Second Language Tutoring using Social Robots

Project No. 688014

L2TOR

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D2.2 Specifications of interactions in space domain.

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Dissemination Level		
PU	Public	**PU**
PP	Restricted to other programme participants (including the Commission Service)	
RE	Restricted to a group specified by the consortium (including the Commission Service)	
CO	Confidential, only for members of the consortium (including the Commission Service)	

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Executive Summary

The aim of this deliverable is to present the design of the child-robot interactions in the space domain. We explain the design considerations for the amended lesson series of the evaluation study and we provide the three storyboards that we created for the lessons in the space domain.

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First version.

Introduction

According to the project proposal, deliverable D2.2 is defined as follows:

> **D2.2: Specifications of interactions in space domain**. (TIU, R, M21). Report on the specifications on the storyboard, interactions and common ground as completed in tasks T2.1, T2.3 and T2.4 relevant to the space domain.

This deliverable will present the design specifications of the lesson series in the space domain that we have adapted conform the revised objectives submitted on 3 November 2017 after the periodic project review, as requested by the reviewers. According to the revised objectives, we reduced the number of lessons in both the number domain and the space domain. In total, we will provide three sessions in the number domain, three sessions in the space domain and one recap session. The storytelling domain will not be used in the revised long-term evaluation study.

Another change with respect to the original evaluation plan is that we now have four conditions:

1. Robot and tablet with iconic gestures
2. Robot and tablet without iconic gestures
3. Tablet only
4. No-treatment

Due to the reduced number of sessions in both the number and space domains, the sessions were slightly adjusted by WP1 with respect to those presented in deliverable D1.1 to ensure that the target words and supporting words followed each other logically.

Since many specifications of the basic interactions for the space domain are the same as for the number domain (e.g., experimental setup, common ground, input measurements, storyboard functions, robot output and tablet output) as presented in deliverable D2.1, we only discuss relevant changes and space domain-specific specifications in this deliverable. In addition, this deliverable only discusses the three lesson conditions and not the no-treatment condition.

The specifications of the three sessions in the space domain are provided in the storyboards as provided in Appendices I-III.

Input measurements

In addition to the input measurements specified for the number domain, we also make use of the robot's arm sensors. These sensors are used to teach the child the difference between *left* and *right* in session 3 of the space domain. The children are asked to sit behind the

robot and touch the arm that is on the *left* or *right* of the robot. The robot can provide support by shaking the correct arm to indicate the correct answer.

Robot gestures

In the revised objectives, all lessons are provided in these conditions (between subjects design): robot and tablet with iconic gestures, robot and tablet without iconic gestures and tablet only. The first two conditions are exactly the same, except that in the with iconic gestures condition, the robot provides the child with extra-linguistic cues about each target word by adding an iconic gesture that depicts either the shape or a function of the target word (conform the experiment reported in De Wit et al., 2018). Other deictic gestures aimed to draw the child's attention to the tablet (e.g., pointing at the tablet, eye-gaze and demonstrating answers on the tablet) occur in both conditions. The rationale for this distinction is that an iconic gesture is a type of gesture that can help children learn language (e.g., Tellier, 2008), different from deictic gestures. The latter may also help language learning, but are used in our experiment only to draw the child's attention to the task they need to carry out on the tablet or to provide feedback by demonstrating answers to instructions. Moreover, keeping these deictic gestures could add to the perceived animacy of the robot in the non-gesture condition, which would otherwise remain rather static.

Iconic gestures
The iconic gestures for the target words in the gesture condition are currently being designed based on a separate study involving two phases. In the first phase, we asked three human adults to perform a gesture that best represents the target word (for example a throwing movement for the target word *throwing*). Then, in the second phase, another group of adults rated how well those gestures represent the target words. Gestures with high rating scores will be used in the lessons.

During the lessons in the with iconic gestures condition, the robot will produce the iconic gestures each time it uses a target word in L2 (second language). In addition, the robot will produce the gesture the first time it introduces the target word in L1 (first language). We hypothesize that this will assist children in mapping L2 words onto known concepts in L1. The robot will remain in the crouched position when performing these gestures to make the movement faster and more natural.

Deictic gestures
Two main forms of deictic gestures will be implemented: 1) Pointing gestures towards the tablet to draw the child's attention to the tablet, either to look at the scene displayed or to perform some action on the tablet. 2) Give help gestures, where the robot is wiping its arm across the tablet as if it is performing an action the child is supposed to carry out. While the robot is performing this wiping action, the tablet shows the result of the action to be carried out. This gesture is used when a child is not responding to an instruction or when she/he has performed an incorrect action.

Storyboards

The design of the storyboards, including all functions used is the same as the number domain, conform the explanations provided in deliverable D2.1. These storyboards specify the expected input of the child, the output behaviour of the robot and the output of the tablet. The storyboards for the three space domain sessions are found in Appendices I-III.

The storyboards are generally the same for all three conditions in which the lessons are provided. The interpreter script used to translate these storyboards to the source code implemented on the robot takes the specific condition into account. So, while the storyboard does not contain specific functions for when to add an iconic gesture, the interpreter will know when these gestures need to be produced, as specified above.

For the tablet only condition, every output produced by the robot will be produced by a separate voice (identical to the robot's voice) coming from the tablet.

References

De Wit, J., Schodde, T., Willemsen, B., Bergmann, K., de Haas, M., Kopp, S., Krahmer, E. & Vogt, P. (2018, accepted). The Effect of a Robot's Gestures and Adaptive Tutoring on Children's Acquisition of Second Language Vocabularies. In Proceedings of ACM/IEEE HRI 2018.

Tellier, M. (2008). The Effect of Gestures on Second Language Memorisation by Young Children. Gesture, 8, 219-235.

APPENDIX I – STORYBOARD LESSON 1.

	Robot			Tablet			
#	Text L1 English	Text L1 Dutch	Text L2	Scene	Objects	Say	Comment
1	**[Introduction: 2 minutes]**						
2	<tablet(off)><Gaze(child)><Face(Neutral)>Hello <name>. Last time we had a lot of fun! Are you also excited to see what we'll be doing today?	<tablet(off)><Gaze(child)><Face(Neutral)>Hallo <name>. De vorige keer was het heel leuk! Ben je ook benieuwd wat we vandaag gaan doen?					
3	<wait(2000)>						
4	<gaze(tablet)> Look where we're going today! <Gaze(child)> <Gesture(Pretends to touch tablet)>	<gaze(tablet)> Kijk waar we vandaag naartoe gaan! <Gaze(child)> <Gesture(Pretends to touch tablet)>		town			[shows a map of the town; two locations, a blue store and a red store, are available]
5	<tablet(off)><Gaze(child)><Face(Neutral)> Where should we go today? <accept_answer><name> pick a place!	<tablet(off)><Gaze(child)><Face(Neutral)> Waar moeten we vandaag naartoe? <accept_answer><name> kies maar een plek uit!			display(redStore AND blueStore) enable(redStore AND blueStore)		
6	<giveResponseToSelectObject(blue_store, red_store)>						{touches one of the available locations}
7	**[Modelling of words: about 10 minutes]**						
8	<Gaze(tablet)>Cool <Face(Happy)> It looks like a fruit shop. <face(neutral)><gaze(child)> I see many apples and oranges.	<Gaze(tablet)>Cool! <Face(Happy)> Dit is een fruitwinkel <face(neutral)><gaze(child)>. Ik zie allemaal appels en sinaasappels.		fruitshop_1			(regardless of which store the child chooses, they will end up in the fruit shop). There are a bunch of fruits as well as boxes in the fruit shop.]

9	<gaze(tablet)> <wait(7000)>				move monkey_walking (-67.29835303678826:0:48.4429268517971:7:false)		[A monkey walks into (or appears in) the scene and sits next to the shop]
10	Oh, monkey. <gaze(child)>	Oh, een aap <gaze(child)>	Monkey!		remove monkey_walking and display monkey_standing		
11	I wonder what she is doing here. Anyway, let's start our game! <name>, <accept_answer><gaze(tablet)><pointAt(tablet)> can you touch the screen? <gaze(child)> <giveResponseToSelectObject(screen)>	Ik vraag me af wat die hier doet. Maar laten we met ons spelletje beginnen! <name>, <accept_answer><gaze(tablet)><pointAt(tablet)> Raak het scherm maar aan! <gaze(child)>					
13	<gaze(tablet)>Look, there are some boxes around.<gaze(child)><tablet(off)> I learned the other day that a box is called <face(happy)>Isn't that a fun word to say? <face(neutral)> Let's repeat the word!	<gaze(tablet)> Kijk, daar staat een tafel.<gaze(child)><tablet(off)> Ik heb gisteren het Engelse woord voor tafel geleerd: <face(happy)>Is dat geen leuk woord om te zeggen? <face(neutral)> Laten we het nazeggen!	table *Table!*	fruitshop_2			[The background diminishes and the screen shows two box, a three-level shelf, and 5 apples on the top shelf]

14	<giveResponseOnSpeech(table)>						
15	<tablet(on)><gaze(tablet)>Wow, there are some apples too! <face(happy)>I love apples! <face(neutral)> <tablet(off)> I also learned that an apple is called Isn't that fun to say too?	<tablet(on)><gaze(tablet)>Wow, daar zijn ook appels! <face(happy)>Ik hou heel veel van appels! <face(neutral)> <tablet(off)> Ik heb ook geleerd wat het Engelse woord is voor appel Dat is ook een leuk woord.	*apple* . *Apple* !				
16	<giveResponseOnSpeech(apple)>						
17	<tablet(on)><gaze(tablet)>Let's see what's going on with these apples. <gaze(child)><name>, can you touch<gaze(tablet)><pointat(tablet)> somewhere on the screen?<gaze(child)>	<tablet(on)><gaze(tablet)>Laten we eens kijken wat er met de appels moet gebeuren. <gaze(child)><name>, <accept_answer>Raak het <gaze(tablet)><pointat(tablet)> scherm maar ergens aan<gaze(child)>					
18	<giveResponseToSelectObject(screen)>						
19	<gaze(tablet)><tablet(on)> can you press <accept_answer> on the apple? <giveResponseToSelectObject(apple_1)>	<gaze(tablet)><tablet(on)> Druk maar <accept_answer> op de appel			highlight apple_1 move apple_1(-74.7319109310913:57:129.7769092664907 5:2:false)	*This is an apple* *The apple is falling*	the apple moves on top of the box, do not repeat the action?
21	<wait(2200)>						

22					highlight apple_1 and table_1	*The apple is on the table*	
25	<tablet(off)><gaze(child)>I think means on so means ‘the apple is on the box’!” Let’s say the word! <giveResponseOnSpeech(on)> Let’s say the word one more time! <wait(1000)>	<tablet(off)><gaze(child)> Ik denk dat "op" betekent Betekent "de appel is op de tafel". Laten we het Engelse woord voor "op" zeggen!	*on* *‘the apple is on the table'*				
27		Laten we het nog een keer zeggen	*on*				
28	“Yes! The apple is on the box. <gaze(tablet)><tablet(on)>	Ja! De appel is op de tafel <gaze(tablet)><tablet(on)>	*The apple is on the table.*				
29	can you press on the apple? <giveResponseToSelectObject(apple_2)>	Druk maar <accept_answer> op de appel			highlight apple_2 move apple_2(-74.7319109310913:102:129.77690926649075:2:false)	*This is an apple* *The apple is falling*	the apple moves above the box, do not repeat the action?
39							

	<wait(2200)>					
41					highlight apple_2 and table_1	*The apple is above the table*
44	<tablet(off)><gaze(child)>I think means above' so	<tablet(off)><gaze(child)>Ik denk dat boven betekent, dus	*above* *'the apple is above the table'*			
	means 'the apple above the box'!"	betekent "de appel is boven de tafel".				
	Let's say the word!	Laten we het Engelse woord voor "boven" zeggen	*above*			
	<giveResponseOnSpeech(above)>					
46	Let's say the word one more time!	Kom, we zeggen het nog 1 keer.	*above*			
	<wait(1000)>	<wait(1000)>				
462	"Yes!	Ja!	*The apple is above the table.*			
	The apple is above the box. <gaze(tablet)><tablet(on)>	De appel is boven de tafel. <gaze(tablet)><tablet(on)>				
47	can you press on the apple? <giveResponseToSelectObject(apple_3)>	Druk maar <accept_answer> op de appel			highlight apple_3	*This is an apple*

48					move apple_3(-67.60040264398025:-3:152.86952586931153:2:false)	*The apple is falling*	the apple moves below the box, do not repeat the action?
50					highlight apple_3 and table_1	*The apple is below the table*	
53	<tablet(off)><gaze(child)>I think	<tablet(off)><gaze(child)>Ik denk dat	*below*				
	means below so	onder betekent	*'the apple is below the table'*				
	means 'the apple below the box'!"	betekent "de appel is onder de tafel".					
	Let's say the word!	Laten we het Engelse woord voor "onder" zeggen	*below*				
54	<giveResponseOnSpeech(below)>						
55	Let's say the word one more time!	Kom, zeg het nog maar een keer	*below*				
57	<wait(1000)> "Yes!	Ja!	*The apple is below the table.*				
	The apple is below the box. <gaze(tablet)><tablet(on)>	De appel is onder de tafel <gaze(tablet)><tablet(on)>					
58	can you press on the apple?	Druk maar <accept_answer> op de appel			highlight apple_4	*This is an apple*	

	<giveResponseToSelectObject(apple_4)>						
59					move apple_4(35.15547918055267:-3:124.26659414996305:2:false) highlight apple_4 and table_1	*The apple is falling* *The apple is next to the table*	the apple moves next to the box, do not repeat the action
61							
64	<tablet(off)><gaze(child)>I think means next to so means ‘the apple next to the box’!” Let’s say the word!	<tablet(off)><gaze(child)>Ik denk dat naast betekent. betekent "de appel is naast de tafel". Zeg het Engelse woord voor "naast" maar	*next to* *‘the apple is next to the table'*				
65	<giveResponseOnSpeech(next to)>		*next to*				
66	Let’s say the word one more time!	Zeg het nog maar een keer	*next to*				
68	<wait(1000)> “Yes! The apple is next to the box.	<wait(1000)> Ja! De appel is naast de tafel.	*The apple is next to the table.*				

	<tablet(off)> The tablet was also saying something else while the apple was falling. <name>, do you remember what the sentence was?	<tablet(off)> De \prn=t E: b l @ t \ zei ook iets terwijl de appel viel. <name>, weet jij wat hij zei?					[says something about the sentence] → If speech was detected within 3 seconds, wait until the speech ends
69	<wait(3000)>	<wait(3000)>					
70	I think the tablet said	Ik denk dat de \prn=t E: b l @ t \ zei:	“*The apple is falling.”*				
	That must mean “the apple is falling”! Don’t you think?	Dat betekent vast "de appel valt", denk je niet?					
	<wait(2000)>						(nods, says “Yes,” something along that line. This does not matter.)
71							
72	<gesture(nodding)>Yeah, I think	<gesture(nodding)>Ja, ik denk dat	“*The apple is falling.”*				
	means “the apple is falling”.	betekent "de appel valt"	*Falling* !				
	Let’s practice this word too!	Laten we dit ook nazeggen.	*Three, two, one…* *Falling* .				
73	<giveResponseOnSpeech(falling)>						
74	One more time!	Nog 1 keer!	*Falling* .				

75	<wait(1000)>						
76	Yes!	Ja!	*The apple is falling.*				
	The apple is falling. <face(happy)>Excellent!<tablet(on)><gaze(tablet)>Let's see what's next	De appel valt. <face(happy)>Super goed!<tablet(on)><gaze(tablet)>Laten we kijken wat er nu komt					
	Oh! That monkey again! <gaze(child)> What does it want now? <gaze(tablet)>	Oh! Daar is de aap weer! <gaze(child)> Wat wil hij nou? <gaze(tablet)>		fruitshop_3			[The monkey goes to the same location as the apple. The tablet says the same sentence with the monkey as the subject (e.g., "*In. The monkey is IN the box"*)]
78					move monkey_1(-25.760515368277265:40:233.76466909485958:2:false)		
79							monkey goes on the box
	<wait(2000)>						
						The monkey is on the table	
792							
	<wait(2000)>						

81	<wait(1000)>				move monkey_1(-25.760515368277265:62:233.76466909485958:1:false)		monkey goes above the box
812	<wait(2000)>					The monkey is above the table	
82	<wait(2000)>				move monkey_1(-23.888960313808803:14:278.56828027902714:2:false)		monkey goes below the box
821	<wait(2000)>				move monkey_1(-28.405597303947985:0:227.19358311043433:2:false)		
822	<wait(2000)>					The monkey is below the table	

					move monkey_1(-102.933581779385 69:0:218.3233177962576:2:false)		
83	<wait(2000)>						monkey goes next to the box
						The monkey is next to the table	
832	<wait(2000)>						
85	Alright, what's next? <wait(2000)>	Ok, wat komt er nu?		fruitshop_4			
							[The monkey moves around the fruit shop and mess up everything], maybe we can use the falling fruits tree animation with the monkey?
86						*The apples are falling*	
							messed up fruitshop with monkey_1 in the middle and a box
87	<wait(3000)>						

88	Nooooo, they all fell... <gaze(child)>We have to put them back! But let's first put the monkey in one of the boxes and give it a banana. Then, it won't make a mess. <wait(1500)> <gaze(child)>Now I am going to give the monkey a banana <gesture(pretendToDragDropMonkey)> <wait(500)> <face(happy)> <wait(3000)>	Oh nee, ze zijn allemaal gevallen! Ik zal de <move(monkey_standing, 131.5419464942099,0,194.80418022941956,1,false)> in de doos zetten <gaze(child)>Nu ga ik <move(banana_1, 119.54023649301546, 22, 211.79956551830224,1,false)> de aap een banaan geven <face(happy)>	monkey		remove monkey_shaking_stand, display monkey_standing and banana_1 remove monkey_standing and display monkey_with_banana		Used to be L2 utterance to practice "in", made it L1 and so the robot will perform the action moves down the right arm, pretending to drag and drop the monkey>
91	**[Task: about 5 minutes]**	**[Task: about 5 minutes]**					
92		<gaze(child)>Ok, we moeten deze opdracht doen. We moeten goed luisteren naar wat de \prn=t E: b l @ t \ zegt en dan de appel op de goede plaats leggen. Dan is het straks weer mooi opgeruimd <name>		fruitshop_5			

93	<gaze(child)>Alright, we need to follow the instruction. So we need to move the apple to where it says in order to reorganize this place				highlight apple_1	Put the apple on the table	
94	<name>	<pointat(tablet)><gaze(tablet)> <accept_answer> <gaze(child)> Volgens mei moeten we het vakje aanraken wat is	Put the apple on the table on the table				(This row is only for the first trial)
	<giveResponseToSelectObject(area_on)>						<giveResponseOnMoveObject(apple_1,on,table)>
95	<wait(2000)>				move apple_1(5.803840331666754:43:216.74341380382126:2:false)		
96					highlight apple_1	the apple is on the table	
97	<face(happy)><gaze(child)>Alright, we got it! <face(neutral)> let's do something else!	<face(happy)><gaze(child)>Ja, we hebben hem goed! <face(neutral)> Laten we er nog 1 doen!	the apple is on the table				

103					highlight apple_2	Put the apple above the table	
104		<pointat(tablet)><gaze(tablet)> <accept_answer> <gaze(child)> Volgens mei moeten we het vakje aanraken wat is	Put the apple above the table above the table				
	<giveResponseToSelectObject(area_above)>						<giveResponseOnMoveObject(apple_3,above,box)>
105	<wait(2000)>				move apple_2(5.8585568305547495:101:222.42518944999162:2:false)		
106					highlight apple_2	the apple is above the table	
107	<face(happy)><gaze(child)>Alright, we got it! <face(neutral)> let's do something else!	<face(happy)><gaze(child)>Ja, we hebben hem goed! <face(neutral)> Kom, dan doen we er nog 1!	the apple is above the table				
108					highlight apple_3	Put the apple below the table	

109		<pointat(tablet)><gaze(tablet)> <accept_answer> <gaze(child)> Volgens mei moeten we het vakje aanraken wat is	Put the apple below the table below the table				
	<giveResponseToSelectObject(area_below)>						<giveResponseOnMoveObject(apple_5,below,table)>
110	<wait(2000)>				move apple_3(5.364355986233068:7:222.42283344297041:2:false)		
111					highlight apple_3	the apple is below the table	
112	<face(happy)><gaze(child)>Alright, we got it! <face(neutral)> let's do something else!	<face(happy)><gaze(child)>Ja, we hebben hem goed! <face(neutral)> We doen er nog eentje!	the apple is below the table				
113					highlight apple_4	Put the apple next to the table	
114		<pointat(tablet)><gaze(tablet)> <accept_answer> <gaze(child)>	Put the apple next to the table				

	<giveResponseToSelectObject(area_next_to)>	Volgens mei moeten we het vakje aanraken wat is	next to the table				<giveResponseOnMoveObject(apple_6,next to,box)>
115	<wait(2000)>				move apple_4(98.8186571968368:32:223.87197453999138:2:false)		
116					highlight apple_4	the apple is next to the table	
117	<face(happy)><gaze(child)>Alright, we got it! <face(neutral)> <face(happy)>Phew, now it is all good!<face(neutral)> **[Test: about 3 minutes]**	<face(happy)><gaze(child)>Ja, we hebben hem goed! <face(neutral)> <face(happy)>Zo, nu is het helemaal netjes!<face(neutral)>	the apple is next to the table				
1		Kijk, dit spelletje mag jij spelen! Ik denk dat je het goed kan.		fruitshop_task_1			
12	<giveResponseToSelectObject(apple_below,table_below,area_2)>	Waar zie je <accept_answer> de tafel	below				
2		Waar zie je					
22		<accept_answer> de doos	next to	fruitshop_task_2			

	<giveResponseToSelectObject(apple_next_to,fruitbox_next_to,lid_next_to,area_1)>						
3 32		Waar zie je <accept_answer> de doos	on	fruitshop_task_3			
	<giveResponseToSelectObject(apple_on,fruitbox_on,lid_on,area_2)>						
4		Waar zie je	falling	fruitshop_task_4			
42	<giveResponseToSelectObject(apple_falling,area_1)>	<accept_answer>			move apple_falling(126.42539819011489:-4:234.0347947440302:1:true) and animate apple_rolling(roll:true)		
5 52		Waar zie je <accept_answer> de tafel	above	fruitshop_task_5			
	<giveResponseToSelectObject(apple_above,table_above,area_3)>						
6 62		Waar zie je <accept_answer> de doos	next to	fruitshop_task_6			

	<giveResponseToSelectObject(monkey_next_to,fruitbox_next_to,lid_next_to,area_3)>						
7		Waar zie je	on	fruitshop_task_7			
72	<giveResponseToSelectObject(monkey_on,fruitbox_on,lid_on,area_1)>	<accept_answer> de doos					
8		Waar zie je	below	fruitshop_task_8			
82	<giveResponseToSelectObject(monkey_below,table_below,area_2)>	<accept_answer> de tafel					
9		Waar zie je	falling	fruitshop_task_9			
92	<giveResponseToSelectObject(monkey_falling,area_3)>	<accept_answer>			move monkey_falling(-60.84357845242005:-11:-254.597264358499 4:1:true) and animate monkey_rolling(roll:true)		

10 102	<giveResponseToSelectObject(monkey_above,table_above,area_1)>	Waar zie je <accept_answer> de tafel	above	fruitshop_task_10			
118	**[End of the lesson]**	**[End of the lesson]**					
119 120 121	<tablet(off)><gaze(child)>I think we finished the game! <face(happy)> That was fun! Shall we play together soon again? <face(neutral)> <wait(3000)> Let's play again! <gesture(waving)> Bye bye!	<tablet(off)><gaze(child)>Ik denk dat we klaar zijn!! <face(happy)> Dat was leuk! Zullen we snel weer samen spelen? <face(neutral)> <wait(3000)> Ja, laten we de volgende keer weer spelen! <gesture(waving)> Daag!				Great job you are all done	

APPENDIX II – STORYBOARD LESSON 2.

	Robot			Tablet			
#	Text L1 English	Text L1 Dutch	Text L2	Scene	Objects	Say	Comment
	[Introduction: 2 minutes]						
1	<face(happy)><gaze(child)>Hey <name> It's time to play another game! Are you ready?	<face(happy)><gaze(child)>Hey <name> Het is tijd voor een nieuw spelletje! Ben je er klaar voor?					(would probably say yes, but the answer does not really matter)
2	<wait(500)>	<wait(500)>					
3	Alright, we are going to the forest today! <accept_answer>Can you touch the forest?	Oké, vandaag gaan we naar het bos! <accept_answer>Raak het bos maar aan.					
	<giveResponseToSelectObject(forest)>						Child touches the forest icon in the town map on the tablet
6	<gaze(tablet)><pointAt(tablet)>Look, there are many footsteps! <gaze(child)> I bet there are many animals. Let's go find them! <name>, let's march together! <gesture(marching)>	<gaze(tablet)><pointAt(tablet)>Kijk, daar zijn allemaal voetafdrukken! <gaze(child)> Ik denk dat die van dieren zijn. Laten we die gaan zoeken! <name>, laten we samen rondlopen! <gesture(marching)>		forestWithFootsteps			
8	<gaze(tablet)>Okay, this looks like a good spot to find animals. <gaze(child)>What should we look for… Oh I know!	<gaze(tablet)>Ok, dit lijkt me een goede plek om dieren te vinden. <gaze(child)>Wat moeten we zoeken… Oh ik weet het!		forest_1			
9						*Monkey*	
10	I think it is telling us where a monkey is...	Ik denk dat de tablet ons vertelt waar een aap zit…	monkey?				
11						*The monkey is behind the tree*	
12			*The monkey is behind the tree…?*				
	I think it is telling us where a monkey is... Can you find and touch a	Ik denk dat hij ons vertelt waar een aap is. Kan jij de aap zoeken <accept_answer> en aanraken?					
	<giveResponseToSelectObject(monkey_behind)>						Child touches around the tail

14			*Behind. The monkey is behind the tree …*			*Behind. The monkey is behind the tree.*	
15	Ohhh<tablet(off)> <gaze(child)>behind must mean “behind”! <name>, what do you think it means.	Oh<tablet(off)> <gaze(child)> betekent vast “achter”! <name>, wat denk jij dat het betekent?	*behind*				(waits for 2 seconds for Child’s response. If Child is talking, wait for additional 2 seconds)?
16	<wait(2000)>						
17	Let’s practice saying the word	Laten we even oefenen met het nazeggen	*Behind. 3, 2, 1…Behind!*				
18	<giveResponseOnSpeech(behind)>						
19	<tablet(on)>	<tablet(on)>				*The monkey is behind the tree .*	
20	<gaze(tablet)>	<gaze(tablet)>			remove monkey_behind, display monkey_in_front_1 move monkey_in_front_1(94.5:0:93:5:false)		(The monkey comes out and stands in front of the tree)
21	<wait(5000)>						
22					remove monkey_in_front_1, display monkey_in_front_2		(The monkey comes out and stands in front of the tree)

23	<wait(5000)>				move monkey_in_front_2(29:0:175:5:false)		
24					remove monkey_in_front_2, display monkey_in_front_3		
25	Oh!	Oh!					
26						*In front of . The monkey is in front of the tree.*	
27	<gaze(child)>I see. means “in front of”! Let’s practice too!	<gaze(child)>Ik snap het. betekent "voor". Laten we het nazeggen	*In front of…? In front of in front of. 3, 2, 1…In front of!*				
28	<giveResponseOnSpeech(in front of)>						
29	Now in a sentence.	Nu in een zin:	*The monkey is in front of the tree*				
30	<giveResponseOnSpeech(the monkey is in front of the tree)>						
31	<gaze(child)>Great!	<gaze(child)>Super goed!					
	[Task]						
32	<tablet(on)>	<tablet(on)>		forest_2			(Body parts of other animals sticking out - A bird’s tail sticking out of the top of a tree, a monkey’s tail from the top of another tree, a giraffe’s tail behind the tree.) + a house with a bird in it

33	<gaze(tablet)><pointat(tablet)>Look! <gaze(child)> There are other animals behind the trees. Can you find all of them? Touch <pointat(tablet)><gaze(tablet)> the animals.	<gaze(tablet)><pointat(tablet)>Kijk! <gaze(child)> Daar zijn nog meer dieren achter de bomen Kun je ze allemaal vinden? Raak <accept_answer> <pointat(tablet)><gaze(tablet)> de zjiraf maar aan.	*The animals, are behind the trees* !				(depending on where Child touches, play one of the following scenarios. Continue until all three scenarios are played.)
34	<giveResponseToSelectObject(giraffe_behind)>						
35	<gaze(child)>I remember! "Giraffe" is in English!	<gaze(child)>Ik weet het weer! "Zjiraf" is in het Engels	giraffe			*Giraffe. The giraffe is next to the flower*	
36	<wait(5000)>				move giraffe_behind(-24:0:103:5:false)		
37					display giraffe_in_front, remove giraffe_behind		
38	<wait(5000)>				move giraffe_in_front(-82:0:133:5:false)		
39	<gaze(tablet)>Oh it moved! The giraffe is in front of the tree! <wait(2000)>	<gaze(tablet)>Oh, hij bewooog! De zjiraf is nu voor de boom!	*The giraffe is in front of the tree!*			the giraffe is in front of the tree	
40	<giveResponseToSelectObject(monkey_in_tree)>	Raak <accept_answer> <pointat(tablet)><gaze(tablet)> de aap maar aan.			display monkey_in_tree		

41					remove monkey_in_tree and display monkey_falling		
42	<wait(5000)>				move monkey_falling(90.97879309646007:0:113.59077889034276:5:false)	Monkey. The monkey is on the tree. The monkey is falling	(as the monkey fall from the top of the tree to the ground, right below the bird house on the tree).
43					remove monkey_falling and display monkey_fallen		
44	Ouch, <gaze(child)>I hope the monkey is fine!	O jee, <gaze(child)>Ik hoop dat het goed gaat met de aap!				*Monkey is below the house.*	
45	<giveResponseToSelectObject(bird_flying)>	Raak <accept_answer> <pointat(tablet)><gaze(tablet)> de vogel maar aan.			display bird_flying		
46	<gaze(tablet)> <wait(5000)>	<gaze(tablet)>			move bird_flying(-181.73548514032768:155:81.20643192022413:5:false)	Bird.	
47	So "bird" is in English	Dus vogel is in het Engels.	bird			*The bird is above the flower.*	
48	<gaze(child)>It looks like we found all animals! <name>, how many animals are there? Say the number in English! <giveResponseOnSpeech(three)>	<gaze(child)>Ik denk dat we alle dieren gevonden hebben! <name>, hoeveel dieren zijn er? Zeg het getal maar in het Engels!					

49	<name>, do you like animals? <wait(1000)>	<name>, hou jij van dieren? <wait(1000)>				*One monkey, one giraffe, one bird .*	
	<face(happy)>I really love animals, and I wish I could join them.	<face(happy)>Ik hou heel veel van dieren. Ik zou willen dat ik bij ze was.					The animals start moving - one of the monkeys running, the other monkey walking, the giraffe jumping in front of a tree, and the bird flying.
50							
51	<gaze(tablet)>Now they are moving! <gaze(child)> Let's pretend we are actually animals by imitating what these animals are doing. Can you touch <pointat(tablet)><gaze(tablet)> one of them?	<gaze(tablet)>Nu bewegen ze weer! <gaze(child)> Laten we doen alsof we dieren zijn door ze na te doen. Raak de aap die aan het rennen is <accept_answer> maar <pointat(tablet)><gaze(tablet)> aan.		forest_3	animate temp_giraffe0(jump:true), move temp_MonkeyWalk0_1(-11.797439540283747:0:200:15:true) and move temp_MonkeyRun0_2(60:0:200:5:true), move temp_BirdFlying0_4(311.39725864319234:130:61.50240183206279:10:true)		
52	<giveResponseToSelectObject(monkeyRunning)>						
53	<gaze(child)>Can you say running That is how we say "running" in English, huh? Let's say the sentence! Can you say	<gaze(child)>Zeg maar: rennen Zo zeggen we rennen in het Engels. Nu zeggen we de hele zin! Zeg maar:	running? the monkey is running		zoom monkeyRunning	*The monkey is running.*	

54	<giveResponseOnSpeech(the monkey is running)>	<giveResponseOnSpeech(the monkey is running)>	*Running , running, running!*				
55	Now let's run together! I cannot quite run, but I will pretend!	Laten we samen rennen! Ik kan niet echt rennen, maar ik zal doen alsof.	*<gesture(running)>*		zoom out		
56	<gaze(child)>Can you say walking That is how we say walking in English, huh? Let's say the sentence! Can you say	<gaze(child)> Zeg maar: lopen Zo zeggen we lopen in het Engels. Nu zeggen we weer de hele zin. Zeg maar	walking? the monkey is walking		zoom monkeyWalking	*The monkey is walking*	
57	<giveResponseOnSpeech(the monkey is walking)>	<giveResponseOnSpeech(the monkey is walking)>	*walking, walking,walking!*				
58	Now let's walk together! I cannot quite walk. but I will pretend!	Laten we nu samen lopen. Ik kan niet echt lopen, maar ik doe gewoon weer alsof	*<gesture(walking)>*		zoom out		
59	<gaze(child)>Can you say flying That is how we say flying in English, huh? Let's say the sentence! Can you say	<gaze(child)>Zeg maar: vliegen Dat is het Engelse woord voor vliegen. Nu gaan we weer de zin zeggen. Zeg maar	flying? the bird is flying		zoom bird	*The bird is flying*	
60	<giveResponseOnSpeech(the bird is flying)>	<giveResponseOnSpeech(the bird is flying)>	*flying, flying,flying!*				
61	Now let's fly together! I cannot quite fly. but I will pretend!	Nu gaan we samen vliegen! Ik kan helemaal niet vliegen maar ik doe alsof	*<gesture(flying)>*		zoom out		
62	<gaze(child)>Can you say jumping That is how we say jumping in English, huh? Let's say the sentence! Can you say	<gaze(child)>Zeg maar: springen Dat is springen in het Engels he? Nu zeggen we weer de zin. Zeg maar	jumping? the giraffe is jumping		zoom giraffe	*The giraffe is jumping*	
63	<giveResponseOnSpeech(the giraffe is jumping)>	<giveResponseOnSpeech(the giraffe is jumping)>	*jumping, jumping,jumping!*				
64	Now let's jump together! I cannot quite jump. but I will pretend!	Nu gaan we samen springen! Ik kan niet springen, maar ik doe alsof	*<gesture(jumping)>*		zoom out		
	[Test]						

	<gaze(child)>We learned many words! Now, let's move on to today's game. Today's game is a guessing game. You hear an English sentence talking about what one of the animals is doing, and you have to find the animal. <name>, are you ready?	<gaze(child)>We hebben echt veel woorden geleerd. Nu gaan we een spelletje doen. Het spelletje van vandaag is een raadspelletje. Je hoort steeds een Engelse zin over wat een van de dieren aan het doen is en dan mag jij dat dier zoeken. <name>, ben je er klaar voor?				
65	<wait(1000)>	<wait(1000)>				
66	Hmmm, Which one is Can you touch the animal?	Hmmm, Welke is Raak dat dier maar aan.	it is running. running?			*It is running*
67	<giveResponseToSelectObject(monkeyRunning)>	<giveResponseToSelectObject(monkeyRunning)>				
68						*Correct. It is running*
69	<face(happy)>Yes, we got it right!	<face(happy)>Ja, we hebben hem goed!				
70	Hmmm,	Hmmm,	it is walking.			*It is walking*
71	Which one is Can you touch the animal?	Welke is Raak dat dier maar aan.	walking?			
	<giveResponseToSelectObject(monkeywalking)>	<giveResponseToSelectObject(monkeywalking)>				
72	<face(happy)>Yes, we got it right!	<face(happy)>Ja, we hebben hem goed!				*Correct. It is walking*
73	Hmmm, Which one is Can you touch the animal?	Hmmm, Welke is Raak dat dier maar aan	it is flying. flying?			*It is flying*
74	<giveResponseToSelectObject(bird)>	<giveResponseToSelectObject(bird)>				
75	<face(happy)>Yes, we got it right!	<face(happy)>Ja, we hebben hem goed!				*Correct. It is flying*
76	Hmmm, Which one is Can you touch the animal?	Hmmm, Welke is Raak dat dier maar aan	it is jumping. jumping?			*It is jumping in front of the tree*
77	<giveResponseToSelectObject(bird)>	<giveResponseToSelectObject(bird)>				
78	<face(happy)>Yes, we got it right!	<face(happy)>Ja, we hebben hem goed!				*Correct. It is jumping*

79	<face(happy)>We have another a star! So exciting! Alright <name>, see you soon again!	<face(happy)>We hebben weer een ster gekregen! Jippie! Oké <name>, tot de volgende keer!		town	display star		

APPENDIX III – STORYBOARD LESSON 3.

	Robot			Tablet			
#	Text L1 English	Text L1 Dutch	Text L2	Scene	Objects	Say	Comment
1	**[Introduction: 2 minutes]**						
2	<gaze(child)><face(happy)>Hi again <name>! Are you ready to play today's game?						(would probably say yes, but the answer does not really matter)
3	<wait(1000)>			map			
4	Alright, let us begin! Today, we are going to the playground! Can you touch <accept_answer)><pointat(tablet)><gaze(tablet)> the playground on the map?				enable map		
5	<giveResponseToSelectObject(playground)>						The child touches the <playground> icon in the town map on the tablet
6	We arrived at the playground,<gaze(child)> but there is nothing to play with. That is weird.			playground_1			(displays an image of a playground with a tree on the side, but the playground is empty with no play equipments)
7	<gaze(Tablet)>Oh hey, the slide appeared in front of the tree!		*In front the tree!*		display slide		(an image of a slide pops up in the playground, in front of a tree)
8	I thought this is a boring playground with nothing, but I now know what is going on. We get to design our own playground! Can you <pointat(tablet)><gaze(tablet)> <acceptanswer> put the slide somewhere in the playground? <gaze(child)> <giveResponseToMoveObject(slide, to, slidePlace)>				highlight slidePlace		

9	Are we done? <gaze(tablet)> If we are done, I think you should touch <pointat(tablet)><gaze(tablet)> the button at the corner. <gaze(child)>				display button		(displays a button at the bottom right corner with a star or an arrow)
10	<giveResponseToSelectObject(button)>						
11	<gaze(tablet)>Yay<face(happy)>, now we are done placing the slide!<gaze(child)>				display confetti		
	<gaze(tablet)>Oh, look!	*She is running!*			display girlRunning	*Girl. The girl is running.*	(a little girl appears and runs towards the slide)
	See? I remember the English word!	*Running!*					
	<tablet(off)>I think	*girl*					
	means "girl." Can you say	*"the girl is running"?*					
12	<giveResponseOnSpeech(the girl is running)>						
13	<gaze(child)>Let's run together with her!	*Running, running, running!* *<gesture(running)>*					(moves arms back and forth to pretend running)
14	<tablet(on)><gaze(Tablet)>Look, she stopped		playground_2				(The girl stops in front of the ladder of the slide, facing the slide - thus her face cannot be seen)
15	Oh, look! Now I see a boy				display boyRunning		(a little boy appears and runs towards the slide)
16	<gaze(child)>Aha,	boy				*Boy. The boy is running.*	
	must mean "boy"						(The boy stops on the left of the girl, facing the slide - thus his face cannot be seen)
17	<gaze(tablet)>Oh he stopped on the left of the girl!					*Left. The boy is on the left of the girl .*	
	<gaze(child)>Hm,	*"boy"*					

	means "boy", and	*"girl"*				
	means "girl"… The boy is next to the girl, but "next to" is	*next to*				
	in English…<name>, do you know what	"*The boy is on the left of the girl*"				
	means?					
18	<wait(1000)>					
					Right . The girl is on the right of the boy.	
19	Hmmm					
		The girl is on the right of the boy . The boy is on the left of the girl …				
	Oh, the word order changed.					
	Ohhh! I know what they mean!	"*Left*"				
	means "left" and	"*right*"				
		The boy is on the left of the girl .				
	means "right"!	*The girl is on the right of the boy*"				
	That is how we say "The boy is on the left of the girl"!					
	means "the girl is on the right of the boy"! <name>, what do you think?					
						(the girl moves to the ladder part of the slide)
20				move girlRunning(x,y,z,speed)		
						(The girl starts climbing up the ladder)
	<gaze(tablet)><pointat(tablet)>Oh look!			move		
21		*The girl* !		girlRunning(x,y,z,speed)		
		The girl is climbing .				
					The girl is climbing.	
22	<gaze(child)>Whoa, that was a new word!	"*Climbing*"				
		"*The girl is*				
23	must mean "climbing"! <tablet(off)>Let's say it together.	*climbing*"!				

24	<giveResponseOnSpeech(the girl is climbing)>					
25	<name> can we pretend to be climbing? You can stand up if you would like to.		*Climbing, climbing, climbing...* <gesture(moves arms up and down to pretend climbing)>			
26	<tablet(on)><gaze(tablet)>Oh, the girl stopped!					(The girl stops at the top of the slide)
27	<gaze(child)>Another new word! must mean "sliding"! Let's practice the sentence.<name> can you say		*Sliding! Sliding*" "*The girl is sliding*"?		*The girl is sliding.*	(the girl slides down the slide)
28	<giveResponseOnSpeech(the girl is sliding)>					
29	Let's pretend we are sliding! You can stand up if you would like to.		*Sliding, sliding, sliding...* <*gesture* (sliding)>	move girl(x,y,z,speed)		(the girl comes to the left of the boy)
30	<gaze(tablet)><pointat(tablet)>Oh look!				*The girl is on the left of the boy . The boy is on the right of the girl.*	(rotates 90 degree and face the same direction as Child - thus showing its back to Child - and looks over to Child its shoulder).
31	<tablet(off)><gaze(child)>Ugh, left and right are really difficult. Let's play a game! I am going to say "left" or "right" in English and you have to touch one of my hands. If I say, you touch the left hand <gesture(raiseLeftHand)>. If I say you touch this hand <gesture(raiseRightHand)> Ready?		"*left*," "*right*",			
32	<wait(2000)>					
33	the first one is		right			

34	<giveResponseToTouch(rightHand)>						
35	yup		right				
33	You got it right. the second one is		left				
34	<giveResponseToTouch(leftHand)>						
35	yup		left				
33	You got it right. the last one is		right				
34	<giveResponseToTouch(rightHand)>						
35	yup		right				
	You got it right. I think we are ready!						
36	Alright. <tablet(on)> <gaze(tablet)>I think we are ready!						(rotates 90 degree and goes back to the original orientation)
37	<pointat(girlOnTablet)>		The girl is on the left of the boy.				
38	<pointat(boyOnTablet)>		The boy is on the right of the girl				
39	Another equipment <gaze(child)> appeared behind the tree!		*Behind the tree!*		display basketballHoop		(an image of a basketball hoop pops up in the playground, behind the tree)
40	<gaze(tablet)>Woo hoo!				display confetti		
41					move girl(x,y,z,speed) and move boy(x,y,z,speed)	*They are walking.*	Two children -- a girl holding a basketball and a boy, walk toward the stand)
42	<gaze(child)>Ah yes, they are walking.		*They are walking* . "*they are walking*"?				
43	<tablet(off)>Can you say <giveResponseOnSpeech(they are walking)>						

44	Let's walk with them! You can stand up if you would like to. <tablet(on)><gaze(tablet)>Hm, what's now?		*Walking, walking, walking…<gesture(walking)>*				(The girl and boy stop) (The girl throws the ball towards the basketball hoop. The ball keeps bouncing back to the girl)
45	<gaze(child)><tablet(off)>Oh, that is a new word!		*Throwing* !		display girlThrowsBall	*Throwing. The girl is throwing the ball.*	
46	Maybe means "throwing"? So must mean "ball"! <name> say		"*throwing*" "*ball*" *The girl is throwing the ball* . "*the girl is throwing the ball*"!				
47	<giveResponseOnSpeech(the girl is throwing the ball)>						
48	<tablet(on)><gaze(tablet)>				display girlThrowsBallToBoy	*The girl is throwing the ball.*	(The girl now throws the ball to the boy)
49						*The boy is catching the ball.*	(The boy catches the ball) (The boy releases the ball, the ball roll toward the girl, and the girl grab the ball and throws toward the boy again)
50					move ball(x,y,z,speed)		
51					display girlThrowsBallToBoy	*The girl is throwing the ball.*	

52	) <gaze(child)><tablet(off)>Alright, now we learned another word.				display boyCatchesBall	*The boy is catching the ball.*	(The boy catches the ball)
53	must mean “catching.” Can you say		“*Catching*” “*the boy is catching the ball*”?				
54	<giveResponseOnSpeech(the boy is catching the ball)>		*I am throwing the ball!* <*gesture* (pretends to throw a ball towards the child)> *You are catching the ball!*				
55	Let’s imitate what they are doing. I throw, and you catch.						
56	<wait(1000)>		*You are throwing the ball. I am catching the ball*				
57	Now, let’s switch! <name> throw me a ball! This is fun!						
58	<tablet(on)><gaze(tablet)><pointat(tablet)>Look! A trampoline appeared behind the tree!		*Behind the tree!*		display trampoline		(an image of a trampoline pops up in the playground, behind the tree)
59					display confetti		(confetti appears, and another boy walks towards the trampoline and starts jumping on it)
60	Oh,		*the boy is flying!*		display boyJumping		

61	<gaze(child)>Wait, not means “flying”, right?<name>, what was the English word for “jumping?		*flying* . “*Flying* ”				
62	<wait(1000)>						
63	Yeah,		*Jumping. the boy is jumping* !				
	Do you remember the word? Let’s say it together.		*3, 2, 1...The boy is jumping* ”!				
64	<wait(2000)>						
	[**Test]**						
65	Great. I think we are done designing the playground, and we learned many new words too! Let’s see if we remember all English words! We are going to quiz each other!						
	Alright, you quiz me! Can you touch one of the children? I will tell you what the child is doing!						
66	<giveResponseToSelectObject(girlSliding,girlThrowing,boyCatching,girlClimbing)>						
67			the girl is sliding				
	is that right?						
68	<wait(1000)>						
	<face(happy)>I got it right!		the girl is sliding<face(neutral)>				
69							
70			the girl is swimming				
	is it right?						
71	<wait(1000)>						
	Oh shoot, I got it wrong, huh?		she is <face(happy)>throwing				
72							
73			the girl is sliding				

	is that right?						
74	<wait(1000)>						
	<face(happy)>I got it right!		the boy is catching<face(neutral)>				
75							
			the girl is				
76			running				
	is it right?						
77	<wait(1000)>						
	Oh shoot, I got it wrong, huh?		she is <face(happy)>				
78			climbing				
79	<face(happy)>Yay we got a star! I am looking forward to playing with you again. Good bye!						