

1 Appendices

1.1 Appendix A - Consent Form

You have been invited to partake in a {type of session}, about designing a 3D open world environment. Your participation in this interview is voluntary.

Purpose of {type of session},

The purpose of the {type of session} is to {type of purpose}, an interactive 3D open world environment for the representation of DCR graphs.

Time Commitment

The interview is anticipated to be completed in a session of 60-90 minutes.

Data Collection

The interview will be recorded on video and audio. You may request not to be video recorded,

If you so desire. The data will only be used for research purposes.

Confidentiality

Only the researcher will have access to any personal information

The research will however include a small professional biography stating your qualifications.

Your Rights

You have the right to:

at any time withdraw from the interview without penalty. refuse to respond to any questions.

refuse anything that may be asked of you.

have any questions about the interview answered, if answering those questions will not affect the data collected during the interview.

At any time request that any data you have supplied be destroyed.

Your Privacy

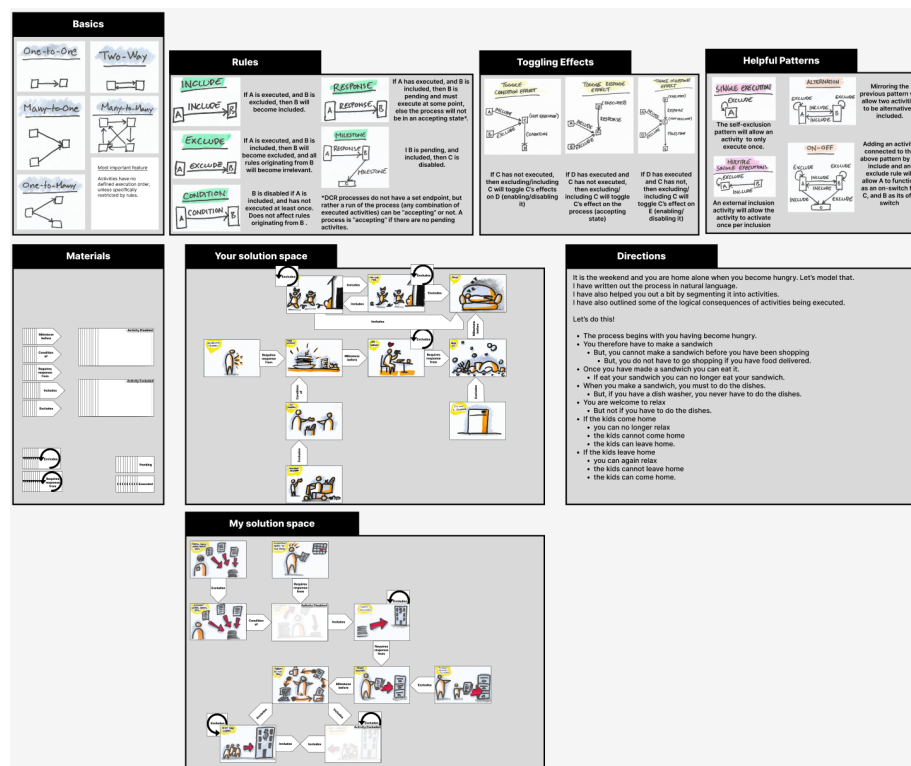
Your privacy is protected according to Danish law and European guidelines.

The transcribed interview will be included as an appendix to the research, and this may be published or shared for scientific purposes, but will not include any personally identifiable information.

Data Security

The data collected from the interviews will be stored securely and access to the data will be restricted to the researcher.

1.2 Appendix B - DCR Training Material



1.3 Appendix C - Ideation Interview Script

1.3.1 Introduction

Begin by welcoming the participant to the interview. Express gratitude for their time and willingness to participate. Provide a brief overview of the purpose of the research, emphasizing the goal of generating requirements for a 3D artifact to render a DCR Graph for user exploration and interaction. Confirm that the participant has read and responded to the consent email, ensuring they understand the nature of the interview and their rights as a participant.

1.3.2 Teaching Material Demonstration

Demonstrate the teaching material available on the Figma board, guiding the participant through its features and functionalities. Encourage the participant to interact with the material, ensuring they feel comfortable navigating through it.

1.3.3 Brainstorming Session

Initiate a brainstorming session with the participant to explore how DCR rules can be represented in the physical world. Encourage creativity and open-mindedness, emphasizing that all ideas are valuable. Instruct the participant to utilize the digital post-it notes available on the Figma board to jot down their thoughts and ideas. Prompt the participant to consider various sensory elements such as sights, sounds, shapes, lighting, and physical sensations like gravity, as well as emotional and cognitive responses.

1.3.4 Exploration of DCR Rule Representation

Guide the participant through a series of questions aimed at exploring different aspects of DCR rule representation in the 3D artifact: Included and Excluded: How can we visually differentiate between included and excluded elements within the DCR Graph? Enabled and Disabled: What visual cues can indicate whether a rule is enabled or disabled? Executed and Not Executed: How should executed and non-executed rules be distinguished? Pending and Non-pending: What indicators can be used to signify pending and non-pending actions? Relationships: How can one-to-one, one-to-many, many-to-one, and many-to-many relationships be visually depicted? Other Elements: Consider how conditions, responses, milestones, and other elements of the DCR Graph can be represented effectively.

1.3.5 Closing

Thank the participant sincerely for their valuable contributions to the ideation process. Reiterate the importance of their insights in shaping the development of the 3D artifact. Provide contact information for any further questions or feedback.

1.4 Validation Session Interview Protocol

1.4.1 Introduction

Welcome the participant to the validation session. Briefly explain the purpose of the session, which is to gather feedback on the implemented 3D artifact for representing DCR graphs. Emphasize the importance of their honest feedback in improving the usability and effectiveness of the artifact. Remind participants that they will be using the think-aloud protocol to vocalize their thoughts during the exploration process.

1.4.2 Stage 1: Comparison of 2D and 3D Representations

Exploration of 2D Representation: Provide the participant with a classic 2D representation of a DCR graph. Instruct the participant to explore the 2D representation while vocalizing their thoughts using the think-aloud protocol. Encourage participants to comment on the clarity, comprehensibility, and ease of understanding of the 2D representation.

Exploration of Canonical 3D Representation: Present the participant with a canonical 3D representation of a DCR graph generated by the artifact. Instruct the participant to explore the 3D representation while vocalizing their thoughts using the think-aloud protocol. Prompt participants to compare the 3D representation with the 2D representation in terms of clarity, visual appeal, and ease of navigation.

1.4.3 Stage 2: Comparison of Canonical and Domain-Specific 3D Representations

Exploration of Canonical 3D Representation: Provide the participant with another canonical 3D representation of a DCR graph generated by the artifact. Instruct the participant to explore this canonical 3D representation while vocalizing their thoughts using the think-aloud protocol. Encourage participants to provide feedback on the usability, intuitiveness, and effectiveness of the canonical representation.

Exploration of Domain-Specific 3D Representation: Present the participant with a domain-specific 3D representation of a DCR graph generated by the artifact. Instruct the participant to explore this domain-specific 3D representation while vocalizing their thoughts using the think-aloud protocol. Prompt participants to compare the domain-specific representation with the canonical representation in terms of relevance, contextuality, and usefulness for domain-specific tasks.

1.4.4 Stage 3: Rating of Representations

Rating Form: Provide participants with a rating form containing relevant criteria such as clarity, comprehensibility, visual appeal, ease of navigation, relevance to domain tasks, etc. Instruct participants to rate each representation (2D, canonical 3D, and domain-specific 3D) based on the provided criteria. Encourage participants to provide additional comments or suggestions for improvement in the feedback section of the rating form.

1.4.5 Closing

Thank the participant for their valuable feedback and participation in the validation session. Reiterate the importance of their insights in refining the 3D artifact for better usability and effectiveness. Provide contact information for any further questions or feedback.

1.5 Appendix D - Ideation Coding 1

1.5.1 Ideation Interview 01 - Ideator 02 and Ideator 03

Participant	Relations	Context	Timestamp
Ideator-02	So if I want to see a process, there will be something at the beginning. Then in this case, for example, you said yourself the staff member calls in sick, so I could imagine this could be fun, but I don't know if it's a good idea that you know if phone is calling and then you actually go, then you you pick up the phone in a virtual environment and then you can see once it picked up then suddenly and you answered then you can see. OK, here's the shift planner suddenly showing up as well and starting to to make sounds.	When asked how to model an activity being a condition of another activity.	[1:30:39]
Ideator-02	Now, what happens then? Then we have to look at all the conditions. And what is then required? So when I answer the call, then suddenly the shift planner will show up, right and the and and be like OK, you need to do something over here in order to make sure we can call in staff.	When asked how to model an activity being a condition of another activity.	[1:33:31]

Ideator-02	In my mind, a condition is typically represented by a door, you know, the door opens when something has been achieved, right?	When asked how to model an activity being a condition of another activity.	[1:40:00]
Ideator-02	What I would do is make the 'call in staff' option greyed out, literally disabled, until something happens with the assigned shift planner.	When asked how to model an activity being a condition of another activity.	[1:49:03]

Participant	Enabled	Context	Timestamp
Ideator-02	Make [a disabled] button grayscale and make it stop spinning.	On asked about the visibility of disabled activities	[1:16:13]
Ideator-02	I'm not sure about which actions need to be done there, but once that's correct, it will light the path and then enable the 'call in staff' option, you know, if other conditions are met	When asked how to signal the connections and disabledness	[1:49:21]
Ideator-02	Maybe it explodes in a enabled you know, achievement unlocked.	When asked how to signal the connections and disabledness	[1:49:59]
Ideator-02	Then I would everything that is and condition of would then take its attention.	When asked what should happen when a user clicks a disabled activity	[1:50:26]
Ideator-02	Maybe would shake, maybe it would have a sound.	When asked what should happen when a user clicks a disabled activity	[1:50:37]

Ideator-02	I think it's a Disney has a some game. I don't remember where it is that some areas, if the conditions aren't met, yet there'll be a cloud and will be dark and look super spooky. But once conditions are met, it'll clear up and be sunny, you know, and all that. And then you feel, oh, I want to go over there now. Because now it's more welcoming and warm.	When asked how to signal activities being enabled/disabled	[1:52:10]
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Participant	Environment	Context	Timestamp
Ideator-02	What if we model it one-to-one in the 3D environment where we can actually visualize the different relevant parts? For instance, when there's a phone call, a phone appears, and it rings. Since you have two ears, you can discern the sound's origin.	When asked how to model an activity being a condition of another activity.	[1:29:01]

Ideator-02	How is that connecting could still make a wire between those two that you have a staff member in the bed grabbing a phone. You see the telephone wire to the phone at the office, and when he calls, it'll light up. So you know, OK, he does something. Then the cable is lighting up or something, you know, and then start moving and you have some some noise.	When asked about how to avoid activities being connected by arrows and boxes	[1:46:45]
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Participant	Activities	Context	Timestamp
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1.5.2 Ideation Interview 02 - Ideator 02

Participant	Relations	Context	Timestamp
Ideator-02	Now an obvious way of doing this is making a path between those two in our world to vary, but that's very much related to an arrow, so I don't know.	When asked how to visualize the existence of relations.	[1:06:11]

Participant	Relations	Context	Timestamp
Ideator-02	I'm thinking a highway with lanes inside, and each lane represents a condition.	When asked how to visualize the existence of multiple relations.	[1:08:55]

Ideator-02	I think that [some kind of color colored colored physical link between activities to indicate their status] is the safe bet.	When asked about keeping track of condition relations.	[1:22:40]
Ideator-02	When I click the make sandwich it should somehow highlighted these conditions aren't met right? Light them up.	When asked when relations should be visual.	[1:23:52]
Ideator-02	Yes. So I think it's very important that we need to show what's in and what's out, so to speak, right?	When asked whether only relations related to the latest selection should light up.	[1:26:29]

Participant	Activities	Context	Timestamp
Ideator-02	I think it's very hard to avoid using iconography and the main reason I'm saying is saying this is because you don't want players to use their their mental capacity on learning to use the tool you want them to.	When asked for alternatives to labelled buttons.	[1:08:55]

Participant	Views	Context	Timestamp
Ideator-02	I would put a big fat button that says go to and another one in that says return.	When asked when panning should happen	[1:11:50]

Ideator-02	We would, if we were keeping the highway Rd metaphor, we would of course be a car. You know you can, or maybe it's a train.	When asked for alternatives to labelled buttons.	[1:13:49]
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Participant	Environment	Context	Timestamp
Ideator-02	I would go back to what we already discussed based on what we know from at least the UX field of research that we know that. Movement and sound are too ways to catch people's attention.	When asked how to draw attention to important events	[7:20]
Ideator-02	So movement can also have, you know, personality. It can be very aggressive, it can be calm and we can use that for, you know, for how severe the information is to communicate.	When asked how to draw attention to important events	[8:56]
Ideator-02	If it's super important, something you have to do something about right now, it should take all the attention.	When asked how to draw attention to important events	[9:25]
Ideator-02	And that's why I would also add sound effects.	When asked how to draw attention to important events	[9:25]
Ideator-02	Not only does it move, it also makes a sound, but also makes the light suddenly move not only itself.	When asked how to draw attention to important events	[9:25]

Ideator-02	You can even if you if it's not important to look at very often, they can just be very slow movement, because if it's very slow, we will not.	When asked how to draw attention to important events	[9:25]
Ideator-02	So we can use movement to say for example, OK, everything's going on. Maybe it's just in a small floaty state, and if it breaks down we put some great dark colors on it. Stops moving, so we know this is no longer active.	When asked how to communicate differences in state	[12:49]
Ideator-02	For example include exclude that could possibly be a, you know, a traffic light, green light, red light, yellow light, right ohm if it's green light it means that this includes over here this this is ready to continue if it's red light is because it's stopped for some reason maybe it's been excluded.	When asked how to make state signals domain agnostic.	[20:02]

Ideator-02	So you can use iconography in that way to to communicate this right? Or a pause button which we also know from from using it. Everyone knows play. Pause. That's something we can relate to, right? Or even a stop if it's excluding something, we stop it possibly.	When asked how to make state signals domain agnostic.	[22:50]
Ideator-02	So if it's pending right now, I'm thinking it's pulsing, you know, take attention over here because, you know, we need to figure out why is this pending?	When asked how to identify the specific disabling activity.	[38:24]
Ideator-02	You know, some games at the top have this compass kind of thing.	When asked how to signal user from off-screen	[1:00:51]
Ideator-02	[draws a speech balloon on the edge of the screen] then when you start looking around, this will move through no until it gets at least into the field of vision.	When asked how to signal user from off-screen	[1:00:51]
Ideator-02	Just writing here between the two activities it says pans, so in. So instead of having an arrow, we actually move the camera, in this case, right?	When asked how to signal user from off-screen	[1:05:22]

Ideator-02	[panning] must never happen automatically. It has to be a user action.	When asked when panning should happen	[1:11:21]
Ideator-02	Green means done. Think pretty much in all cultures, green is kind of like, yeah, yeah, yeah, yeah. And then among usual color when it's not yet, I wouldn't put red because red is a, you know. But then again, red means something is wrong.	When asked how to keep track of met condition	[1:21:04]
Ideator-02	Just putting in some, whereas untouched needs to shout. "Ohh, you need to to be clicking me." By giving it in this case, I'm giving it a border color to show some kind of action on it, right?	When asked how to signal whether an activity has happened/has not happend (untouched)	[1:30:23]

1.5.3 Ideation Interview 03 - Ideator 03

Participant	Enabled	Context	Timestamp
Ideator-03	I use shadows and light at the same time.	When asked how to signal activities being enabled/disabled	[1:51:23]

Participant	Relations	Context	Timestamp
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Ideator-03	You need to do something before and then also you will use light to show what is the other thing you have to do it before or and then this is.	When asked how to visualize responses and conditions	[48:07]
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Participant	Markings	Context	Timestamp
Ideator-03	You can perceive the light because the colors of all space change.	When asked how to signal off-screen changes.	[49:51]
Ideator-03	And then that light can give you a perception that you have to move your body to see where is actually the light.	When asked how to signal off-screen changes.	[50:20]

1.5.4 Ideation Interview 04 - Ideator 02 and Ideator 03

Participant	Relations	Context	Timestamp
Ideator-02	So you could have it so if we have paths going from things you know with small Rd for people walking or whatever, and then we have a path directly from the the in to the church and we can see that no one walks from the end to the church, but we see that people are walking from the church to the inn.	On being asked how to immersively visualize relations in the game world.	[38:28]

Ideator-02	I mean, I guess if we trigger it, we need to see what happens, right? So in that case, I would imagine that we then see a drunk cool follow me along now that that then walks to the church and then someone would be like, no, you're not getting in here.	On being asked how to immersively visualize relations in the game world.	[39:24]
Ideator-02	And then we might consider these people who come from the inn in a good color code. Maybe in yellow.	On being asked how to immersively visualize relations in the game world.	[39:48]

Participant	Relations	Context	Timestamp
Ideator-03	I was thinking like to create a great scale of colors and that part and then if you move outside of that area that is disabled and then you can start seeing the colors, they'll natural colors of the environment.	On being asked how to immersively visualize relations in the game world.	[41:11]

Ideator-03	For example, if you have an area that is disabled [...] I will put it in Gray colors like in black, white and then if you go out of that area that is disabled and then you can start seeing the colors that like the yeah, they're all rainbow.	On being asked how to immersively visualize relations in the game world.	[41:46]
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Ideator-02	<p>I mean the obvious one is some kind of progress bar somewhere, right? [...]</p> <p>I would definitely recommend having some kind of calendar so you can see how many are we talking about. Otherwise it might get too abstract, especially one to end a situation where there are a lot of stuff that needs to be a lot of activities. We need to make sure that we actually that actually getting active because it's it's easy if it's only two or three activities need to be active, but once you have like 10 or 11 gets really hard to to do it without something concrete that you can take a look at. It could be a circular diagram where it's like, you know, like when you play Trivial Pursuit, you have the different cheese that gets filled out as you progress.</p>	On being asked how to visualize condition relations.	[51:48]
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Ideator-03	I was thinking like to reduce the kind of smoke step by step every time that you do on a task and then we'll do a start just removing the smoke until you can see the completed image.	On being asked how to visualize condition relations.	[58:22]
Ideator-02	I was just thinking maybe if you color code of the light between the the pinning activity and the milestone then you get an immediate one-to-one. You see "oh, this is red, this is green. You just add more color, right, different color sources. For example, if there's a pending activity influencing three or four milestones, then you should have three or four light sources on the activity. Then you could start turning off the lights as they actually become non-pending. That also solved the thing that we talked about earlier about showing progression. You can even have it like disco laser lights.	On asked about differentiating pending events	[1:23:35]

Participant	Environment	Context	Timestamp
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Ideator-03	<p>They actually feel happier for being involved in these kind of environments, completely different, because sometimes they they don't have the opportunity to be to be there and then it's actually more simple. I mean, I think that it's not a problem, in my humble opinion, of course, because I don't really know what kind of stakeholder do you have.</p>	<p>On being asked about using domain specific or fantastical assets</p>	[30:20]
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Ideator-02	I think that if we go with a fantasy world, those people you're using to validate it on will need to learn the abstractions of the system itself, but also need to spend time trying to figure out how [they] can apply this to a real life situation. I think it's too abstract. As a [former] consultant who went and did consulting work for different companies I found that When I was trying to use examples, the more close I could get to their ways of working and their ways of understanding the world, the better results.	On being asked on the merits of fantastical vs domain-specific setting	[1:43:31]
Ideator-02	I think it depends on where you want to. If you want to teach people about DCR, this could probably work. If you want to use DCR as a workflow tool in a company setting you might need to get at least a little closer.	On being asked on the merits of fantastical vs domain-specific setting	[1:45:37]

Ideator-02	Fog maybe the only thing that doesn't necessarily fit [in an office domain]. [In an office setting] of a nice forest, which which is bordered by these trees, it could just be a wall. I think it's fine to have the light. I can easily see how [the day/night cycle] can work. Natural light, the colors we just discussed, worked just fine when I was mapping out process flows.	On being asked on the merits of fantastical vs domain-specific setting	[1:46:51]
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Participant	Markings	Context	Timestamp
Ideator-02	We need to know [the excluded activity] is there, but we shouldn't care about it until [it's included]. So yes, throw transparency on it. Lots.	On asked about the visibility of excluded activities	[1:13:24]

Participant	Activities	Context	Timestamp
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Ideator-02	I think if it's executed maybe it should move to indicate that something has happened to it in some way. [...] Maybe you know turn, spin or something like that's been around to indicate that something is going on, cause then you know the difference between it's a static thing that's ready to start and then you have this thing that is moving because you know it's ongoing.	On being how visualize execution state change.	[54:07]
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Participant	Views	Context	Timestamp
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Ideator-02	<p>It depends on what we want. Do we want to know about it at all times, or do we want to know about it sometimes? If we if we want to keep an overview, we can show how the game will change if you execute an activity. If it's something that's critical to know beforehand we could have a small indicator when were looking at the map, just to show you that we aren't there yet, but then when you tab you get more details on why aren't we there yet.</p>	<p>On being asked when and where to visualize condition relations.</p>	[54:07]
Ideator-02	<p>Mouseover gives us more options if we want to [free up right clicking], which is often allows panning or more information. I really like mouse over interaction, because it's very simple. You get immediate feedback on what you're doing, but you're not committing. That's the most important part. Mouseover never commits.</p>	<p>On asked about how to allow the user to preview the effects of executing activities.</p>	[1:30:34]

Ideator-02	When previewing the activity [I can navigating and cancel the preview]. Alternatively, when you preview an activity, you get to fly up and see get the overview.	On asked about how to allow the user to preview the effects of executing activities.	[1:33:31]
Ideator-02	However, if I'm able to see the [process] from up here, why would I ever want to watch it in first person?	On asked about how to allow the user to preview the effects of executing activities.	[1:35:32]

Participant	Markings	Context	Timestamp
Ideator-02	Well, those I cannot see actually the difference between one and the other one.	On being asked about the difference between many sparkles (idea for un-executed activity) and few sparkles (executed activity)	[19:20]
Ideator-02	Maybe it makes more sense to have it like a a beam of light on it to indicate to indicate "Ohh, look over here there's something." And then maybe there's some, you know, some God ray around it, like "Ohh, you want to go and touch it?"	On being asked how to visualize un-executed activities	[1:05:5]

Ideator-02	I think it makes sense to that when the activity executes, sparks shoot out, the God ray disappears and the activity starts shining and bobbing instead	On being asked how to visualize un-executed activities	[1:09:08]
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Participant	Process	Context	Timestamp
Ideator-03	That is like noon, I suppose. And then we have the sunset, and then we have actually at night. But between those steps, I don't really recognize actually from the sunset and to until the night, I cannot recognize the difference between both of them.	On being asked about the difference between day (process is accepting), sunset (pending activities), night (pending activities with milestones).	[20:12]
Ideator-03	I mean in terms of light, I was thinking about a theater when everything is finished in a theater and everything, everybody's gone.	When asked how to signal a global state change, i.e., accepting/non-accepting.	[55:15]

1.5.5 Ideation Interview 05 - Ideator 05

Participant	Enabled	Context	Timestamp
Ideator-05	So for me enabledness [...] that is composed by inclusion, pending, executed and not disabled. What are good metaphors for that?	On being asked what is important when they navigate a DCR graph	[00:05:41]

Participant	Relations	Context	Timestamp
Ideator-05	If it's in simulation mode I will basically look at the derived property of is enabled, so that's the. I would direct my attention to the visual clue that tells me whether an event is enabled or not.	On being asked what is important when they navigate a DCR graph	[00:00:18]
Ideator-05	But I can also ask when can I execute B? [...] I'm in a state in which I cannot really execute it right now. So how do I get there?	On being asked what is important when they navigate a DCR graph	[00:02:38]
Ideator-05	[Allowing the player to move backwards thorough their execution history] would be nice, yes.	On being asked whether execution history and backtracking would be useful.	[00:05:41]
Ideator-05	I think I do not need the full path, but I need some indications that I'm not going over and over in the same loop, I need some indications of what are the next two or three stages, whether the these two three stages are somehow helping me to [my goal], but I don't need every single step on the way.	On being asked whether seeing all relations concurrently would be useful.	[00:07:52]

Ideator-05	I think if if I get too much data it would get too cluttered, so it's like my my attention would go "plop".	On being asked whether seeing all relations concurrently would be useful.	[00:08:33]
Ideator-05	Why I cannot execute B? I go back to B and then I see that B has 3 padlocks. OK, where do I get the keys from these padlocks?	On being asked how they envision guiding the player.	[00:09:52]

1.5.6 Ideation Interview 06 - Ideator 06

Participant	Views	Context	Timestamp
Ideator-06	If I have to make an educated guess, I would imagine that like the point and click type of interface. Is probably going to reduce like the focus on the controls and increase the focus on the activities	On asked about the most sensible choice of player perspective.	[00:13:55]

Ideator-06	<p>You have an objective within the game and that objective is not to be a commercial success or anything beyond people being given tasks to actually perform. So my point with that is simply that if you add some levels of metaphor, you risk like to fail on the the actual objective of the game. People will play the game anyway because they are tasked to do it. I'm not an expert in gamification and serious games, but I would be worried that like people would have a hard time like relating back to the scenario that they actually need to apply those relations on if you create any form of like abstraction or metaphor which is not using with domain context.</p>	<p>On being asked about fantastical versus domain specific settings</p>	[00:18:51]
Ideator-06	<p>I don't feel there is like a right answer other than like a whatever you're doing, it should be visible to the user like using keyboard shortcuts, for instance.</p>	<p>On being asked about on-screen menus versus keyboard shortcuts.</p>	[00:22:57]

Ideator-06	<p>Suspension of disbelief is this idea where, when consuming any form of narrative or like entertainment, you're accepting the relations of the world you are actually involved in. Putting a waste paper basket like a in a fantasy scenario has like the high risk of actually breaking the suspension of disbelief, because it breaks the internal relations of the environment you have created in terms of like what you're talking about there.</p>	<p>On being asked about the risks of placing domain specific elements in a fantastical setting</p>	[00:25:45]
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1.6 Appendix E - Ideation Coding 2

#	Participant	Fragment
1	Ideator-03	[process] <i>I mean in terms of light, I was thinking about a theater when everything is finished in a theater and everything, everybody's gone.</i>
2	Ideator-03	[process] <i>That is like noon [(process is accepting)], I suppose. And then we have the sunset [(pending activities)], and then we have actually at night. But between those steps, I don't really recognize actually from the sunset and to until the night [(pending activities with milestones)], I cannot recognize the difference between both of them.</i>
3	Ideator-02	[activity] <i>I think it's very hard to avoid using iconography and the main reason I'm saying is saying this is because you don't want players to use their their mental capacity on learning to use the tool you want them to.</i>
4	Ideator-02	[relations] <i>How is that connecting could still make a wire between those two that you have a staff member in the bed grabbing a phone. You see the telephone wire to the phone at the office, and when he calls, it'll light up. So you know, OK, he does something. Then the cable is lighting up or something, you know, and then start moving and you have some some noise. Maybe it explodes in a enabled you know, achievement unlocked.</i>
5	Ideator-02	[relations] <i>Now an obvious way of doing this is making a path between those two in our world to vary, but that's very much related to an arrow, so I don't know.</i>
6	Ideator-02	[relations] <i>I'm thinking a highway with lanes inside, and each lane represents a condition.</i>
7	Ideator-02	[relations] <i>[As an alternative to labelled buttons] We would, if we were keeping the highway Rd metaphor, we would of course be a car. You know you can, or maybe it's a train.</i>

8	Ideator-02	[relations] <i>o you could have it so if we have paths going from things you know with small Rd people walking or whatever, and then we have a path directly from the the in to the church and we can see that no one walks from the end to the church, but we see that people are walking from the church to the inn. I mean, I guess if we trigger it, we need to see what happens, right? So in that case, I would imagine that we then see a drunk cool follow me along now that that then walks to the church and then someone would be like, no, you're not getting in here. And then we might consider these people who come from the inn in a good color code. Maybe in yellow.</i>
9	Ideator-03	[relations: condition and milestone] <i>I was thinking like to create a great scale of colors and that part and then if you move outside of that area that is disabled and then you can start seeing the colors, they'll natural colors of the environment. example, if you have an area that is disabled [...] I will put it in Gray colors like in black, white and then if you go out of that area that is disabled and then you can start seeing the colors that like the yeah, they're all rainbow.</i>
10	Ideator-02	[relations: condition and milestone] <i>In my mind, a condition is typically represented by a door, you know, the door opens when something has been achieved, right?</i>
11	Ideator-02	[relations: condition and milestone] <i>So if I want to see a process, there will be something at the beginning. Then in this case, example, you said yourself the staff member calls in sick, so I could imagine this could be fun, but I don't know if it's a good idea that you know if phone is calling and then you actually go, then you you pick up the phone in a virtual environment and then you can see once it picked up then suddenly and you answered then you can see. OK, here's the shift planner suddenly showing up as well and starting to to make sounds.</i>
12	Ideator-02	[relations: condition and milestone] <i>Now, what happens then? Then we have to look at all the conditions. And what is then required? So when I answer the call, then suddenly the shift planner will show up, right and the and and be like OK, you need to do something over here in order to make sure we can call in staff.</i>
13	Ideator-02	[relations: condition and milestone] <i>What I would do is make the 'call in staff' option greyed out, literally disabled, until something happens with the assigned shift planner.</i>

14	Ideator-02	[relations: condition and milestone] <i>[When a user clicks a disabled activity] everything that it is a condition of would then take its attention. Maybe would shake, maybe it would have a sound.</i>
15	Ideator-02	[relations: condition and milestone] <i>What if we model it one-to-one in the 3D environment where we can actually visualize the different relevant parts? instance, when there's a phone call, a phone appears, and it rings. Since you have two ears, you can discern the sound's origin.</i>
16	Ideator-02	[relations: condition and milestone] <i>I'm not sure about which actions need to be done there, but once that's correct, it will light the path and then enable the 'call in staff' option, you know, if other conditions are me</i>
17	Ideator-02	[relations: condition and milestone] <i>I think that [some kind of color colored colored physical link between activities to indicate their status] is the safe bet.</i>
18	Ideator-02	[relations: condition and milestone] <i>When I click the make sandwich it should somehow highlighted these conditions aren't met right? Light them up.</i>
19	Ideator-02	[relations: condition and milestone] <i>[Only rules related to the latest selection should light up]. I think it's very important that we need to show what's in and what's out, so to speak, right?</i>
20	Ideator-02	[relations: condition and milestone] <i>It depends on what we want. Do we want to know about [a rule] at all times, or do we want to know about it sometimes? If we if we want to keep an overview, we can show how the game will change if you execute an activity. If it's something that's critical to know beforehand we could have a small indicator when were looking at the map, just to show you that we aren't there yet, but then when you tab you get more details on why aren't we there yet.</i>

21	Ideator-02	[relations: condition and milestone] <i>I mean the obvious one is some kind of progress bar somewhere, right? [...] I would definitely recommend having some kind of calendar so you can see how many are we talking about. Otherwise it might get too abstract, especially one to end a situation where there are a lot of stuff that needs to be a lot of activities. We need to make sure that we actually that actually getting active because it's it's easy if it's only two or three activities need to be active, but once you have like 10 or 11 gets really hard to to do it without something concrete that you can take a look at. It could be a circular diagram where it's like, you know, like when you play Trivial Pursuit, you have the different cheese that gets filled out as you progress.</i>
22	Ideator-02	[relations: condition and milestone] <i>I was just thinking maybe if you color code of the light between the the pinning activity and the milestone then you get an immediate one-to-one. You see "oh, this is red, this is green. You just add more color, right, different color sources. example, if there's a pending activity influencing three or four milestones, then you should have three or four light sources on the activity. Then you could start turning off the lights as they actually become non-pending. That also solved the thing that we talked about earlier about showing progression. You can even have it like disco laser lights.</i>
23	Ideator-03	[relations: condition and milestone] <i>I was thinking like to reduce the kind of smoke step by step every time that you do on a task and then we'll do a start just removing the smoke until you can see the completed image.</i>
24	Ideator-05	[relations: condition and milestone] <i>Why I cannot execute B? I go back to B and then I see that B has 3 padlocks. OK, where do I get the keys from these padlocks?</i>
25	Ideator-03	[relations: condition and milestone] <i>You need to do something before and then also you will use light to show what thing you have to do before is</i>
26	Ideator-03	[relations: condition and milestone] <i>You can perceive the [offscreen] light because the colors of all space change and then that light can give you a perception that you have to move to see where the light actually is.</i>

27	Ideator-03	[environment] <i>They actually feel happier being involved in these kind of environments, completely different, because sometimes they they don't have the opportunity to be to be there and then it's actually more simple. I mean, I think that it's not a problem, in my humble opinion, of course, because I don't really know what kind of stakeholder do you have.</i>
28	Ideator-02	[environment] <i>I think that if we go with a fantasy world, those people you're using to validate it on will need to learn the abstractions of the system itself, but also need to spend time trying to figure out how [they] can apply this to a real life situation. I think it's too abstract. As a [former] consultant who went and did consulting work different companies I found that When I was trying to use examples, the more close I could get to their ways of working and their ways of understanding the world, the better results.</i>
29	Ideator-02	[environment] <i>I think it depends on where you want to. If you want to teach people about DCR, this could probably work. If you want to use DCR as a workflow tool in a company setting you might need to get at least a little closer.</i>
30	Ideator-02	[environment] <i>Fog maybe the only thing that doesn't necessarily fit [in an office domain]. [In an office setting] of a nice forest, which which is bordered by these trees, it could just be a wall. I think it's fine to have the light. I can easily see how [the day/night cycle] can work. Natural light, the colors we just discussed, worked just fine when I was mapping out process flows.</i>
31	Ideator-06	[environment] <i>You have an objective within the game and that objective is not to be a commercial success or anything beyond people being given tasks to actually perform. So my point with that is simply that if you add some levels of metaphor, you risk like to fail on the the actual objective of the game. People will play the game anyway because they are tasked to do it. I'm not an expert in gamification and serious games, but I would be worried that like people would have a hard time like relating back to the scenario that they actually need to apply those rules on if you create any form of like abstraction or metaphor which is not using with domain context.</i>
32	Ideator-02	[markings: disabled] <i>Make [a disabled] button grayscale and make it stop spinning.</i>

33	Ideator-03	[markings: disabled and enabled] <i>I use shadows and light at the same time.</i>
34	Ideator-02	[markings: disabled and enabled] <i>I think it's a Disney has a some game. I don't remember where it is that some areas, if the conditions aren't met, yet there'll be a cloud and will be dark and look super spooky. But once conditions are met, it'll clear up and be sunny, you know, and all that. And then you feel, oh, I want to go over there now. Because now it's more welcoming and warm.</i>
35	Ideator-02	[markings: executed] <i>I think if it's executed maybe it should move to indicate that something has happened to it in some way. [...] Maybe you know turn, spin or something like that's been around to indicate that something is going on, cause then you know the difference between it's a static thing that's ready to start and then you have this thing that is moving because you know it's ongoing.</i>
36	Ideator-03	[markings: executed] <i>Well, those I cannot see actually the difference between [many sparkles (un-executed activity)] and [few sparkles (executed activity)].</i>
37	Ideator-02	[markings: un-executed] <i>Maybe it makes more sense to have it like a a beam of light on it to indicate to indicate "Ohh, look over here there's something." And then maybe there's some, you know, some God ray around it, like "Ohh, you want to go and touch it?", then I think it makes sense to that when the activity executes, sparks shoot out, the God ray disappears and the activity starts shining and bobbing instead.</i>
38	Ideator-02	[markings: excluded] <i>We need to know [the excluded activity] is there, but we shouldn't care about it until [it's included]. So yes, throw transparency on it. Lots.</i>
39	Ideator-02	[markings: pending] <i>So if it's pending right now, I'm thinking it's pulsing, you know, take attention over here because, you know, we need to figure out why is this pending?</i>
40	Ideator-02	[navigation] <i>You know, some games at the top have this compass kind of thing.</i>
41	Ideator-02	[navigation] <i>[draws a speech balloon on the edge of the screen] then when you start looking around, this will move through no until it gets at least into the field of vision</i>

42	Ideator-02	[navigation] <i>Just writing here between the two activities it says pans, so in. So instead of having an arrow, we actually move the camera, in this case, right?</i>
43	Ideator-02	[navigation] <i>[panning] must never happen automatically. It has to be a user action.</i>
44	Ideator-05	[navigation] <i>If it's in simulation mode I will basically look at the derived property of is enabled, so that's the. I would direct my attention to the visual clue that tells me whether an event is enabled or not.</i>
45	Ideator-05	[navigation] <i>But I can also ask when can I execute B? [...] I'm in a state in which I cannot really execute it right now. So how do I get there</i>
46	Ideator-05	[navigation] <i>So for me enabledness [...] that is composed by inclusion, pending, executed and not disabled. What are good metaphors for that?</i>
47	Ideator-05	[navigation] <i>[Allowing the player to move backwards thorough their execution history] would be nice, yes.</i>
48	Ideator-05	[navigation] <i>I think I do not need the full path, but I need some indications that I'm not going over and over in the same loop, I need some indications of what are the next two or three stages, whether the these two three stages are somehow helping me to [my goal], but I don't need every single step on the way.</i>
49	Ideator-02	[Views] <i>[On panning to points of interest] I would put a big fat button that says go to and another one in that says return.</i>
50	Ideator-06	[Views] <i>If I have to make an educated guess, I would imagine that like the point and click type of interface. Is probably going to reduce like the focus on the controls and increase the focus on the activities</i>
51	Ideator-06	[Views] <i>I don't feel there is like a right answer other than like a whatever you're doing, it should be visible to the user like using keyboard shortcuts, for instance.</i>
52	Ideator-02	[environment] <i>I would go back to what we already discussed based on what we know from at least the UX field of research that we know that. Movement and sound are too ways to catch people's attention.</i>
53	Ideator-02	[environment] <i>So movement can also have, you know, personality. It can be very aggressive, it can be calm and we can use that for, you know, how severe the information is to communicate.</i>

54	Ideator-02	[environment] <i>If it's super important, something you have to do something about right now, it should take all the attention. And that's why I would also add sound effects.</i>
55	Ideator-02	[environment] <i>Not only does it move, it also makes a sound, but also makes the light suddenly move not only itself.</i>
56	Ideator-02	[environment] <i>You can even if you if it's not important to look at very often, they can just be very slow movement, because if it's very slow, we will not.</i>
57	Ideator-02	[environment] <i>[activities] we can use movement to say example, OK, everything's going on. Maybe it's just in a small floaty state, and if it breaks down we put some great dark colors on it. Stops moving, so we know this is no longer active.</i>
58	Ideator-02	[environment] <i>example include/exclude that could possibly be a, you know, a traffic light, green light, red light, yellow light, right ohm if it's green light it means that this includes over here this this is ready to continue if it's red light is because it's stopped some reason maybe it's been excluded.</i>
59	Ideator-02	[environment] <i>So you can use iconography in that way to to communicate [activities]? Or a pause button which we also know from from using it. Everyone knows play. Pause. That's something we can relate to, right? Or even a stop if it's excluding something, we stop it possibly.</i>
60	Ideator-02	[environment] <i>Green means done. Think pretty much in all cultures, green is kind of like, yeah, yeah, yeah, yeah. And then among usual color when it's not yet, I wouldn't put red because red is a, you know. But then again, red means something is wrong.</i>
61	Ideator-02	[environment] <i>Mouseover gives us more options if we want to [free up right clicking], which is often allows panning or more information. I really like mouse over interaction, because it's very simple. You get immediate feedback on what you're doing, but you're not committing. That's the most important part. Mouseover never commits.</i>
62	Ideator-02	[environment] <i>When previewing the activity [I can navigating and cancel the preview]. Alternatively, when you preview an activity, you get to fly up and see get the overview.</i>

63	Ideator-02	[environment] <i>However, if I'm able to see the [process] from up here, why would I ever want to watch it in first person?</i>
64	Ideator-05	[environment] <i>I think if I get too much data it would get too cluttered, so it's like my my attention would go "plop".</i>
65	Ideator-06	[environment] <i>Suspension of disbelief is this idea where, when consuming any form of narrative or like entertainment, you're accepting the rules of the world you are actually involved in. Putting a waste paper basket like a in a fantasy scenario has like the high risk of actually breaking the suspension of disbelief, because it breaks the internal rules of the environment you have created in terms of like what you're talking about there.</i>

1.7 Appendix F - Ideation Coding 3

Element	Animation	Color	Domain	Effects	Light	Object	Sound	UI
process: ac- cept- ing					1, 2			
activities								3
relations: con- dition and mile- stone	14	13		23	9, 16, 17, 19, 22, 25, 26	4, 5, 6, 7, 8, 10, 11, 12, 15, 16, 17, 20	14	21, 24, 25, 26
Environment			27, 28, 29, 31	30				
markings: dis- abled	32	32		33, 34	33, 34			
markings: exe- cuted	35			36				
markings: un- executed				37	37			
markings: ex- cluded		38						
markings: pend- ing	39				39			
environment								40, 41, 42, 43, 44, 45, 46, 47, 48

View	52, 53, 55, 56, 57	57, 58, 60	65		55		52, 54, 55	49, 50, 51, 59, 61, 62, 63, 64
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1.8 G - Validation Coding 1

1.8.1 Validation Interview 01 - Validator 01

Participant	2D DCR representation	Context	Timestamp
Validator 1	It signals that it's okay, I think. I can move on. Then I go to number two and press execute there. And it also turned green and fine. So that activity is completed.	On being asked on the meaning of the green checkmark	[00:02:46]
Validator 1	I think maybe something orange appeared. I'm actually not sure.	On being asked about the effect of executing an activity on the state of the process overview.	[00:03:08]
Validator 1	There are [...] some exclamation marks. Yes, so there must be something I need to pay attention to. Maybe something where I need to provide input or something similar, but I can't do anything here. I can't click on anything. It could be that there is something that needs to be done. Something that needs active consideration, perhaps? The exclamation marks draw attention to something. But there's not much that directly tells me what to do here.	On being asked about the meaning of the blue arrows	[00:03:50]

Validator 1	It's illogical to me that one must do 3 and 5 before you can do 4.	Commenting on the discrepancy between the numerical labels and the non-linear structure of the graph.	[00:06:18]
Validator 1	If it was something temporary, an option or a fallback or something similar, it could be something we don't need after all. [...] It's something it removes, I think. It's something else you do, make an intermediate calculation, and then it's no longer needed, so away with it. I think that, I don't know, but you do.	On being asked about the meaning of the read arrow and the target state change of the target activity upon source activity execution.	[00:07:53]
Validator 1	No, because then someone like me might think of trying 6 and 4. I can start from the back, so now I press there. And a checkmark appears, apparently, you can start with that one. There's nothing indicating you can't start with it. Normally, when it's in sequence, you'd think you have to follow it, but here you don't need to. So now this one is fixed, and the number five is gone, strangely enough.	On being prompted to try executing an activity in the lower part of the graph first.	[00:09:14]

Validator 1	It's an arrow that runs both ways. That's the thing... There is an arrow at both ends of the line, so I think something goes back and forth.	Commenting on the *- \hookleftarrow shape of the response relation.	[00:14:48]
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Participant	Canonical 3D DCR representation	Context	Timestamp
Validator 1	I can't pass through here, there's something jumping up and down. Now it's blocking, and now I'm let in so I can pass on. Now I've figured out, I have to press the button, so I can go under it [...] so I can move on. And then suddenly it's a different color.	Commenting on jumping box animation, which denotes an executed activity in the Canonical 3D DCR representation.	[00:20:30]
Validator 1	I haven't tried that, but I will definitely try. I can do that easily, so I really don't need to wait for it.	On being asked if they could go around the jumping box	[00:26:16]
Validator 1	But it just signals that the next step is open, as I see it.	On being asked the purpose of the jumping box	[00:26:45]
Validator 1	It's something to do with time.	On being asked about the meaning of the global switch from day (accepting) to night (non-accepting).	[00:27:52]

Validator 1	Or it needs to process something. Something needs to be considered before moving on.	On being asked about the meaning of the global switch from day (accepting) to night (non-accepting).	[00:28:31]
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Participant	Domain specific 3D DCR representation	Context	Timestamp
Validator 1	No.	On being asked if they noticed the fog effect on the disabled activities.	[00:30:43]
Validator 1	This didn't give me a very good insight into the process	Commenting on their experience with the process representation.	[00:33:15]
Validator 1	I like the DSB journey planner, you know? 1, 2, 3, 4... Here there was a lot of back and forth. That might be easier for some, but for my brain, it's better to have something more concrete like 2, 3, 4, 5, 6. And you can even have splits, like... 2, 3, boom, and then you go back again. But this was not for me.	Commenting on their experience with the process representation.	[00:33:28]

Validator 1	When I was doing this, I didn't get much into it, I almost didn't even see what was written, because I was looking for where it lit up next. All that written there, it's probably made into a nice little story. I didn't pay much attention to it, because I was focused on where to go next.	Commenting on their experience with the process representation.	[00:34:09]
Validator 1	There are these little stars that tell me where to start. Where something is going on.	Commenting on the glitter effect on un-executed activities.	[00:35:40]
Validator 1	I can't press... Oh, it seems I could.	On realizing that activities can be executed more than once.	[00:35:46]
Validator 1	To me green signales, like the tick mark, that everything is okay.	Commenting in the buttons turning green upon activity execution.	[00:35:53]
Validator 1	And now I can see the moon, so it will take some time... but it shouldn't take long to register someone calling in sick. And I click and there, it became light again. But you can see that something isn't adding up...	Musing on the meaning of global state change from day to night and back again (accepting/non-accepting state).	[00:36:06]

Validator 1	It's a tool for calling in sick.	On being asked about the meaning of the phone jumping upon activity execution.	[00:36:41]
Validator 1	So I expect that those light columns [...] are where I have to do something. As you can see, so I just have to go into them, and well, then they're gone.	Commenting on the meaning of the light columns that accompany newly included, un-executed activities.	[00:38:23]
Validator 1	So everything's okay, because that's what I expect, when it jumps up and down. Then it's like, the place is completed, also a bit like a check mark, right?	Commenting on the activity animation functioning as a check mark.	[00:39:35]

1.8.2 Validation Interview 02 - Validator 02

Participant	Canonical 3D DCR representation	Context	Timestamp
Validator 2	I pressed the button [...] Some green light came out [...] That means I can move on, it being green.	On being asked what happened when an execute activity button was pressed.	[00:00:50]
Validator 2	I certainly can't get past those things. I can get past but I can't get over them. Or through them.	Reflecting on the static cubes waiting to bounce upon activity execution.	[00:02:37]

Participant	2D DCR representation	Context	Timestamp
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Validator 2	Well, I think it's green and active, so that's where I think I can start. Then I think maybe this one activates afterward. The one that is yellow, it seems like something needs to be done here before I can do that.	Commenting on the colors of the activities and rules.	[00:03:23]
Validator 2	There are some exclamation marks. I wonder if that means I have run them before I can go down there.	Commenting on the pending icons.	[00:05:09]
Validator 2	There's a percentage mark on it? I honestly don't know. Maybe that something isn't active?	On being asked about the red exclude rule.	[00:05:32]
Validator 2	It seems like activity 4 is dependent on me having executed 3 and 5.	Commenting on the milestone relation.	[00:06:03]

Participant	Canonical 3D DCR representation with domain specific labels	Context	Timestamp
Validator 2	There's a bunch of smoke there. I don't want to go there.	Commenting on a disabled activity.	[00:11:01]

Validator 2	I think that those are dependent on these completed activities, but it's also because I have cheated a little by peeking at the buttons, so the fog in and of itself does not make me think that this is dependent on that.	On being asked about the fog effect on the disabled activities.	[00:14:14]
Validator 2	If there was a closed door, that would more indicate to me that I needed to do something before being able to do this.	On being asked about the fog effect on the disabled activities.	[00:14:33]
Validator 2	Nope that burned my fingers [...] That one started to glitter, so I think that means i need to activate it before I can activate this.	On pressing a disabled button and triggering a glitter effect on a condition activity.	[00:14:59]
Validator 2	The fog has disappeared and this activity over here is glittering with some green glitter. I'll interpret that as a signal that this needs to be executed. Also that button is now blue.	On executing a condition activity.	[00:15:32]
Validator 2	In any event I have executed this activity and that one is jumping, which I expect means that I have completed the task.	On executing an activity.	[00:15:47]

Validator 2	I think that I have turned off the task in a way or another. So either I should find a place to light it again, or... [...] The name of the button indicates that it is necessary, I think. It's about the manager wanting to be informed, but it could also be that it was only if I chose to select that something exceeded the budget. Well then, that one lit up again so. it might be that I should get permission from the manager to exceed the budget. I lit that one up again. I prefer that one. So now it's within the budget, that one is jumping it's completed. It's not necessary to inform the manager.	On experiment- ing with mutually excluding activites.	[00:20:03]
Validator 2	This one has a spotlight on it. It want's to be pressed, I feel.	On noticing a pend- ing activity.	[00:21:41]

Participant	Domain specific 3D DCR repre- sentation	Context	Timestamp
Validator 2	Now it got dark outside. I still haven't quite... Why is it night? I haven't... Why is it night?	On the global state switching to night (non-accepting state).	[00:26:02]

Validator 2	I think this one, since there's a spotlight on it and there's glitter coming up, I think this is what I should do next. I think it's like a hint, come over here [...] So I think, I'm going over here now. And then I press on. This one. Oh, then it became light again.	On triggering a pending state.	[00:26:46]
Validator 2	I can see that maybe it's the darkness so that you can see the spotlight even more. And when I have solved this task in the spotlight and the glitter is gone, then it can become day again, then it's back to the normal flow, or whatever you call it.	On being asked if there is any relationship between the global lighting and the pending activities.	[00:27:44]
Validator 2	It could indicate that the blue ones are dependent on one of the white ones being done first.	On being asked the significance of a button being blue (a condition)	[00:29:43]
Validator 2	It's because I don't think I've been through all the steps. And this one is turned off.	On being asked why they did not execute the complete process activity immediately when it became available.	[00:33:19]

Validator 2	As it stands I think I am allowed to decide if I want to do it myself or if I want to involve the planner, because there's nothing telling me that I have to go into that room now, like there was with this room.	Comments on only some activities being conditions of reaching the goal.	[00:36:38]
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1.8.3 Validation Interview 03 - Validator 03

Participant	2D DCR representation	Context	Timestamp
Validator 3	It seems like if you have activity 2 active, you can choose either activity 3 or activity 5, and no matter which one of those two you choose, you can return to activity 4. But this is only if you want to go down to activity 6. For activity 5, you go directly to activity 6, not directly, but then you have two options at that activity.	On being asked to interpret the meaning of the rules in the 2D DCR representation.	[00:03:54]
Validator 3	It tells me that I have pressed 0, 1, 2 and 6 but not 3.	On being asked to describe the execution buttons in the 2D DCR graph simulation.	[00:06:36]

Participant	Canonical 3D DCR representation	Context	Timestamp
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Validator 3	There is a white box where something is hidden. You can see it moving up and down, suggesting something is concealed. It also shows me, when I hold it, that it is an activity. If I press on it, it turns green, and then I could imagine something, some text or something that could help me understand what it is. So, a box has been opened over here, the one in the corner. It's almost jumping, signaling that I need to do something. But I can't click on it. No, okay. So, nothing happens with it. It just stands and jumps, and it could be that the task is over there. I have no idea. So, I continue to the next activity. It might not be in that order, but that's what I do, can I?	On executing an activity, triggering a jumping animation on the cube object.	[00:11:54]
Validator 3	It definitely wants me to go over there and check out those activities.	On being asked about pending activities lighting up.	[00:14:39]
Validator 3	It means you probably won't be making it over there at all. You probably can't.	On being asked about the fog effect on a disabled activity.	[00:15:19]

Validator 3	Well this being blue tells me that I don't need to progress any further. If I could go back and click on activity 5 i expect it would be green instead.	On being asked about the dynamic coloring of buttons (blue signifying it being an un-executed condition).	[00:16:17]
Validator 3	It indicates an ongoing process. That's what I would say, but I don't know. It could be that when you finish, it stops moving. Because if you're engaged in these activities, you don't need to finish one to proceed with the next. You can work on several things at once.	On being asked about the meaning of the animated elements (signifying an activated activity).	[00:17:01]
Validator 3	But this one is green, and that means to me that you can still work on it, also because the boxes are jumping. The jumping boxes tell me that you can still work on it.	Commenting on the meaning of the green button and animated cubes.	[00:18:07]
Validator 3	This one is closed because it's white.	Commenting on button colors.	[00:18:37]

Validator 3	It could mean that the cloud indicated that you didn't really know what you were supposed to solve, and it's only something you can figure out after you have engaged in this activity. Before that, you can't start the process there, so maybe it was necessary to activate this process to move forward.	When asked to comment on the meaning of the fog disappearing when an activity becomes enabled.	[00:19:12]
Validator 3	It's gone gray. So it has kind of said we are no longer working on this. Maybe there was a choice? I'm not sure.	When asked to comment on an activity becoming excluded.	[00:20:19]

Participant	Canonical 3D DCR representation with domain-specific labels	Context	Timestamp
Validator 3	The light blue color doesn't really tell me anything. If it were red I'd want to push it, but I don't know what the blue color signifies.	When asked about the meaning of the colored execute activity button (un-executed condition).	[00:22:54]
Validator 3	It could be anything, but that's what I'm saying, the purple color doesn't really tell me anything. I can't see what the purple color signifies for me.	When asked about the meaning of the colored execute activity button (un-executed condition).	[00:22:58]

Validator 3	They are the same color, okay? They have the same colors and the one further ahead is misty and turquoise blue. I can only see it's white down here, so yes, I link them together.	After having their attention directed to similarly colored particles emitting from a disabled activity.	[00:27:17]
Validator 3	The one over here to the left that was there before turns white. That tells me that I can't use it anymore. It seems like I shouldn't use it anymore after making this choice.	Commenting on the meaning of a presence of a white button after an activity becomes enabled.	[00:27:45]
Validator 3	So there's an option, but it's white. I find the colors a bit disturbing. Yes.	On being asked if they associate the white colored buttons with inactivity.	[00:30:37]
Validator 3	So now it's just black instead of white, yes, yes, yes. But it's black, so in another way, it tells me it's not the right solution.	Commenting on an excluded activity turning transparent.	[00:33:16]

Validator 3	Well, then it's okay, but I don't know if it's because I've chosen not to go with that solution, so... And now it's... Well, it's difficult. It's difficult for me to visualize this other than now it seems like this. This is the best solution I have chosen and now I have, so I would say. Well, then I should choose again. That's how I feel, so I must try something else and. And think, I can't figure this out.	Commenting on an excluded activity removing a condition rule.	[00:34:08]
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Participant	Domain specific 3D DCR representation	Context	Timestamp
Validator 3	I have to start over here on the left, it looks like. A hospital, so the picture tells me that someone needs to call in sick.	Commenting on the inclusion of domain specific graphical assets.	[00:40:58]
Validator 3	The clouds disappear on the picture right over to the right, so I think that's where I should go next.	Commenting on a condition becoming enabled.	[00:41:16]
Validator 3	The little man, he becomes. He actually gets happy, he starts to jump. Like the boxes.	Commenting on executed activities becoming animated.	[00:42:23]

Validator 3	So these two, I can't see what order I should take them in. Now I'm just taking it in that order, because that's the order they lie in along the way here.	Musing on which activity to execute next.	[00:42:23]
Validator 3	Well, when everything I assigned an employee to consider, I actually... So I could have skipped everything else.	Upon being asked why the Complete Process activity is enabled.	[00:45:33]

1.8.4 Validation Interview 04 - Validator 04

Participant	2D DCR representation	Context	Timestamp
Validator 4	The check mark means success.	Commenting on an executed activity state change.	[00:04:36]
Validator 4	My guess is that the yellow means that it is not active. The activity is not in progress, so.	On being asked about the condition rule.	[00:05:35]
Validator 4	It is happening in parallel with something else.	On being asked about the meaning of the exclamation marks.	[00:08:10]
Validator 4	I would guess it means that they are currently running.	On being asked about the meaning of an activity being bordered green.	[00:14:19]
Validator 4	I think dotted means that it cannot run.	On being asked about disabled activities.	[00:15:09]
Validator 4	I think [the yellow arrow] means that A must have executed before B can execute.	On being asked about the meaning of the condition relation.	[00:15:52]

Validator 4	So [pending activity 1] and [pending activity 2] must have [executed] before [milestone activity] can execute.	On being asked about the pending and milestone rules.	[00:18:09]
Validator 4	I would guess it makes it inactive, so it doesn't "count" in this context	On being asked about the exclude rules.	[00:19:04]

Participant	Canonical 3D DCR representation	Context	Timestamp
Validator 4	I think it means it activates, like the check mark in the previous assignment.	On being asked about the bouncing cube and green particle emission when executing an activity.	[00:22:36]
Validator 4	Oh hey, I can execute multiple times.	On realizing that the button will shoot particles each time you click it.	[00:22:44]
Validator 4	It means that it is un-executed, but is executable.	On being asked about the meaning of a white button.	[00:23:31]
Validator 4	I think it means that it's locked.	On being asked about a transparent activity (excluded).	[00:24:11]
Validator 4	I think it means... something because the other activities aren't colored.	On being asked about a pending activity lighting up in color.	[00:24:11]

Participant	Domain specific 3D DCR representation	Context	Timestamp
Validator 4	I think it means that the process splits.	On being asked about the global lighting changing from day to night.	[00:32:51]

Validator 4	I can see a color coded lock and key so I guess I need to activate a blue thing in order to unlock it.	Commenting on the relation between the source and target of a condition rule.	[00:33:47]
Validator 4	I think that if it's gray, it means that. It requires that. You have to think about whether it was? It meant at least that the walls depend on whether it gets locked or unlocked, one can lock it unlocked by others. But and I think that. The interaction you have with the grayed out, it means that if you activate another. So it's the opposite. It requires so well, so the opposite. Of it being locked. Yes, that makes sense so if. So they really mean that they're not locked, and they are dependent on some processes, so they can read with light, whereas if they are gray, it means that they are the opposite. So if they get a response required that another state was where a state should be activated, then it means now inactive before it works.	On being asked to explain the difference between a disabled and an excluded activity.	[00:44:18]

Participant	Canonical 3D DCR representation with domain-specific labels	Context	Timestamp
Validator 4	I think it deactivates Inform Manager and activates Roster Exceeds Budget.	In being asked about an activity with an outgoing include and exclude rule.	[00:48:26]

1.8.5 Validation Interview 06 - Validator 06

Participant	Domain specific 3D DCR representation	Context	Timestamp
Validator 5	It's locked, so it's possible I need to use a key.	Commenting on a disabled activity.	[00:02:01]
Validator 5	There's a key that I presume I need for a lock.	Commenting on a condition activity.	00:02:43]
Validator 5	Now it's night again, so that means time has passed.	Commenting on the global state change to an un-accepting state.	00:03:33]
Validator 5	It's funny it seems like those particles are directing me to one of the other rooms.	Commenting on the look of the particles, when seen from above and at an angle.	[00:06:17]
Validator 5	I'm too lazy to read the text.	Commenting on their own behavioral pattern when exploring the graph.	[00:14:42]
Validator 5	The sounds help me by letting me know if I do something right or wrong.	Commenting on sound feedback when pushing activity execution buttons.	[00:15:34]
Validator 5	The [transparent activity] is not part of the available decision process.	Commenting on the excluded activities.	[00:18:07]

Validator 5	The activities I haven't interacted with seem to have particles.	Commenting on un-executed activities.	[00:20:11]
Validator 5	Okay I can see that I could also have chosen to cover the shift internally, rather than call people.	Commenting on a mutually excluding rule between two activities.	[00:24:26]

Participant	Canonical 3D DCR representation with domain-specific labels	Context	Timestamp
Validator 5	It doesn't seem like it's a logical place to start if you look at the text.	Commenting the non-linear nature of DCR.	[00:27:56]
Validator 5	[The activity lighting up] tells me that I should really execute it now.	Commenting on a pending activity.	[00:30:18]

Participant	Canonical 3D DCR representation	Context	Timestamp
Validator 5	I think maybe some actions require time to pass before something new can happen.	Commenting on the day/night changes that signify accepting/non-accepting states.	[00:30:18]

Participant	2D DCR representation	Context	Timestamp
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Validator 5	The ticks seem to signify that the choice was correct - even though you said that there were no incorrect choices (laughs).	On being asked the significance of green check marks.	[00:41:14]
Validator 5	It's a sort of flowchart. The arrows signify order of execution; if this then that.	On being asked to describe the significance of the arrows.	[00:41:18]
Validator 5	Green signifies a possible order of execution and red an impossible order of execution. Blue may also signify a possible execution. I don't know what the hierarchy is, except that red seems to be a "bad" act. Orange I'm not sure. It might signify a preceding act.	On being asked to describe the significance of the arrow color.	[00:42:15]
Validator 5	[The activity] is green now, which presumably means that it was better that I executed that first.	On being asked about the significance of disabled activity becoming enabled.	[00:48:27]

1.8.6 Validation Interview 06 - Validator 06

Participant	Domain specific 3D DCR representation	Context	Timestamp
Validator 6	[The activity descriptions] are written at the bottom of the screen.	Commenting on the activity labels.	[00:12:23]

Validator 6	There's a white divider, that must be the activity.	Commenting on the activity labels.	[00:12:54]
Validator 6	I think you need to click that thing if you want to execute something.	Commenting on the activity button.	[00:16:18]
Validator 6	It turned green so that means it's executed.	Commenting on the activity button.	[00:16:18]
Validator 6	So, I guess that the lock must mean there's something else I should do. A condition, I guess. I wonder if it won't let you know where the condition leads to, if you click on the lock.	Commenting on a disabled activity.	[00:18:31]
Validator 6	Does it come down again over there? Yes, it comes down again, I'm guessing on this one [...] should probably happen. It's clear [...] I need to perform that first.	Commenting on the matching colored glitter on pairs of disabled and condition activities.	[00:18:55]
Validator 6	Oh. Yes, the cage. It's been removed, and the lock is removed, so I can enter the room. Now I can do it, I understand that.	Commenting on the state change after executing the condition activity.	[00:20:21]
Validator 6	It's blinking, I guess it means it's pending.	On being asked about the meaning of the lit up and pulsing activity (pending).	[00:22:45]

Validator 6	Yes, okay, the graph became accepting, that's pretty clear.	On being asked about the change from day to night and back to day, before, during and after a pending activity.	[00:23:50]
Validator 6	One of the biggest challenges we talk about in processes and communicating this, is that people expect [a process to finish at some point], but it's very artificial. It doesn't exist in the real world.	Musing on the expectations of a process being done.	[00:24:47]
Validator 6	It's like it is removed. It's not included at the moment.	On being asked about a transparent activity (excluded).	[00:26:57]
Validator 6	Would it makes sense to say, that if an activity is enabled, but not executed, it will emit particles. Meaning you haven't done that yet.	On being asked to compare a white button with particles to a green button without.	[00:28:04]

Validator 6	I think, I would rather focus on whether whether an activity was pending and enabled. I would be quite indifferent whether or not it has executed [...] because that's a classic way of thinking. "If it's happened once, then it's probably not important to do it again", but frankly you don't know that. Because you might end up doing many things several times.	Commenting on the particles emitting from un-executed activities.	[00:29:09]
Validator 6	It must mean something has to happen. Does it mean pending again?	Commenting on the jumping animation on executed activities.	[00:34:04]

Validator 6	<p>We can show many states on an activity if you count them all. But you quickly find out that there's only really two that are interesting. [...]</p> <p>But it's because we come from a world of checklist, where having ticked the box is central. But now when its suddenly no longer central, people have a hard time letting go. People want control. [...]</p> <p>That's the challenge here; you have to let go of control to gain control, if you insist on having control like a checklist, then you end up doing something so rigid there's only one way to do it and then you really lose control. So people don't do it.</p>	<p>Commenting on what should be the focus of DCR.</p>	[00:34:04]
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Validator 6	The reason you have check-boxes is because when you look at them, you can see what you have done, and when you look down the list, it's here, so that's why it has value. But in a world where things move around and where things can become something you have to do again, what you have done becomes less important, and suddenly what you need to do becomes much more important. [...] I think we need to let go of the sequence, and we need to let go of that, like what makes us navigate.	Commenting on what should be the focus of DCR.	[00:37:15]
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Participant	Canonical 3D DCR representation with domain-specific labels	Context	Timestamp
Validator 7	There's a spinning box with a thing on top of it; a key. Then there's another box like the first one. And then in the back, it looks like there's a lock. It's the same color as the key that was over on the other side.	On being asked to describe two neighboring activities with a condition rule.	[00:02:48]

Validator 7	OK, it's getting bigger and smaller.	On being asked to about any noticable effects when mousing over the lock object. Question had to be amended with "animated" before subject could answer.	[00:05:07]
Validator 7	Well, it changes when when you hover the mouse over it so.	On being asked if the lock was interactive.	[00:05:36]
Validator 7	Umm that you need that key to open that lock.	On being asked if there was significance in the particles emitting from lock and key had the same color.	[00:06:13]
Validator 7	That you have to do something with the sphere and the cube in order to get the key.	On being asked the significance of the burst of green particles and subsequent animated sphere on an executed activity.	[00:06:42]
Validator 7	No. Because none of the shapes are solid, nothing happens when you hold the mouse over them.	On being asked if (and subsequently why not) they could interact with a transparent (excluded) activity.	[00:08:21]
Validator 7	You can interact with it now.	On being asked what the change from transparent to opaque means for the state of an activity.	[00:11:40]
Validator 7	Go to that area first.	On being asked what the lit up activity might compel.	[00:12:07]

Validator 7	Umm, that time has passed.	On being asked the meaning of the global lighting turning to night and back to day when a pending activity is executed.	[00:13:17]
Validator 7	With the locked door, you need to go find the key. Whereas with the the [transparent] shapes it's not as clear what you need to do to make them opaque.	On being asked the significance of transparent (excluded) activities vs. walled-off (disabled) activities.	[00:15:27]
Validator 7	If the roster is within budget, then you don't have to inform the manager.	On being asked the significance of executing A in the A -excludes- i B -condition- i rule structure.	[00:20:41]

Participant	Domain specific 3D DCR representation	Context	Timestamp
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Participant	2D DCR representation	Context	Timestamp
Validator 7	It's something you can interact with.	On being asked to comment on an activity with a solid green border.	[00:34:57]
Validator 7	The step is completed.	On being asked to comment on an activity with a check mark.	[00:35:56]
Validator 7	You need to focus your attention on it.	On being asked about the significance if an exclamation mark.	[00:36:37]

Validator 7	I'm not sure.	On being asked the significance of the blue arrow.	[00:37:14]
Validator 7	You can't do that.	On being asked the significance of the red arrow.	[00:42:21]
Validator 7	That that's the way you should go.	On being asked the significance of the green arrow.	[00:42:48]
Validator 08	I don't know.	On being asked the significance of the yellow arrow.	[00:43:46]

Participant	Canonical 3D DCR representation	Context	Timestamp
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1.9 Appendix H -Validation coding 2

#	Participant	Fragment
1	Validator-01	[2D DCR representation][1][marking:executed] <i>It signals that it's okay, I think. I can move on. Then I go to number two and press execute there. And it also turned green and fine. So that activity is completed.</i>
2	Validator-01	[2D DCR representation][1][relation:condition] <i>I think maybe something orange appeared. I'm actually not sure.</i>
3	Validator-01	[2D DCR representation][1][marking:pending] <i>There are [...] some exclamation marks. Yes, so there must be something I need to pay attention to. Maybe something where I need to provide input or something similar, but I can't do anything here. I can't click on anything. It could be that there is something that needs to be done. Something that needs active consideration, perhaps? The exclamation marks draw attention to something. But there's not much that directly tells me what to do here.</i>
4	Validator-01	[2D DCR representation][1][activities] <i>It's illogical to me that one must do 3 and 5 before you can do 4.</i>
5	Validator-01	[2D DCR representation][1][relation:excludes] <i>If it was something temporary, an option or a fallback or something similar, it could be something we don't need after all. [...] It's something it removes, I think. It's something else you do, make an intermediate calculation, and then it's no longer needed, so away with it. I think that, I don't know, but you do.</i>
6	Validator-01	[2D DCR representation][1][activities] <i>No, because then someone like me might think of trying 6 and 4. I can start from the back, so now I press there. And a checkmark appears, apparently, you can start with that one. There's nothing indicating you can't start with it. Normally, when it's in sequence, you'd think you have to follow it, but here you don't need to. So now this one is fixed, and the number five is gone, strangely enough.</i>
7	Validator-01	[2D DCR representation][1][relation:response] <i>It's an arrow that runs both ways. That's the thing... There is an arrow at both ends of the line, so I think something goes back and forth.</i>

8	Validator-01	[Canonical 3D DCR representation][2][marking:executed] <i>I can't pass through here, there's something jumping up and down. Now it's blocking, and now I'm let in so I can pass on. Now I've figured out, I have to press the button, so I can go under it [...] so I can move on. And then suddenly it's a different color.</i>
9	Validator-01	[Canonical 3D DCR representation][2][marking:executed] <i>I haven't tried [going around the box], but I will definitely try. I can do that easily, so I really don't need to wait for [the jumping box to clear].</i>
10	Validator-01	[Canonical 3D DCR representation][2][marking:executed] <i>[The jumping box] just signals that the next step is open, as I see it.</i>
11	Validator-01	[Canonical 3D DCR representation][2][process: accepting] <i>[The switch from day to night] has something to do with time.</i>
12	Validator-01	[Canonical 3D DCR representation][2][process: accepting] <i>Or [The switch from day to night] means that it needs to process something. Something needs to be considered before moving on.</i>
13	Validator-01	[Domain specific 3D DCR representation][4][marking: pending] <i>No [I did not notice the fog effect on the enabled activities.]</i>
14	Validator-01	[Domain specific 3D DCR representation][4][evaluation] <i>This didn't give me a very good insight into the process.</i>
15	Validator-01	[Domain specific 3D DCR representation][4][evaluation] <i>I like the DSB journey planner, you know? 1, 2, 3, 4... Here there was a lot of back and forth. That might be easier for some, but for my brain, it's better to have something more concrete like 2, 3, 4, 5, 6. And you can even have splits, like... 2, 3, boom, and then you go back again. But this was not for me.</i>
16	Validator-01	[Domain specific 3D DCR representation][4][activities] <i>When I was doing this, I didn't get much into it, I almost didn't even see what was written, because I was looking for where it lit up next. All that written there, it's probably made into a nice little story. I didn't pay much attention to it, because I was focused on where to go next.</i>

17	Validator-01	[Domain specific 3D DCR representation][4][marking: executed] <i>There are these little stars that tell me where to start. Where something is going on</i>
18	Validator-01	[Domain specific 3D DCR representation][4][marking:executed] <i>I can't press... Oh, it seems I could [execute an activity more than once]</i>
19	Validator-01	[Domain specific 3D DCR representation][4][accepting state] <i>And now I can see the moon, so it will take some time... but it shouldn't take long to register someone calling in sick. And I click and there, it became light again. But you can see that something isn't adding up...</i>
20	Validator-01	[Domain specific 3D DCR representation][4][marking:executed] <i>[The jumping phone] a tool for calling in sick.</i>
21	Validator-01	[Domain specific 3D DCR representation][4][marking: executed] <i>So I expect that those light columns [...] are where I have to do something. As you can see, so I just have to go into them, and well, then they're gone.</i>
22	Validator-01	[Domain specific 3D DCR representation][4][marking: executed] <i>So everything's okay, because that's what I expect, when it jumps up and down. Then it's like, the place is completed, also a bit like a check mark, right?</i>
23	Validator-02	[Canonical 3D DCR representation][1][marking: executed] <i>I pressed the button [...] Some green light came out [...] That means I can move on, it being green.</i>
24	Validator-02	[Canonical 3D DCR representation][1][marking: executed] <i>I certainly can't get past those [cubes]. I can get past but I can't get over them. Or through them.</i>
25	Validator-02	[2D DCR representation][2][marking: executed; relation: condition] <i>Well, [that button] is green and active, so that's where I think I can start. Then I think maybe this one activates afterward. The [pending] one that is yellow, it seems like something needs to be done here before I can do that.</i>
26	Validator-02	[2D DCR representation][2][marking: pending] <i>There are some exclamation marks. I wonder if that means I have run them before I can go down there.</i>
27	Validator-02	[2D DCR representation][2][relation: excludes] <i>There's a percentage mark on it? I honestly don't know. Maybe that something isn't active?</i>
28	Validator-02	[2D DCR representation][2][relation: milestone] <i>It seems like activity 4 is dependent on me having executed 3 and 5.</i>

29	Validator-02	[Canonical 3D DCR representation with domain specific labels][3][marking: enabled] <i>There's a bunch of smoke there. I don't want to go there.</i>
30	Validator-02	[Canonical 3D DCR representation with domain specific labels][3][marking:enabled] <i>I think that those are dependent on these completed activites, but it's also because I have cheated a little by peeking at the buttons, so the fog in and of itself does not make me think that this is dependent on that.</i>
31	Validator-02	[Canonical 3D DCR representation with domain specific labels][3][marking:enabled] <i>If there was a closed door, that would more indicate to me that I needed to do something before being able to do this.</i>
32	Validator-02	[Canonical 3D DCR representation with domain specific labels][3][marking:enabled] <i>Nope that burned my fingers [...] That one started to glitter, so I think that means i need to activate it before I can activate this.</i>
33	Validator-02	[Canonical 3D DCR representation with domain specific labels][3][marking: enabled] <i>The fog has disappeared and this activity over here is glittering with some green glitter. I'll interpret that as a signal that this needs to be executed. Also that button is now blue.</i>
34	Validator-02	[Canonical 3D DCR representation with domain specific labels][3][marking: executed] <i>In any event I have exectued this activity and that one is jumping, which I expect means that I have completed the task.</i>
35	Validator-02	[Canonical 3D DCR representation with domain specific labels][3][relation: excludes; relation: includes] <i>I think that I have turned off the task in a way or another. So either I should find a place to light it again, or... [...] The name of the button indicates that it is necessary, I think. It's about the manager wanting to be informed, but it could also be that it was only if I chose to select that something exceeded the budget. Well then, that one lit up again so. it might be that I should get permission from the manager to exceed the budget. I lit that one up again. I prefer that one. So now it's within the budget, that one is jumping it's completed. It's not necessary to inform the manager.</i>
36	Validator-02	[Domain specific 3D DCR representation][4][process: accepting] <i>Now it got dark outside. I still haven't quite... Why is it night? I haven't... Why is it night?</i>

37	Validator-02	[Domain specific 3D DCR representation][4][marking: pending] <i>I think this one, since there's a spotlight on it and there's glitter coming up, I think this is what I should do next. I think it's like a hint, come over here [...]. So I think, I'm going over here now. And then I press on. This one. Oh, then it became light again.</i>
38	Validator-02	[Domain specific 3D DCR representation][4][process: accepting] <i>I can see that maybe it's the darkness so that you can see the spotlight even more. And when I have solved this task in the spotlight and the glitter is gone, then it can become day again, then it's back to the normal flow, or whatever you call it.</i>
39	Validator-02	[Domain specific 3D DCR representation][4][relation: condition] <i>It could indicate that the blue [buttons] are dependent on one of the white ones being done first.</i>
40	Validator-02	[Domain specific 3D DCR representation][4][environment] <i>[I didn't execute the complete process activity immediately when it became available] because I didn't think I've been through all the steps.</i>
41	Validator-02	[Domain specific 3D DCR representation][4][environment] <i>As it stands I think I am allowed to decide if I want to do it myself or if I want to involve the planner, because there's nothing telling me that I have to go into that room now, like there was with this room.</i>
42	Validator-03	[2D DCR representation][1][relation: milestone; relation: exclude] <i>It seems like if you have activity 2 active, you can choose either activity 3 or activity 5, and no matter which one of those two you choose, you can return to activity 4. But this is only if you want to go down to activity 6. For activity 5, you go directly to activity 6, not directly, but then you have two options at that activity.</i>
43	Validator-03	[2D DCR representation][1][marking: executed] <i>[The execution buttons in the 2D DCR graph simulation] tell me that I have pressed 0, 1, 2 and 6 but not 3.</i>

44	Validator-03	[Canonical 3D DCR representation][2][marking: executed] <i>There is a white box where something is hidden. You can see it moving up and down, suggesting something is concealed. It also shows me, when I hold it, that it is an activity. If I press on it, it turns green, and then I could imagine something, some text or something that could help me understand what it is. So, a box has been opened over here, the one in the corner. It's almost jumping, signaling that I need to do something. But I can't click on it. No, okay. So, nothing happens with it. It just stands and jumps, and it could be that the task is over there. I have no idea. So, I continue to the next activity. It might not be in that order, but that's what I do, can I?</i>
45	Validator-03	[Canonical 3D DCR representation][2][marking: pending] <i>It definitely wants me to go over there and check out those activities.</i>
46	Validator-03	[Canonical 3D DCR representation][2][marking: enabled] <i>[The fog] means you probably won't be making it over there at all. You probably can't.</i>
47	Validator-03	[Canonical 3D DCR representation][2][relation: condition] <i>Well this [button] being blue tells me that I don't need to progress any further. If I could go back and click on activity 5 i expect it would be green instead.</i>
48	Validator-03	[Canonical 3D DCR representation][2][marking: executed] <i>It indicates an ongoing process. That's what I would say, but I don't know. It could be that when you finish, it stops moving. Because if you're engaged in these activities, you don't need to finish one to proceed with the next. You can work on several things at once.</i>
49	Validator-03	[Canonical 3D DCR representation][2][marking: executed] <i>But this one is green, and that means to me that you can still work on it, also because the boxes are jumping. The jumping boxes tell me that you can still work on it.</i>
50	Validator-03	[Canonical 3D DCR representation][2][marking: executed] <i>This [activity] is closed because [the button] is white.</i>

51	Validator-03	[Canonical 3D DCR representation][2][marking: enabled; relation: condition] <i>[The cloud disappearing] could mean that the cloud indicated that you didn't really know what you were supposed to solve, and it's only something you can figure out after you have engaged in this activity. Before that, you can't start the process there, so maybe it was necessary to activate this process to move forward.</i>
52	Validator-03	[Canonical 3D DCR representation][2][marking: included; relation: excludes; marking: included] <i>[The activity] has gone gray. So it has kind of said we are no longer working on this. Maybe there was a choice? I'm not sure.</i>
53	Validator-03	[Canonical 3D DCR representation with domain-specific labels][3][relation: condition] <i>The light blue color doesn't really tell me anything. If it were red I'd want to push it, but I don't know what the blue color signifies.</i>
54	Validator-03	[Canonical 3D DCR representation with domain-specific labels][3][relation: condition] <i>It could be anything, but that's what I'm saying, the purple color doesn't really tell me anything. I can't see what the purple color signifies for me.</i>
55	Validator-03	[Canonical 3D DCR representation with domain-specific labels][3][relation: condition] <i>[The button and the sparkles] are the same color, okay? They have the same colors and the one further ahead is misty and turquoise blue. I can only see it's white down here, so yes, I link them together.</i>
56	Validator-03	[Canonical 3D DCR representation with domain-specific labels][3][marking: enabled] <i>The one over here to the left that was there before turns white. That tells me that I can't use it anymore. It seems like I shouldn't use it anymore after making this choice.</i>
57	Validator-03	[Canonical 3D DCR representation with domain-specific labels][3][marking: enabled] <i>So there's an option, but [the button] is white. I find the colors a bit disturbing. Yes.</i>
58	Validator-03	[Canonical 3D DCR representation with domain-specific labels][3][marking: included] <i>So now it's just black instead of white, yes, yes, yes. But it's black, so in another way, it tells me it's not the right solution.</i>

59	Validator-03	[Canonical 3D DCR representation with domain-specific labels][3][marking: included; marking: enabled] <i>Well, then it's okay, but I don't know if it's because I've chosen not to go with that solution, so... And now it's... Well, it's difficult. It's difficult for me to visualize this other than now it seems like this. This is the best solution I have chosen and now I have, so I would say. Well, then I should choose again. That's how I feel, so I must try something else and. And think, I can't figure this out.</i>
60	Validator-03	[Domain specific 3D DCR representation][4][environment] <i>I have to start over here on the left, it looks like. A hospital, so the picture tells me that someone needs to call in sick.</i>
61	Validator-03	[Domain specific 3D DCR representation][4][marking: enabled] <i>The clouds disappear on the picture right over to the right, so I think that's where I should go next.</i>
62	Validator-03	[Domain specific 3D DCR representation][4][marking: executed] <i>The little man, he becomes. He actually gets happy, he starts to jump. Like the boxes.</i>
63	Validator-03	[Domain specific 3D DCR representation][4][environment] <i>So these two, I can't see what order I should take them in. Now I'm just taking it in that order, because that's the order they lie in along the way here.</i>
64	Validator-03	[Domain specific 3D DCR representation][4][environment] <i>Well, when everything I assigned an employee to consider, I actually... So I could have skipped everything else.</i>
65	Validator-04	[2D DCR representation][1][marking: executed] <i>The check mark means success.</i>
66	Validator-04	[2D DCR representation][1][relation: condition] <i>My guess is that the yellow means that it is not active. The activity is not in progress, so.</i>
67	Validator-04	[2D DCR representation][1][marking: pending] <i>[The exclamation marks mean that] it is happening in parallel with something else.</i>
68	Validator-04	[2D DCR representation][1][marking: enabled] <i>I would guess [the green color] means that they are currently running.</i>
69	Validator-04	[2D DCR representation][1][marking: enabled] <i>I think dotted means that it cannot run.</i>

70	Validator-04	[2D DCR representation][1][relation: condition] <i>I think [the yellow arrow] means that A must have executed before B can execute.</i>
71	Validator-04	[2D DCR representation][1][relation: milestone] <i>So [pending activity 1] and [pending activity 2] must have [executed] before [milestone activity] can execute.</i>
72	Validator-04	[2D DCR representation][1][relation: excludes] <i>I would guess it makes it inactive, so it doesn't "count" in this context</i>
73	Validator-04	[Canonical 3D DCR representation][2][marking: executed] <i>I think [the bouncing cube and green particle emission] means it activates, like the check mark in the previous assignment.</i>
74	Validator-04	[Canonical 3D DCR representation][2][marking: executed] <i>Oh hey, I can execute multiple times.</i>
75	Validator-04	[Canonical 3D DCR representation][2][marking: executed] <i>[The white button] means that it is un-executed, but is executable.</i>
76	Validator-04	[Canonical 3D DCR representation][2][marking: included] <i>I think it means that it's locked.</i>
77	Validator-04	[Canonical 3D DCR representation][2][marking: pending] <i>I think [an activity lighting up] means... something because the other activities aren't colored.</i>
78	Validator-04	[Domain specific 3D DCR representation][3][process: accepting] <i>I think [the global lighting changing to night] means that the process splits.</i>
79	Validator-04	[Domain specific 3D DCR representation][3][relation: condition] <i>I can see a color coded lock and key so I guess I need to activate a blue thing in order to unlock it.</i>

80	Validator-04	[Domain specific 3D DCR representation][3][marking: enabled; marking: included] <i>I think that if it's gray, it means that. It requires that. You have to think about whether it was? It meant at least that the walls depend on whether it gets locked or unlocked, one can lock it unlocked by others. But and I think that. The interaction you have with the grayed out, it means that if you activate another. So it's the opposite. It requires so well, so the opposite. Of it being locked. Yes, that makes sense so if. So they really mean that they're not locked, and they are dependent on some processes, so they can read with light, whereas if they are gray, it means that they are the opposite. So if they get a response required that another state was where a state should be activated, then it means now inactive before it works.</i>
81	Validator-04	[Canonical 3D DCR representation with domain-specific labels][4][relation: excludes; relation: includes] <i>I think it deactivates Inform Manager and activates Roster Exceeds Budget.</i>
82	Validator-05	[Domain specific 3D DCR representation][1][marking: enabled] <i>It's locked, so it's possible I need to use a key.</i>
83	Validator-05	[Domain specific 3D DCR representation][1][relation: condition] <i>There's a key that I presume I need for a lock.</i>
84	Validator-05	[Domain specific 3D DCR representation][1][process: accepting] <i>Now it's night again, so that means time has passed.</i>
85	Validator-05	[Domain specific 3D DCR representation][1][marking: executed] <i>It's funny it seems like those particles are directing me to one of the other rooms.</i>
86	Validator-05	[Domain specific 3D DCR representation][1][activities] <i>I'm too lazy to read the text.</i>
87	Validator-05	[Domain specific 3D DCR representation][1][marking: enabled] <i>The sounds help me by letting me know if I do something right or wrong.</i>
88	Validator-05	[Domain specific 3D DCR representation][1][marking: included] <i>The [transparent activity] is not part of the available decision process.</i>
89	Validator-05	[Domain specific 3D DCR representation][1][marking: executed] <i>The activities I haven't interacted with seem to have particles.</i>

90	Validator-05	[Domain specific 3D DCR representation][1][relation: exclude; relation: response] <i>Okay I can see that I could also have chosen to cover the shift internally, rather than call people.</i>
91	Validator-05	[Canonical 3D DCR representation with domain-specific labels][2][activities] <i>It doesn't seem like it's a logical place to start if you look at the text.</i>
92	Validator-05	[Canonical 3D DCR representation with domain-specific labels][2][marking: pending] <i>[The activity lighting up] tells me that I should really execute it now.</i>
93	Validator-05	[Canonical 3D DCR representation][3][process: accepting] <i>I think maybe some actions require time to pass before something new can happen.</i>
94	Validator-05	[2D DCR representation][4][marking: executed] <i>The ticks seem to signify that the choice was correct - even though you said that there were no incorrect choices (laughs).</i>
95	Validator-05	[2D DCR representation][4][environment] <i>It's a sort of flowchart. The arrows signify order of execution; if this then that.</i>
96	Validator-05	[2D DCR representation][4][relation: include; relation: exclude; relation: condition; relation: response] <i>Green signifies a possible order of execution and red an impossible order of execution. Blue may also signify a possible execution. I don't know what the hierarchy is, except that red seems to be a "bad" act. Orange I'm not sure. It might signify a preceding act.</i>
97	Validator-05	[2D DCR representation][4][marking: enabled] <i>[The activity] is green now, which presumably means that it was better that I executed that first.</i>
98	Validator-06	[Domain specific 3D DCR representation][1][activities] <i>[The activity descriptions] are written at the bottom of the screen.</i>
99	Validator-06	[Domain specific 3D DCR representation][1][environment] <i>There's a white divider, that must be the activity.</i>
100	Validator-06	[Domain specific 3D DCR representation][1][marking: executed] <i>I think you need to click that thing if you want to execute something.</i>
101	Validator-06	[Domain specific 3D DCR representation][1][marking: executed] <i>It turned green so that means it's executed</i>

102	Validator-06	[Domain specific 3D DCR representation][1][marking: enabled] <i>So, I guess that the lock must mean there's something else I should do. A condition, I guess. I wonder if it won't let you know where the condition leads to, if you click on the lock.</i>
103	Validator-06	[Domain specific 3D DCR representation][1][relation: condition] <i>Does it come down again over there? Yes, it comes down again, I'm guessing on this one [...] should probably happen. It's clear [...] I need to perform that first.</i>
104	Validator-06	[Domain specific 3D DCR representation][1][marking: enabled] <i>Oh. Yes, the cage. It's been removed, and the lock is removed, so I can enter the room. Now I can do it, I understand that.</i>
105	Validator-06	[Domain specific 3D DCR representation][1][marking: pending] <i>It's blinking, I guess it means it's pending.</i>
106	Validator-06	[Domain specific 3D DCR representation][1][process: accepting] <i>Yes, okay, the graph became accepting, that's pretty clear.</i>
107	Validator-06	[Domain specific 3D DCR representation][1][activities] <i>One of the biggest challenges we talk about in processes and communicating this, is that people expect [a process to finish at some point], but it's very artificial. It doesn't exist in the real world.</i>
108	Validator-06	[Domain specific 3D DCR representation][1][marking: included] <i>It's like it is removed. It's not included at the moment.</i>
109	Validator-06	[Domain specific 3D DCR representation][1][marking: enabled; marking: executed] <i>Would it make sense to say, that if an activity is enabled, but not executed, it will emit particles. Meaning you haven't done that yet.</i>
110	Validator-06	[Domain specific 3D DCR representation][1][marking: enabled; marking: executed] <i>I think, I would rather focus on whether whether an activity was pending and enabled. I would be quite indifferent whether or not it has executed [...] because that's a classic way of thinking. "If it's happened once, then it's probably not important to do it again", but frankly you don't know that. Because you might end up doing many things several times.</i>
111	Validator-06	[Domain specific 3D DCR representation][1][marking: executed] <i>[The jumping animation] must mean something has to happen. Does it mean pending again?</i>

112	Validator-06	[Domain specific 3D DCR representation][1][marking: executed] <i>We can show many states on an activity if you count them all. But you quickly find out that there's only really two that are interesting. [...] But it's because we come from a world of checklist, where having ticked the box is central. But now when its suddenly no longer central, people have a hard time letting go. People want control. [...] That's the challenge here; you have to let go of control to gain control, if you insist on having control like a checklist, then you end up doing something so rigid there's only one way to do it and then you really lose control. So people don't do it.</i>
113	Validator-07	[Canonical 3D DCR representation with domain-specific labels][1][relation: condition] <i>There's a spinning box with a thing on top of it; a key. Then there's another box like the first one. And then in the back, it looks like there's a lock. It's the same color as the key that was over on the other side.</i>
114	Validator-07	[Canonical 3D DCR representation with domain-specific labels][1][UI] <i>OK, [the lock] is getting bigger and smaller.</i>
115	Validator-07	[Canonical 3D DCR representation with domain-specific labels][1][UI] <i>Well, it changes when when you hover the mouse over it so [it might be interactive].</i>
116	Validator-07	[Canonical 3D DCR representation with domain-specific labels][1][relation: condition; relation: milestone] <i>[The matching particle colors signify] that you need that key to open that lock.</i>
117	Validator-07	[Canonical 3D DCR representation with domain-specific labels][1][marking: executed] <i>[The animated sphere means] that you have to do something with the sphere and the cube in order to get the key.</i>
118	Validator-07	[Canonical 3D DCR representation with domain-specific labels][1][marking: included] <i>[You cannot interact with a transparent activity] Because none of the shapes are are solid, nothing happens when you hold the mouse over them.</i>
119	Validator-07	[Canonical 3D DCR representation with domain-specific labels][1][marking: included] <i>[The change from transparent to opaque means that] you can interact with it now.</i>

120	Validator-07	[Canonical 3D DCR representation with domain-specific labels][1][marking: pending] <i>[A lit up area means that you should] go to that area first.</i>
121	Validator-07	[Canonical 3D DCR representation with domain-specific labels][1][process: accepting] <i>[The global light changing means] that time has passed.</i>
122	Validator-07	[Canonical 3D DCR representation with domain-specific labels][1][marking: enabled; marking: included] <i>With the locked door, you need to go find the key. Whereas with the the [transparent] shapes it's not as clear what you need to do to make them opaque.</i>
123	Validator-07	[Canonical 3D DCR representation with domain-specific labels][1][relation: excludes; relation: condition] <i>If the roster is within budget, then you don't have to inform the manager.</i>
124	Validator-07	[2D DCR representation][3][marking: enabled; marking: executed] <i>[An activity with a solid green border] is something you can interact with.</i>
125	Validator-07	[2D DCR representation][3][marking: executed] <i>[A check mark means that] the step is completed.</i>
126	Validator-07	[2D DCR representation][3][marking: pending] <i>[An exclamation mark means that] you need to focus your attention on it</i>
127	Validator-07	[2D DCR representation][3][relation: response] <i>I'm not sure.</i>
128	Validator-07	[2D DCR representation][3][relation: excludes] <i>You can't do that.</i>
129	Validator-07	[2D DCR representation][3][relation: includes] <i>That that's the way you should go.</i>
130	Validator-07	[2D DCR representation][3][relation: condition] <i>I don't know.</i>

1.10 Appendix I - Validation Coding 3.1

Table 1: Markings

Representation [order]	Included	Excluded	Pending	Enabled
2D [1]		1, 43, 65	3, 67, 69	68
2D [2]		25	26	
2D [3]		125	126	124
2D [4]		94		97
Canonical 3D [1]		23, 24		
Canonical 3D [2]	52	8, 9, 10, 44, 48, 49, 50, 73, 74, 75	45, 77	46, 51
Canonical 3D w/ Domain labels [1]	118, 119, 122	117	120	122
Canonical 3D w/ Domain labels [2]			92	
Canonical 3D w/ Domain labels [3]	58, 59	34		29, 30, 31, 32, 33, 56, 57, 59
Domain specific 3D [1]	88, 108	85, 89, 100, 101, 109, 110, 111, 112	105	82, 87, 102, 104, 109, 110
Domain specific 3D [3]	80			80
Domain specific 3D [4]		17, 18, 20, 21, 22, 62	13, 37	61

Table 2: Rules

Representation [order]	Includes	Excludes	Condition	Response	Milestone
2D [1]		5, 42, 72	2, 66, 70	7	42, 71
2D [2]		27	25		28
2D [3]	129	128	130	127	
2D [4]	96	96	96	96	

Canonical 3D [2]		52	47, 51		
Canonical 3D w/ labels [1]		123	113, 116, 123		116
Canonical 3D w/ labels [3]		35	53, 54, 55		
Canonical 3D w/ labels [4]		81			
Domain specific 3D [1]		90	83, 103	90	
Domain specific 3D [3]			79		
Domain specific 3D [4]			39		

Table 3: Other Features

Representation [order]	Accepting	Evaluation	Labels	Navigation	UI
2D [1]			4, 6		
2D [4]				95	
Canonical 3D [2]	11, 12				
Canonical 3D [3]	93				
Canonical 3D w/ labels [1]	121				114, 115
Canonical 3D w/ labels [2]			91		
Domain-specific 3D [1]	84, 106		86, 98, 107	99	
Domain-specific 3D [3]	78				
Domain-specific 3D [4]	19, 36, 38	14, 15	16	40, 41, 63, 64	

1.11 Appendix I - Validation Coding 3.2

Table 4: Markings summary

Element	Representation	Observations
Included	Canonical 3D	<ul style="list-style-type: none"> • [2] The activity] has gone gray. So it has kind of said we are no longer working on this. Maybe there was a choice? I'm not sure.
Included	Canonical 3D w/labels	<ul style="list-style-type: none"> • [1] [You cannot interact with a transparent activity] Because none of the shapes are are solid, nothing happens when you hold the mouse over them. The change from transparent to opaque means that] you can interact with it now. • [1] With the locked door, you need to go find the key. Whereas with the the [transparent] shapes it's not as clear what you need to do to make them opaque. • [3] It's black [transparent], so in another way, it tells me it's not the right solution. Well, then it's okay, but I don't know if it's because I've chosen not to go with that solution. [...] This is the best solution I have chosen and now I have, so I would say. Well, then I should choose again. That's how I feel, so I must try something else and. And think, I can't figure this out.

Included	Domain specific 3D	<ul style="list-style-type: none"> • [1] It's like [transparent activity] is removed. It's not included at the moment. • [3] The walls depend on whether it gets locked or unlocked, one can lock it unlocked by others. The interaction you have with the grayed out, it means that if you activated another. So it's the opposite. It requires so well, so the opposite of it being locked.
Executed	2D	<ul style="list-style-type: none"> • [1] [The check mark] signals that it's okay, [...] So that activity is completed. • [1] [The execution buttons] tell me that I have pressed 0, 1, 2 and 6 but not 3. • [3] [A check mark means that] the step is completed. • [4] The ticks seem to signify that the choice was correct - even though you said that there were no incorrect choices (laughs).

Executed	Canonical 3D	<ul style="list-style-type: none"> • [1] I pressed the button [...] Some green light came out [...] That means I can move on, it being green. • [1] I certainly can't get past those [cubes]. I can get past but I can't get over them. Or through them. • [2] I can't pass through here, there's something jumping up and down. Now it's blocking, and now I'm let in so I can pass on. Now I've figured out, I have to press the button, so I can go under it [...] so I can move on. And then suddenly it's a different color. • [2] I haven't tried [going around the box], but I will definitely try. I can do that easily, so I really don't need to wait for [the jumping box to clear]. • [2] [The jumping box] just signals that the next step is open, as I see it. • [2] There is a white box where something is hidden. You can see it moving up and down, suggesting something is concealed. It also shows me, when I hold it, that it is an activity. If I press on it, it turns green, and then I could imagine something, some text or something that could help me understand what it is. So, a box has been opened over here, the one in the corner. It's almost jumping, signaling that I need to do something. But I can't click on it. No, okay. So, nothing happens with it. It just stands and jumps, and it could be that the task is over there. I have no idea. So, I continue to the next activity. It might not be in that order, but that's what I do, can I? • [2] It indicates an ongoing process. That's what I would say, but I don't know. It could be that when you finish, it stops moving. Because if you're engaged in these activities, you don't need to finish one to proceed with the next. You can work on several things at once. • [2] But this one is green, and that means to me that you can still work on it, also because the boxes are jumping. The jumping boxes tell me that
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Executed	Canonical w/labels	3D	<ul style="list-style-type: none"> • [1] [The animated sphere means] that you have to do something with the sphere and the cube in order to get the key. • [3] In any event I have executed this activity and that one is jumping, which I expect means that I have completed the task.
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Executed	Domain specific 3D	<ul style="list-style-type: none"> • [1] It's funny it seems like those particles are directing me to one of the other rooms. • [1] The activities I haven't interacted with seem to have particles. • [1] I think you need to click that thing if you want to execute something. • [1] It turned green so that means it's executed • [1] Would it makes sense to say, that if an activity is enabled, but not executed, it will emit particles. Meaning you haven't done that yet. • [1] I think, I would rather focus on whether whether an activity was pending and enabled. I would be quite indifferent whether or not it has executed [...] because that's a classic way of thinking. "If it's happened once, then it's probably not important to do it again", but frankly you don't know that. Because you might end up doing many things several times. • [1] [The jumping animation] must mean something has to happen. Does it mean pending again? • [1] We can show many states on an activity if you count them all. But you quickly find out that there's only really two that are interesting. [...] But it's because we come from a world of checklist, where having ticked the box is central. But now when its suddenly no longer central, people have a hard time letting go. People want control. [...] That's the challenge here; you have to let go of control to gain control, if you insist on having control like a checklist, then you end up doing something so rigid there's only one way to do it and then you really lose control. So people don't do it. • [4] There are these little stars that tell me where to start. Where something is going on • [4] I can't press... Oh, it seems I could [execute an activity more than once]
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Pending	2D	<ul style="list-style-type: none"> • [1] There are [...] some exclamation marks. Yes, so there must be something I need to pay attention to. Maybe something where I need to provide input or something similar, but I can't do anything here. I can't click on anything. It could be that there is something that needs to be done. Something that needs active consideration, perhaps? The exclamation marks draw attention to something. But there's not much that directly tells me what to do here. • [1] [The exclamation marks mean that] it is happening in parallel with something else. • [1] I think dotted means that it cannot run. • [2] There are some exclamation marks. I wonder if that means I have run them before I can go down there. • [3] [An exclamation mark means that] you need to focus your attention on it
Pending	Canonical 3D	<ul style="list-style-type: none"> • [2] It definitely wants me to go over there and check out those activities. • [2] I think [an activity lighting up] means... something because the other activities aren't colored.

Pending	Canonical 3D w/labels	<ul style="list-style-type: none"> • [1] [A lit up area means that you should] go to that area first. • [2] [The activity lighting up] tells me that I should really execute it now.
Pending	Domain specific 3D	<ul style="list-style-type: none"> • [1] It's blinking, I guess it means it's pending. • [4] No [I did not notice the fog effect on the enabled activities.] • [4] I think this one, since there's a spot-light on it and there's glitter coming up, I think this is what I should do next. I think it's like a hint, come over here [...] So I think, I'm going over here now. And then I press on. This one. Oh, then it became light again.
Enabled	2D	<ul style="list-style-type: none"> • [1][3] I would guess [the solid green color] means that they are currently running / active / is something you can interact with. • [4] [The activity] is green now, which presumably means that it was better that I executed that [condition] first.

Enabled	Canonical 3D	<ul style="list-style-type: none"> • [2] [The fog] means you probably won't be making it over there at all. You probably can't. • [2] [The cloud disappearing] could mean that the cloud indicated that you didn't really know what you were supposed to solve, and it's only something you can figure out after you have engaged in this activity. Before that, you can't start the process there, so maybe it was necessary to activate this process to move forward.
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Enabled	Canonical w/labels	3D	<ul style="list-style-type: none"> • [1] With the locked door, you need to go find the key. Whereas with the the [transparent] shapes it's not as clear what you need to do to make them opaque. • [3] There's a bunch of smoke there. I don't want to go there. • [3] I think that those are dependent on these completed activites, but it's also because I have cheated a little by peeking at the buttons, so the fog in and of itself does not make me think that this is dependent on that. • [3] If there was a closed door, that would more indicate to me that I needed to do something before being able to do this. • [3] Nope that burned my fingers [...] That one started to glitter, so I think that means i need to activate it before I can activate this. • [3] The fog has disappeared and this activity over here is glittering with some green glitter. I'll interpret that as a signal that this needs to be executed. Also that button is now blue. • [3] The one over here to the left that was there before turns white. That tells me that I can't use it anymore. It seems like I shouldn't use it anymore after making this choice. • [3] So there's an option, but [the button] is white. I find the colors a bit disturbing. Yes. • [3] Well, then it's okay, but I don't know if it's because I've chosen not to go with that solution, so... And now it's... Well, it's difficult. It's difficult for me to visualize this other than now it seems like this. This is the best solution I have chosen and now I have, so I would say. Well, then I should choose again. That's how I feel, so I must try something else and. And think, I can't figure this out.
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Enabled	Domain specific 3D	<ul style="list-style-type: none"> • [1] It's locked, so it's possible I need to use a key. • [1] The sounds help me by letting me know if I do something right or wrong. • [1] So, I guess that the lock must mean there's something else I should do. A condition, I guess. I wonder if it won't let you know where the condition leads to, if you click on the lock. • [1] Oh. Yes, the cage. It's been removed, and the lock is removed, so I can enter the room. Now I can do it, I understand that. • [1] Would it makes sense to say, that if an activity is enabled, but not executed, it will emit particles. Meaning you haven't done that yet. • [1] I think, I would rather focus on whether whether an activity was pending and enabled. I would be quite indifferent whether or not it has executed [...] because that's a classic way of thinking. "If it's happened once, then it's probably not important to do it again", but frankly you don't know that. Because you might end up doing many things several times. • [3] I think that if it's gray, it means that. It requires that. You have to think about whether it was? It meant at least that the walls depend on whether it gets locked or unlocked, one can lock it unlocked by others. But and I think that. The interaction you have with the grayed out, it means that if you activate another. So it's the opposite. It requires so well, so the opposite. Of it being locked. Yes, that makes sense so if. So they really mean that they're not locked, and they are dependent on some processes, so they can read with light, whereas if they are gray, it means that they are the opposite. So if they get a response required that another state was where a state should be activated, then it means now inactive before it works. • [4] The clouds disappear on the picture right over to the right, so I think that's
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Table 5: Relations summary

Element	Representation	Observations
Includes	2D	<ul style="list-style-type: none"> • [3] That that's the way you should go. • [4] Green signifies a possible order of execution and red an impossible order of execution. Blue may also signify a possible execution. I don't know what the hierarchy is, except that red seems to be a "bad" act. Orange I'm not sure. It might signify a preceding act.

Excludes	2D	<ul style="list-style-type: none"> • [1] If it was something temporary, an option or a fallback or something similar, it could be something we don't need after all. [...] It's something it removes, I think. It's something else you do, make an intermediate calculation, and then it's no longer needed, so away with it. I think that, I don't know, but you do. • [1] It seems like if you have activity 2 active, you can choose either activity 3 or activity 5, and no matter which one of those two you choose, you can return to activity 4. But this is only if you want to go down to activity 6. For activity 5, you go directly to activity 6, not directly, but then you have two options at that activity. • [1] I would guess it makes it inactive, so it doesn't "count" in this context • [2] There's a percentage mark on it? I honestly don't know. Maybe that something isn't active? • [3] You can't do that. • [4] Green signifies a possible order of execution and red an impossible order of execution. Blue may also signify a possible execution. I don't know what the hierarchy is, except that red seems to be a "bad" act. Orange I'm not sure. It might signify a preceding act.
Excludes	Canonical 3D	<ul style="list-style-type: none"> • [2] The activity] has gone gray. So it has kind of said we are no longer working on this. Maybe there was a choice? I'm not sure.

Excludes	Canonical w/labels	3D	<ul style="list-style-type: none"> • [1] If the roster is within budget, then you don't have to inform the manager • [3] I think that I have turned off the task in a way or another. So either I should find a place to light it again, or... [...] The name of the button indicates that it is necessary, I think. It's about the manager wanting to be informed, but it could also be that it was only if I chose to select that something exceeded the budget. Well then, that one lit up again so. it might be that I should get permission from the manager to exceed the budget. I lit that one up again. I prefer that one. So now it's within the budget, that one is jumping it's completed. It's not necessary to inform the manager. • [4] I think it deactivates Inform Manager and activates Roster Exceeds Budget.
Excludes	Domain specific	3D	<ul style="list-style-type: none"> • [1] Okay I can see that I could also have chosen to cover the shift internally, rather than call people.

Condition	2D	<ul style="list-style-type: none"> • [1] I think maybe something orange appeared. I'm actually not sure. • [1] My guess is that the yellow means that it is not active. The activity is not in progress, so. • [1] I think [the yellow arrow] means that A must have executed before B can execute. • [2] Well, [that button] is green and active, so that's where I think I can start. Then I think maybe this one activates afterward. The [pending] one that is yellow, it seems like something needs to be done here before I can do that. • [3] I don't know. • [4] Green signifies a possible order of execution and red an impossible order of execution. Blue may also signify a possible execution. I don't know what the hierarchy is, except that red seems to be a "bad" act. Orange I'm not sure. It might signify a preceding act.
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Condition	Canonical 3D	
		<ul style="list-style-type: none"> • [2] Well this [button] being blue tells me that I don't need to progress any further. If I could go back and click on activity 5 i expect it would be green instead. • [2] [The cloud disappearing] could mean that the cloud indicated that you didn't really know what you were supposed to solve, and it's only something you can figure out after you have engaged in this activity. Before that, you can't start the process there, so maybe it was necessary to activate this process to move forward.

Condition	Canonical w/labels	3D	
			<ul style="list-style-type: none"> • [1] There's a spinning box with a thing on top of it; a key. Then there's another box like the first one. And then in the back, it looks like there's a lock. It's the same color as the key that was over on the other side. • [1] [The matching particle colors signify] that you need that key to open that lock. • [1] If the roster is within budget, then you don't have to inform the manager. • [3] The light blue color doesn't really tell me anything. If it were red I'd want to push it, but I don't know what the blue color signifies. • [3] It could be anything, but that's what I'm saying, the purple color doesn't really tell me anything. I can't see what the purple color signifies for me. • [3] [The button and the sparkles] are the same color, okay? They have the same colors and the one further ahead is misty and turquoise blue. I can only see it's white down here, so yes, I link them together.

Condition	Domain specific 3D	<ul style="list-style-type: none"> • [1] There's a key that I presume I need for a lock. • [1] Does it come down again over there? Yes, it comes down again, I'm guessing on this one [...] should probably happen. It's clear [...] I need to perform that first. • [3] I can see a color coded lock and key so I guess I need to activate a blue thing in order to unlock it. • [4] It could indicate that the blue [buttons] are dependent on one of the white ones being done first.
Response	2D	<ul style="list-style-type: none"> • [1] It's an arrow that runs both ways. That's the thing... There is an arrow at both ends of the line, so I think something goes back and forth. • [3] I'm not sure. • [4] Green signifies a possible order of execution and red an impossible order of execution. Blue may also signify a possible execution. I don't know what the hierarchy is, except that red seems to be a "bad" act. Orange I'm not sure. It might signify a preceding act.
Response	Domain specific 3D	<ul style="list-style-type: none"> • [1] Okay I can see that I could also have chosen to cover the shift internally, rather than call people.

Milestone	2D	<ul style="list-style-type: none"> • [1] It seems like if you have activity 2 active, you can choose either activity 3 or activity 5, and no matter which one of those two you choose, you can return to activity 4. But this is only if you want to go down to activity 6. For activity 5, you go directly to activity 6, not directly, but then you have two options at that activity. • [1] So [pending activity 1] and [pending activity 2] must have [executed] before [milestone activity] can execute. • [2] It seems like activity 4 is dependent on me having executed 3 and 5.
Milestone	Canonical 3D w/labels	<ul style="list-style-type: none"> • [1] [The matching particle colors signify] that you need that key to open that lock.

Table 6: Other features summary

Element	Representation	Observations
Accepting	Canonical 3D	<ul style="list-style-type: none"> • [2] [The switch from day to night] has something to do with time. • [2] Or [The switch from day to night] means that it needs to process something. Something needs to be considered before moving on. • [3] I think maybe some actions require time to pass before something new can happen.

Accepting	Canonical 3D w/labels	<ul style="list-style-type: none"> • [1] [The global light changing means] that time has passed.
Accepting	Domain specific 3D	<ul style="list-style-type: none"> • [1] Now it's night again, so that means time has passed. • [1] Yes, okay, the graph became accepting, that's pretty clear. • [3] I think [the global lighting changing to night] means that the process splits. • [4] And now I can see the moon, so it will take some time... but it shouldn't take long to register someone calling in sick. And I click and there, it became light again. But you can see that something isn't adding up... • [4] Now it got dark outside. I still haven't quite... Why is it night? I haven't... Why is it night? • [4] I can see that maybe it's the darkness so that you can see the spotlight even more. And when I have solved this task in the spotlight and the glitter is gone, then it can become day again, then it's back to the normal flow, or whatever you call it.
Environment	Domain specific 3D	<ul style="list-style-type: none"> • [4] I have to start over here on the left, it looks like. A hospital, so the picture tells me that someone needs to call in sick.

Environment	Domain specific 3D	<ul style="list-style-type: none"> • [4] This didn't give me a very good insight into the process. • [4] I like the DSB journey planner, you know? 1, 2, 3, 4... Here there was a lot of back and forth. That might be easier for some, but for my brain, it's better to have something more concrete like 2, 3, 4, 5, 6. And you can even have splits, like... 2, 3, boom, and then you go back again. But this was not for me.
Activities	2D	<ul style="list-style-type: none"> • [1] It's illogical to me that one must do 3 and 5 before you can do 4. • [1] No, because then someone like me might think of trying 6 and 4. I can start from the back, so now I press there. And a checkmark appears, apparently, you can start with that one. There's nothing indicating you can't start with it. Normally, when it's in sequence, you'd think you have to follow it, but here you don't need to. So now this one is fixed, and the number five is gone, strangely enough.
Activities	Canonical w/labels 3D	<ul style="list-style-type: none"> • [2] It doesn't seem like it's a logical place to start if you look at the text.

Activities	Domain specific 3D	<ul style="list-style-type: none"> • [1] I'm too lazy to read the text. • [1] [The activity descriptions] are written at the bottom of the screen. • [1] One of the biggest challenges we talk about in processes and communicating this, is that people expect [a process to finish at some point], but it's very artificial. It doesn't exist in the real world. • [4] When I was doing this, I didn't get much into it, I almost didn't even see what was written, because I was looking for where it lit up next. All that written there, it's probably made into a nice little story. I didn't pay much attention to it, because I was focused on where to go next.
Environment	2D	<ul style="list-style-type: none"> • [4] It's a sort of flowchart. The arrows signify order of execution; if this then that.

Environment	Domain specific 3D	<ul style="list-style-type: none"> • [1] There's a white divider, that must be the activity. • [4] [I didn't execute the complete process activity immediately when it became available] because I didn't think I've been through all the steps. • [4] As it stands I think I am allowed to decide if I want to do it myself or if I want to involve the planner, because there's nothing telling me that I have to go into that room now, like there was with this room. • [4] So these two, I can't see what order I should take them in. Now I'm just taking it in that order, because that's the order they lie in along the way here. • [4] Well, when everything I assigned an employee to consider, I actually... So I could have skipped everything else.
Views	Canonical w/labels 3D	<ul style="list-style-type: none"> • [1] OK, [the lock] is getting bigger and smaller. • [1] Well, it changes when when you hover the mouse over it so [it might be interactive].

1.12 Appendix J - Participant Preference

Ranking

Last time we saw each other, we tried 4 different process representations.

1a) The classic "boxes and arrows" representation, without domain-specific descriptive text. 1b) A 3d representation of the same process, again without domain-specific descriptive text.

2a) A 3d representation of a domain-specific process, with abstract graphic elements. 2b) A 3d representation of a domain-specific process, with domain-specific graphic elements.

Validation Participant 1

Usability:

Question: "If you had to choose between 1a and 1b, which model did you find the easiest to get around?" Your answer: 1b

Question: "If you had to choose between 2a and 2b, which model did you find the easiest to get around?" Your answer: 2b

Question: "If you had to choose between 1a, 1b, 2a and 2b, which model did you find the easiest to find around?" Your answer: 2b

Understandability:

Question: "If you had to choose between 1a and 1b, with which model was it easiest to calculate the underlying process?" Your answer: 1b

Question: "If you had to choose between 2a and 2b, with which model was it easiest to calculate the underlying process?" Your answer: 2b

Question: "If you had to choose between 1a, 1b, 2a and 2b, with which model was it easiest to calculate the underlying process?" Your answer: 2b

Engagement:

Question: "If you had to choose between 1a and 1b, which model made you want to explore the process the most?" Your answer: 1b

Question: "If you had to choose between 2a and 2b, which model made you want to explore the process the most?" Your answer: 2b

Question: "If you had to choose between 1a, 1b, 2a and 2b, which model made you want to explore the process the most?" Your answer: 2b

Preference:

Question: "If you had to choose between 1a and 1b, which model would you prefer in the future if you had to learn a new process?" Your answer: 1b

Question: "If you had to choose between 2a and 2b, which model would you prefer in the future if you had to learn a new process?" Your answer: 2b

Question: "If you had to choose between 1a, 1b, 2a and 2b, which model would you prefer in the future if you had to learn a new process?" Your answer: 2b

Validation Participant 3

Usability:

Question: "If you had to choose between 1a and 1b, which model did you find the easiest to get around?" Your answer: 1a

Question: "If you had to choose between 2a and 2b, which model did you find the easiest to get around?" Your answer: 2b

Question: "If you had to choose between 1a, 1b, 2a and 2b, which model did you find the easiest to find around?" Your answer: 1a

Understandability:

Question: "If you had to choose between 1a and 1b, with which model was it easiest to calculate the underlying process?" Your answer: 1a

Question: "If you had to choose between 2a and 2b, with which model was it easiest to calculate the underlying process?" Your answer: 2b

Question: "If you had to choose between 1a, 1b, 2a and 2b, with which model was it easiest to calculate the underlying process?" Your answer: 2b

Engagement:

Question: "If you had to choose between 1a and 1b, which model made you want to explore the process the most?" Your answer: 1a

Question: "If you had to choose between 2a and 2b, which model made you want to explore the process the most?" Your answer: 1a

Question: "If you had to choose between 1a, 1b, 2a and 2b, which model made you want to explore the process the most?" Your answer: 2b

Preference:

Question: "If you had to choose between 1a and 1b, which model would you prefer in the future if you had to learn a new process?" Your answer: 1a

Question: "If you had to choose between 2a and 2b, which model would you prefer in the future if you had to learn a new process?" Your answer: 2a

Question: "If you had to choose between 1a, 1b, 2a and 2b, which model would you prefer in the future if you had to learn a new process?" Your answer: 1a

Validation Participant 5

Usability:

Question: "If you had to choose between 1a and 1b, which model did you find the easiest to get around?" Your answer: I thought 1a was the easiest. It was easier to form an overview

Question: "If you had to choose between 2a and 2b, which model did you find the easiest to get around?" Your answer: I liked 2b best. It was easier to remember the relationships between the elements and their location.

Question: "If you had to choose between 1a, 1b, 2a and 2b, which model did you find the easiest to find around?" Your answer: 2b for the same reason as previous question

Understandability:

Question: "If you had to choose between 1a and 1b, with which model was it easiest to calculate the underlying process?" Your answer: 1a one could see both processes simultaneously

Question: "If you had to choose between 2a and 2b, with which model was it easiest to calculate the underlying process?" Your answer: I would probably say that they were about equally difficult

Question: "If you had to choose between 1a, 1b, 2a and 2b, with which model was it easiest to calculate the underlying process?" Your answer: 1a for the same reason as the previous question

Engagement:

Question: "If you had to choose between 1a and 1b, which model made you want to explore the process the most" Your answer: 1b. It's fun to move around the world

Question: "If you had to choose between 2a and 2b, which model made you want to explore the process the most" Your answer: 2b. Just like previous questions but even more fun since there was more to look at

Question: "If you had to choose between 1a, 1b, 2a and 2b, which model made you want to explore the process the most" Your answer: 2b

Preference:

Question: "If you had to choose between 1a and 1b, which model would you prefer in the future if you had to learn a new process" Your answer: 1a because it is faster to see the relationships between the elements

Question: "If you had to choose between 2a and 2b, which model would you prefer in the future if you had to learn a new process" Your answer: 2b since it is the most fun

Question: "If you had to choose between 1a, 1b, 2a and 2b, which model would you prefer in the future if you had to learn a new process" Your answer: I would probably choose 1a as it is the most manageable

Validation Participant 6

Usability:

Question: "If you had to choose between 1a and 1b, which model did you find the easiest to get around?" Your answer: 1b

Question: "If you had to choose between 2a and 2b, which model did you find the easiest to get around?" Your answer: 2a

Question: "If you had to choose between 1a, 1b, 2a and 2b, which model did you find the easiest to find around?" Your answer: 2a

Understandability:

Question: "If you had to choose between 1a and 1b, with which model was it easiest to calculate the underlying process?" Your answer: 1b

Question: "If you had to choose between 2a and 2b, with which model was it easiest to calculate the underlying process?" Your answer: 2a

Question: "If you had to choose between 1a, 1b, 2a and 2b, with which model was it easiest to calculate the underlying process?" Your answer: 2a

Engagement:

Question: "If you had to choose between 1a and 1b, which model made you want to explore the process the most" Your answer: 1b

Question: "If you had to choose between 2a and 2b, which model made you want to explore the process the most" Your answer: 2a

Question: "If you had to choose between 1a, 1b, 2a and 2b, which model made you want to explore the process the most" Your answer: 2a

Preference:

Question: "If you had to choose between 1a and 1b, which model would you prefer in the future if you had to learn a new process" Your answer: 1a

Question: "If you had to choose between 2a and 2b, which model would you prefer in the future if you had to learn a new process" Your answer: 2a

Question: "If you had to choose between 1a, 1b, 2a and 2b, which model would you prefer in the future if you had to learn a new process" Your answer: 2a

Validation Participant 7

Usability:

Question: "If given the choice between 1a and 1b, which model did you find most easily navigable?"

Your answer: 1b

Question: "If given the choice between 2a and 2b, which model did you find most easily navigable?"

Your answer: 2b

Question: "If given the choice between 1a, 1b, 2a and 2b, which model did you find most easily navigable?"

Your answer: 2b

Understandability:

Question: "If given the choice between 1a and 1b, which model made it easiest to figure out the process underlying process."

Your answer: 1b

Question: "If given the choice between 2a and 2b, which model made it easiest to figure out the process underlying process."

Your answer: 2b

Question: "If given the choice between 1a, 1b, 2a and 2b, which model made it easiest to figure out the process underlying process."

Your answer: 2b

Engagement:

Question: "If given the choice between 1a and 1b, which model most inspired you to explore the process?"

Your answer: 1b

Question: "If given the choice between 2a and 2b, which model most inspired you to explore the process?"

Your answer: 2b

Question: "If given the choice between 1a, 1b, 2a and 2b, which model most inspired you to explore the process?"

Your answer: 2b

Preference:

Question: "If given the choice between 1a and 1b, which model would you prefer to learn new processes in the future?"

Your answer: 1b

Question: "If given the choice between 2a and 2b, which model would you prefer to learn new processes in the future?"

Your answer: 2b

Question: "If given the choice between 1a, 1b, 2a and 2b, which model would you prefer to learn new processes in the future?"

Your answer: 2b