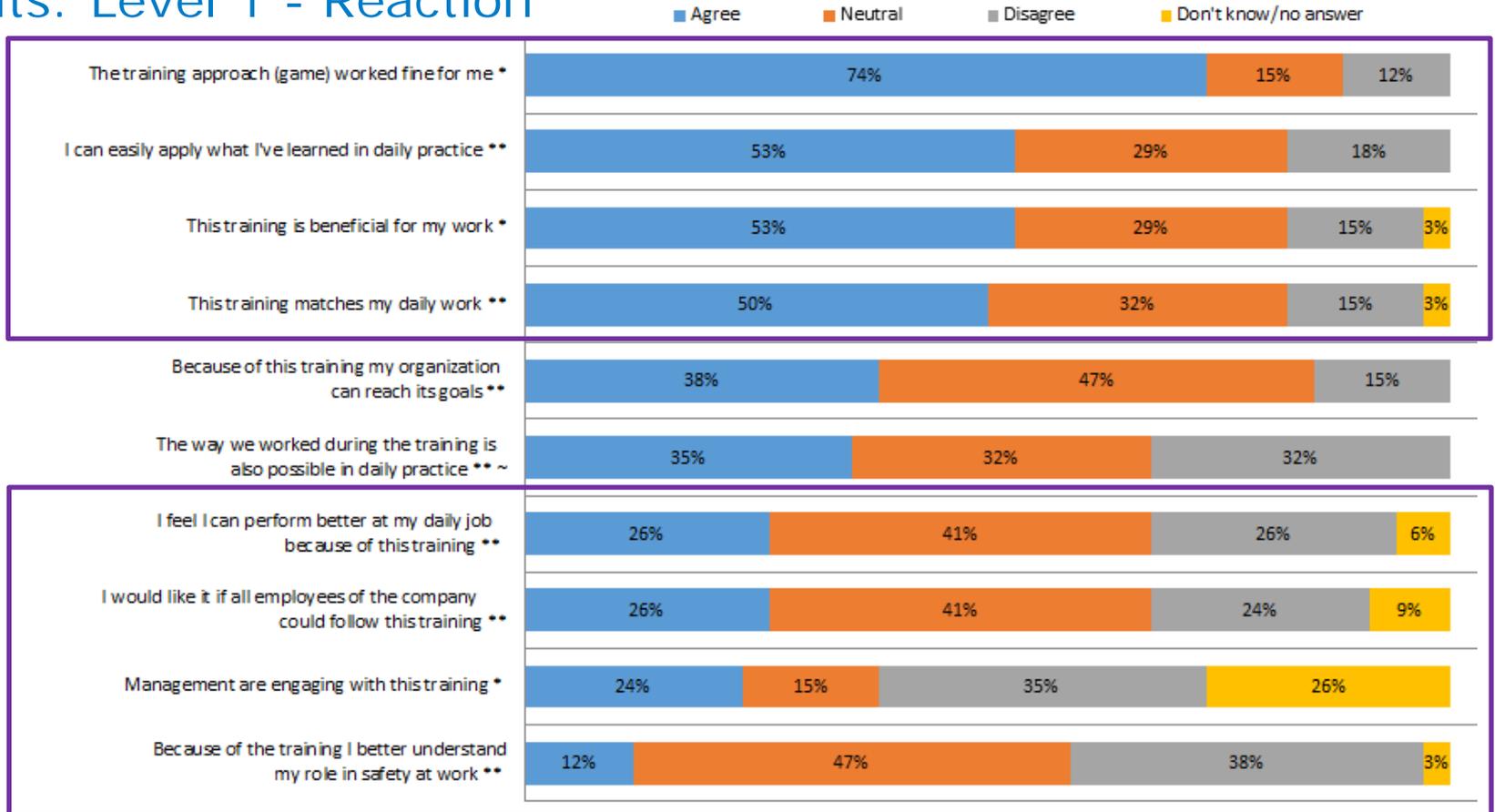
Results: Attitudes of the participants



^: Based on Mayer I. (2012). Towards a Comprehensive Methodology for the Research and Evaluation of Serious Games. Procedia Computer Science, 15, 233-247.



Results: Level 1 - Reaction



*: Literally derived from the TORC questionnaire

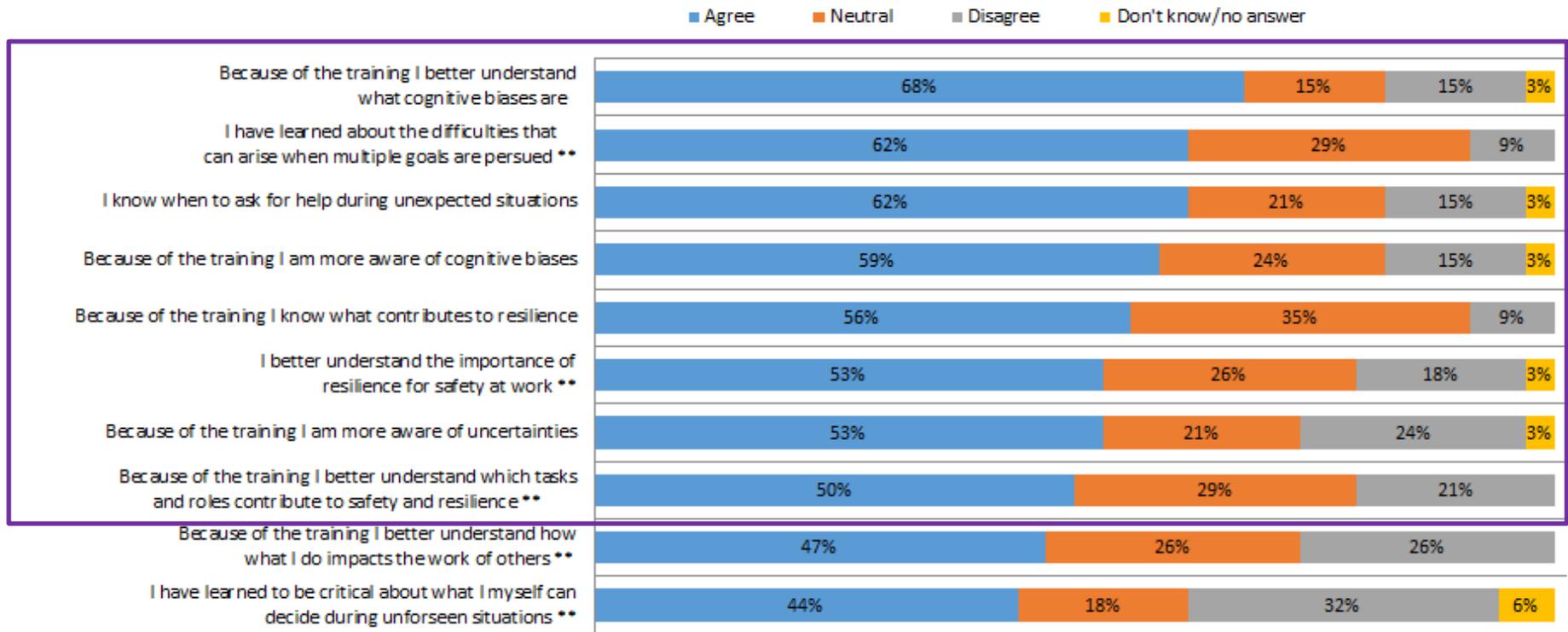
** : Based on the TORC questionnaire

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~: Recoded from negative formulation to positive formulation



Results: Level 2 – Learning (1)



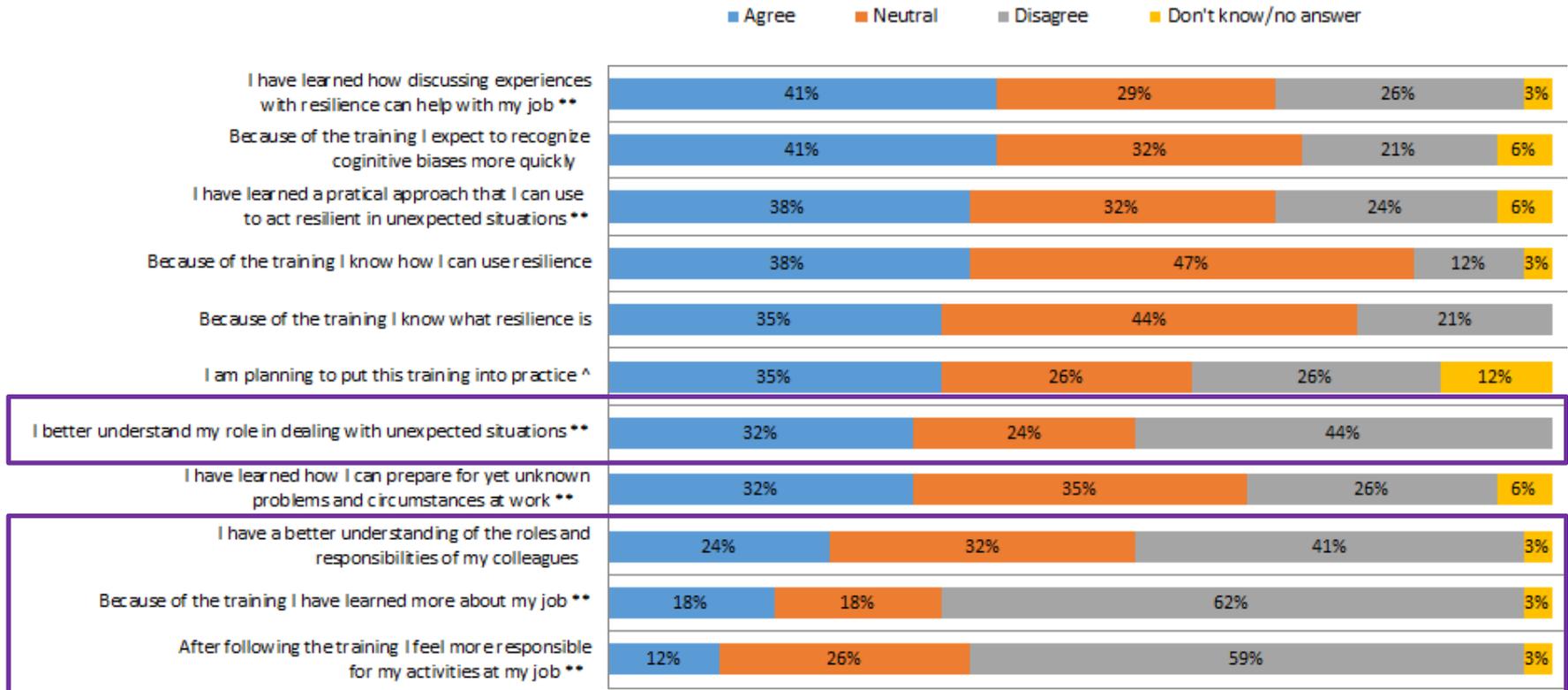
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Results: Level 2 – Learning (2)



^: Based on Mayer I. (2012). Towards a Comprehensive Methodology for the Research and Evaluation of Serious Games. *Procedia Computer Science*, 15, 233-247.

** : Based on the TORC questionnaire

Van der Beek D, Veldhuis G, Van der Vorm J, Grøtan TO, Wærø I, Macchi L. (2016). D5.1 TORC Impact Assessment, Framework, Methodology and Validation Roadmap TNO 2016 R10988 | Final report 26 July 2016.



Results: word list

“What words do you think of for safety in unexpected/unforeseen situations?”

Difference score: % before vs. % after

+ Difference score:

‘Options’	+39%
‘Time(pressure)’	+36%
‘Risk’	+21%
‘Uncertain’	+18%
‘Scenario’	+18%
‘Pitfall’	+18%
‘Decision(making)’	+15%
‘Together’	+12%
‘Think’	+12%

- Difference score:

‘Environment’	-15%
‘Prepared’	-15%
‘Accident’	-12%



Results: observations and feedback

- **Positive**

- Fun
- Structured
- Learning the resilience vocabulary
- Contributes to group process

- **Points of improvement**

- Amount of information and game elements
- Abstract concepts
- Game needs to be played multiple times

- **Other points**

- Case study of the company vs. other case study
- Playing own role vs. playing another role
- How the game is played depends on the trainer



Discussion

- Effectiveness (using Kirkpatrick): participants have a positive reaction to the game (level 1) and have learned from the game (level 2)
- Positive attitude before and after the game
- Learning effect:
 - Knowledge was gained
 - Effect on skills was less convincing
- Resilience playing cards difficult to understand
- Lots of information
- Game needs to be played more often to be more effective



What's next?

- Last steps in developing the game
- Game design
- Train-the-trainer
- Companies all around the country playing the game!





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