Project Queuing Behavior: N.T.M. van Kleef
Internship at Kyoto University Report
Coping with Differing Human Crowd Queuing
Behavior among Cultures

N.T.M. van Kleef, 0086223

Supervisors:
Toyoaki Nishida-Sensei & Yoshimasa Ohmoto
& Divesh Lala-kun (Kyoto University)
Prof Dirk Heylen (University of Twente)

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Preface

“Indeed, research is a continuous process of trial and errors, rather than completing things as scheduled. It would be nice if you can write the process of trial-and-errors in detail, exactly what kind of issues have popped up and how you have handled them, or a space of possible solutions, including both your actual solution and other potential solutions so other people can share your experiences.”
– Nishida-sensei

My name is Nils van Kleef, master student of Human Media Interaction at the University of Twente. This report details my internship at Kyoto University, at the lab of Prof. Toyoaki Nishida.

My main reasons for doing an internship are twofold: one, it was a compulsory part of the Human Media Interaction masters program. Two, I believed and still do, that an internship is a good way to develop myself as a student on a more practical level, especially as a lot of the masters program is theoretical or just contains some work assignments that do not simulate later real-life work environments.

I have always wanted to do a stay abroad during my time as a student. When I was faced with the choice of where I wanted to do my internship, as staying in the Netherlands or going abroad, I quickly picked the first option. Because I have a part Asian heritage and have always been interested in Asian culture, my eyes were set on an Asian destination. While talking with different professors and others who might know of an internship location for me, Prof. Anton Nijholt told me of a place in Japan where I might be able to go. After sending a few e-mails back and forth, I was allowed to do an internship at Kyoto University. This showed me the value of networking: because Nishida-sensei, the professor at the lab I would be doing research, was a friend of Prof. Nijholt (they both hosted and edited the International Workshops on Social Intelligence Design), he accepted me as a researcher.

After filling in and sending some paperwork, with which the labs secretary Ayako Izutani helped me greatly, I was on a plane to Kyoto on 15 November 2012. For four months, until 15 March 2012, I would be living in Kyoto, experiencing life in a foreign country and as a researcher at Kyoto University. Four months is a very short time for internship, especially in foreign country, but it’s a great opportunity for someone to learn something about the country and culture and experience life abroad. I absolutely think this is one of the best experiences I have had in my life, and am grateful for the opportunity.
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Chapter 1

Background

I have finished a bachelor in computer science at the University of Twente (finished in 2010). I am currently working on obtaining my masters degree in Human Media Interaction at the same university. The internship I have done at the Nishida Laboratory at Kyoto University is a compulsory part of the Human Media Interaction masters program.

Some of the courses I have followed previous to my internship:

- Computer ethics
- Graphics
- Human computer interaction
- Information retrieval
- Machine learning
- Speech and language processing

1.1 Nishida Lab

The Nishida Laboratory is a research lab which is part of the Group of Applied Intelligence Information Processing, in the Department of Intelligence Science and Technology, in the Graduate School of Informatics, at Kyoto University. It has three large rooms in Engineering Building 10, on the Yoshida Campus (main campus). Its main focus is dedicated to research on applied intelligent information processing, focusing on Social Intelligence Design and Conversational Informatics [6], and its lab members are shown in figure 1.1. Its main research activities fall into three categories [6]:

- interaction measurement, analysis and modeling
- intelligent interactive systems
There was not really an idea of what my research would be about, but I knew I wanted to do something with graphics programming. I had the freedom to explore the available topics at first, with guidance from Nishida-sensei and Divesh-kun. I was not sure what section I would focus on, but soon it became clear that I would do research in the topic of social intelligence design: a field dedicated to researching an individual’s ability to improve its life in a social context [6].

Nishida Lab is working on multiple projects, some of which I was also interested in. Some of the projects that Nishida Lab works on that I could have helped with:

- Creating a 3D world of the Kyoto University main entrance using camera shots
- Using the Kinect to create a 3D model of a room, and being able to move around in it
- Using a Kinect to control a helicopter by means of gestures and body movements
- Extending the Simulated Crowd, which is a simulation that tries to simulate cultural immersion by means of a virtual crowd in an immersive interactive environment
I decided to work on extending the Simulated Crowd, because this was a project where I could do some hands-on graphics programming. Also, I felt that I could use whatever ideas I had myself to further the project here more than with the other projects. A different subtitle of my project could have been “Researching Japanese Social Awkwardness Using Virtual Environmental Simulated Shopping Queues”
Chapter 2

Research Questions

One of the topics researched at the Nishida Laboratory is social behavior. I believe social behavior is an interesting topic, so this was the topic I would first try to find a matching research assignment. Living in Japan gave me the option to first-hand experience the difference in social behavior between Japanese and Dutch people, as well as some other cultures that I knew at least something about (for example the Western culture in the United States, which differs in important aspects from that in the Netherlands), so using my own experiences as input for the research was something I also wanted to try.

In the lab, a specific research topic is: social intelligence as an individuals ability to better live in a social context. I wanted to find myself a way in which I could try to teach people about specific social behavior. Here, my experiences of living in the Netherlands as opposed to Japan came in handy. I wanted to do an experiment, because that is the most practical way of going about the assignment: I preferred a practical approach above a more theoretical one.

An aspect of social behavior that I find interesting is how people react in socially uncomfortable situations. An example of important differences between the Western culture and the Japanese culture has to do with the way people experience embarrassment in social situations, by looking at one’s self-image: “Do I look respectable? Should I be embarrassed because I might not?” In Japan, a lot of people are concerned with the self-image of others and whether they will make them look bad: “Do I look respectable? Will others be embarrassed because I might not?” This shows one of the differing points of view in a social context between the Western culture and the Japanese culture.

2.1 Queuing

Testing how people behave in social situations is possible in multiple ways. Especially when testing

- Putting someone in an uncomfortable social situation
• Putting someone in an initial comfortable situation that slowly or suddenly becomes uncomfortable

A social situation that usually only presents low levels of discomfort is the way people queue in a line, waiting for something. When looking at social behavior, this is a situation that comes up a lot in crowd behavior, e.g. in front of a shop, stand or escalator. Queuing seems the logical and social thing to do in the Netherlands and in Japan. But if you look at countries like India, people tend not to queue in a lot of situations where we would. This happens for example in stall, even though ‘social’ queuing behavior is slowly being enforced more and more [1]. Even if you compare the situation of waiting for a train in the Netherlands and Japan, in the Netherlands people just clump in front of a door and try to enter as quickly as possible, while in Japan people get into orderly lines and go inside in order of who was first. This shows that queueing is a good way to represent a social situation that differs between cultures, so can be used to teach people about specific social behavior.

Let us take these two main ways of queueing:

• in a line
• rushing

It is interesting to see which way people think is preferable and more efficient or effective. Even though someone comes from a mainly orderly queuing culture, that person might still think the other way is more efficient, and vice versa. Of course, the first situation applies to the typical Japanese and Western (not in front of trains though!) way of queuing, and the second situation applies to an Indian way of queuing.

2.2 The Questions

So, we can set the broad goal of my internship project as doing an experiment on awkward social behavior and teaching people the correct way of handling a situation, coming up with the research question:

How will people react to a socially uncomfortable situation?

Of course this is still a broad question, but the constraints, such as using a virtual reality environment to simulate the socially uncomfortable situation, will become apparent.

The second research question, derived from the text about queuing above, can be formulated as follows:

Which way of queuing will people think is preferable and more efficient: In a line or rushing?

One of the problems with this is that it is hard to simulate awkward social behavior in crowds in real life. Often it is difficult to find enough people that
are willing to participate in such an experiment in a real way, because as it is a social experiment with crowds, you will need a sufficient amount of people to simulate such crowds. The matter of ethics can also be brought into play. It is not ethical to put random people in the real-world that are not aware of the experiment in social awkward situations, but is it even ethical to put people who know an experiment is taking place in such a situation?

This is where the Simulated Crowd project came into play. The Simulated Crowd project is a project in which a virtual world, complete with inhabitants, is displayed on an immersive interactive environment. This means that a maximum of eight giant screens are set up vertically next to each other in such a manner as to create a circle of monitors. These screens show a virtual world with a village square with houses and roads surrounding it, with stalls placed on it. In this virtual world a number of robots are programmed to walk around to these stalls and interact with a shopkeeper. The virtual world and the robots are shown in figure 2.1 from [5].

I used this virtual world to program the ways of queuing that I described above. I have simulated a real-world social crowd situation that occurs a lot, which in my case is of course queuing. Then I did an experiment with real people to answer my research questions. This was built for peoples of different cultures, in my case mostly Japanese and Western people, also to see if the reactions of Japanese persons differed from those of non-Japanese persons.

2.3 Sub Research Questions

Another research question that I found interesting was the following one:
Can a virtual environment be suitable for learning about human social behavior?

I of course had a virtual environment at my disposal, and one of the major constraints was the virtual environment I would program. To create a real and genuine real world experience would be impossible, but I was curious about how my simulation would be experienced.
Chapter 3

Research

This chapter tells a bit more about the research part of my internship. I kept the literature research part short and simple, because with only a short four-month internship (excluding breaks and time lost to adaptation to Japanese culture and living abroad), and also wanting to do an experiment, left little time for doing extended research. I wanted my main focus to be on doing an experiment anyways.

3.1 Introduction

I went about the research part of my internship in mainly these ways, all of which are explained in their respective sections:

- Read up on literature
- Study real-life queues
- Look at the Hofstede Dimensions

3.2 Literature

As I wrote before, I only focused on finding a couple of relevant articles so that I could move on to the next phase of my research.

The first step was to find literature that was mostly focused on social anxiety in Japan. I mainly used Scopus and Google Scholar for this. Obviously a lot of research has been done in this area, so I could easily find a lot of articles on for example social anxiety. They were often related to differences between the Japanese’ and the United States’ in regards to social behavior, but these were mainly outside IT-related research groups. Most of the literature I found was irrelevant to my research; it was harder to find literature on queuing behavior and more specifically queuing behavior related to my research. Fortunately,
there were some others in the research group who had relevant literature that I could use.

Two interesting quotes I found in literature:

- “A good way to experience cultural immersion is to walk in a crowd.” [7].
- “… queuing behavior could take place when agents carry out the following decision rules: (1) walk randomly until a goal is determined, (2) seek the goal, (3) if obstructed by other agents, negotiate to initiate a queue, (4) join an existing queue if encounter one, and (5) execute target following to move forward in a queue” [8].

I included these because they said something about crowd and queuing behavior.

Most of what I did and created for my experiment was based on other sources, and Nishida-sensei and I agreed that I could better use other, more practical sources as basis for my experiment.

3.3 Real-life queuing

So I wanted to observe some real life queuing situations because they would be a good reference for how I needed to make a queue look as realistic as possible. There were two ways in which I obtained these movies: YouTube and making movies myself at Kyoto Station.

3.3.1 YouTube Movies

The first step was watching YouTube movies. So many people are bound to put movies there that I would probably find some relevant ones. I was looking for interesting situations in Japan where people were either queuing, moving in a crowd or otherwise showing what I would consider weird crowd behavior. Some of the more interesting YouTube movies that I found, of which those with the name Sutasine in the were filmed by my fellow lab mate Sutasinee Thovittikul:

- http://www.youtube.com/watch?v=IW4MkgMxiU (one long queue for entering a building)
- http://www.youtube.com/watch?v=sa-xnffeZBw (queuing with poles)
- http://www.youtube.com/watch?v=09Jzt1xP4as (queuing in front of a metro)
- http://www.youtube.com/watch?v=QyRZHaiLWhkE (Sutasinee: crowd in shopping street)
- http://www.youtube.com/watch?v=X6w7slPCbbE (Sutasinee: crowd in shopping street)
3.3.2 Kyoto Station Movies

I knew I could count on my memory to remember something about queuing in the Netherlands and perhaps some other places I had visited. In order to experience the way Japanese queue at a station first-hand, I went to Kyoto Station early in the morning to shoot some movies of Japanese people queuing. I did not have any problems filming, although I had to buy the cheapest available ticket to get closer to the railway tracks.

Both figures 3.1 and 3.2 show a still of two of the movies I made of Japanese people queuing at Kyoto Station.

3.3.3 Observations

After looking through all material, my next step was to make observations regarding the movies I found and shot myself. In general, Japanese people seem to queue very orderly in queues. Sometimes something noticeable. I wrote down
everything that I noticed, looking especially for situations that seemed peculiar to my Western (Dutch) worldview.

The observations I made in general:

• The Japanese prefer to make optimal use of the space available around them. Whenever there is a possible space to be filled, people go there. For example, in a train the people tend to position themselves based on distance to others. With few people this is not so much an issue, but with only a bit more people they even tend to go out of their way to shuffle around and make space for other people. They do this in a way that they are located as distance as possible from everyone around them, but my Western eye did not notice this until I started paying attention: they did it as unnoticed as possible.

• The Japanese will not stand in a semicircle in front of an opening, but as a group of people tend to stand as a block line in whatever they are queuing for. They tend to create a queue about as wide as the opening of the thing they are queuing for: for a shop it is per cassier, for a temple it is as wide as the opening of the temple. I especially noticed this in front of doors and gates, where only when it was extremely busy, people started queuing in slightly more aggressive ways than just forming a line in front of it.
• The Japanese almost do not seem to cut the line at all, especially when the line is orderly and there is an attendant watching the line. However, if the line is chaotic because of the huge amount of people involved (example given with New Years temple visits), people tend to cut the line sometimes, especially at places where the line takes a turn.

• Whenever I have seen someone cut the line, nobody has made any remarks about it (to that person or anyone else), or addressed that person for cutting the line. People seem to ignore this as much as possible. In most Western countries, depending on the situation, that person would often be told to go back to the end of the line, or at least some snidy remarks would be made about that person.

• You do not need to place fences to create an orderly queue, as long as the number of people in it is not too big. People will not try to get in from all the sides, but enter the queue at the back. This also happens when there are lines indicating the outlines of where the queue should be.

• Sometimes there are lines on the floor that denote where people should queue up. They are placed at locations where forming a usual queue could present an obstruction, for example close to an escalator. These lines are usually adhered to rigorously.

• Pushing can happen when Japanese people get drunk, enthusiastic or annoyed, as exemplified by the following quote: “The enthusiasm was so great, clerks with megaphones asked the crowd to stop pushing, warning that all sales would end if there were any injuries” [3].

• Of course you have Japanese train pushers, but that is a socially accepted situation.

What I noticed was the order of things for people queuing in front of a train (or metro), looking only at one queue:

• The first person stands in front of a sign on the floor that says where the door of the train will be.

• The next one will line up after that person, perpendicular to the track. The one after that will do the same, etc.

• The train arrives. People get out. The people queuing to get in move as close to the train entrance as possible.

• Right after everybody gets out; the people get in, in order of the queue.

Sometimes there are two lines in front of one train entrance, and what happens then is:

• The first person stands in front of one of the signs on the floor. The next person will stand in front of the other sign.
- The next one will line up after one of the other persons, perpendicular to
  the track. The one after that will do the same, etc.
- The train arrives. People get out. The people in both queues move as
  close to the train entrance as possible.
- People get in, and as that happens both queues merge to one single queue
  just before the entrance (wide enough for two people to fit through, in
  order of the queue.

All the above observations could possibly be of use for my simulation, which
I will explain in the next section (Simulation).

It seemed that people need to believe that other people follow ‘the’ social
rules. According to Nishida-sensei, when there is no sign in the environment:
people in the east (Tokyo) try to create social rule, but people in the Kansai
area would think that if there is no rule, then they will try to just get in. I
noticed that when it was busy at Kyoto Station, people would often just try to
get ahead of other people if there was space available in front of them. At Kyoto
Station, they would not push, but they would immediately fill in empty spaces
to make use of the available space in order to get closer to their destinations.

3.4 Hofstede Dimensions of National Culture

While doing my literature research, I came upon the Hofstede Dimensions of
National Culture by Hofstede, from [4], in short the Hofstede Dimensions. These
are interesting dimensions on which the values in a workplace of a country can
be explained in terms of five dimensions:

- Power Distance (PDI)
- Individualism versus Collectivism (IDV)
- Masculinity versus Feminity (MAS)
- Uncertainty Avoidance (UAI)
- Long-Term Orientation (LTO)

A sixth dimension (Indulgence versus Restraint: IVR) was added in 2010, but as
it is the least studied of the dimensions and has not been discussed as extensively,
I did not consider this dimension. It is important to note that the scores of
countries on dimensions only mean something when compared to those of other
countries [4].

3.4.1 Hofstede Dimensions Comparison with Japan

It might be interesting to see how I can use the Hofstede Dimensions to change
the behavior of the robots in the crowd, or the crowd itself, in the Crowd
Queuing Simulation. I could use a dimension to determine whether people line up or rush, or maybe also use it to determine a possible transition from lining up to rushing and seeing how an experimentee reacts to this situation. The Hofstede Dimensions:

1. Power Distance (PDI)
2. Individualism versus Collectivism (IDV)
3. Masculinity versus Feminity (MAS)
4. Uncertainty Avoidance (UAI)
5. Long-Term Orientation (LTO)

In order to do this, I first had to consider which of the Hofstede Dimensions were usable. I took a look at two countries that I knew at least something about, in regards to queuing people. Figure 3.3 shows the Hofstede Dimensions of Japan in comparison with China and India. I tried looking for a Hofstede dimension that would explain why people in Japan in general queue far more orderly when compared to China and India.

When looking at a comparison between the Hofstede dimensions of the above three countries, we can notice the following: We cannot make sense of the

![Hofstede Dimensions of Japan in comparison with China and India](http://geert-hofstede.com/)

Figure 3.3: Image of the Hofstede Dimensions of Japan in comparison with China and India (from http://geert-hofstede.com/)
countries respective queuing behavior for trains by comparing the countries respective Individuality (IDV), or Long Term Orientation (LTO):

- The Individuality levels for Japan (54) and India (77) are closer together, while China (20) is under half that of the other two countries.

- The Long Term Orientation of Japan (80) and India (61) are quite comparable when compared to China (118), which is a lot higher.

There is a difference in the other three cultural dimensions: Power Distance (PDI), Masculinity (MAS) and Uncertainty Avoidance (UAI):

- The Power Distance of Japan (54) is a bit lower than that of China (80) and India (77). This could be one of the dimensions I was looking for.

- The Masculinity of Japan (95) is a lot lower than that of China (66) and India (56). This was another interesting dimension worth a closer look.

- The Uncertainty Avoidance is the one that stands out the most. For Japan (92) it is a lot higher than for China and India (both 40).

Thailand is comparable to Japan with queuing behavior. Its Hofstede dimension scores are: PDI 64, IDV 20, MAS 34, UAI 64, LTO 56. This means that apart from IDV and LTO we can also discount MAS, because Japan has MAS 95, Thailand 34 and e.g. China 66. The ones we can still look at are PDI and UAI. Netherlands has PDI of 38 so we can discount PDI too. NL has an uncertainty avoidance of 53.

Based on the above and because I wanted to find one Hofstede Dimension that would be the best predictor of queuing behavior, I determined that uncertainty avoidance (92 for Japan) is the best to predict queuing behavior in different countries. When looking at countries where the uncertainty avoidance is high, this means that its people do not like to deal with uncertainty and ambiguity at all [4]. This could mean that people in a queue in India and China care less about ambiguity and uncertainty when people queue in a chaotic way (which also applies to the Netherlands, but slightly less), while Japanese people really do not want the ambiguity and uncertainty that comes with that way of queuing and therefore opt for a non-chaotic way whenever possible (when there is no over-crowding).

In the end, I have not pursued the idea of using the correct Hofstede Dimensions for determining whether the (people in the) robot crowd line up or rush due to time constraints, but I believe this is an interesting topic to pursue as future research. Also, another research could determine whether the sixth dimensions is a usable one for determining different cultures’ queuing behavior. The simulation already uses some of the Hofstede Dimensions in its programing, for example individualism is a variable that helps determining personal space and future orientation of the robots in the robot crowd.
Chapter 4

Simulation

I had found some literature and viewed and created some YouTube films on queuing (in Japan), but now we want to see a practical situation in which we test assumptions we have about the Japanese. So, the next step was building the simulation itself. The first thing I did before building the simulation is to follow a couple of jMonkey tutorials to get familiar with the platform. An important point to consider with this scenario would be the behavior of the virtual agents, as they have to match Japanese cultural behavior really well in order to ensure the participants feel most comfortable at first [2] I knew I would never be able to create virtual agents that could fool the participant into thinking they were real people, so instead I tried to use as few time as possible to create the best possible virtual agents.

I used the immersive interactive environment as explained in the chapter Research Questions, because that was the best way to picture a virtual world. Basically I adapted an existing simulation created by Divesh Lala (another lab member), who also adjusted another existing simulation. I started with the basic idea of how I wanted the queues to work. Originally I wanted to create a few different scripts representing different cultures, and see how participants react to those different cultures queuing. This didn’t plan out because of time constraints, so I decided to go for two different scenarios that could represent two different cultures.

4.1 Two Scenarios

Most of the time, Japanese people use ‘block queuing’ (see previous chapter):

When comparing the Japanese culture with other cultures, one thing that I noticed is that often, in other cultures such as the Indian culture, its people use semi-circle queuing:

This semi-circle queuing is a perfect way to put Japanese people in an uncomfortable social situation, because often they have not been in such a situation before, due to the Japanese way of queuing.
Figure 4.1: Situation sketch of waiting in front of train, in Japan

Figure 4.2: Situation sketch of waiting in front of train, in foreign countries
I already started thinking about the simulation and implementation while I was analyzing the video images and thinking about how I could incorporate them into my simulation. I decided to use shops instead of trains because they were readily available in the simulation. Creating a simulation with trains instead would have taken up a lot more time. Thus, I translated this into queuing for an eatery:

A choice I made was to have one goal type, to keep the experiment simple (the participant orders something from a shop). The number of lines of one queue I also set to one (one line per queue in front of a shop), and I had three different goals (getting something from exactly one of the three shops). I gave the roofs of all three shops a different color to make them easily distinguishable from each other for the experiments.

4.2 Agents

Next, I modified the agents’ behavior. This had to be scripted somehow. I had to choose between an agent based simulation and an interaction based simulation, the last of which the participant can interact with the agent(s). I decided to first make it an agent based simulation; then I could make it an interaction based simulation if I had time (which I did not).

The way I worked was to model the states of agents and then implement a goal per state, and then create behavior to support that goal. I analyzed the already present behavior of the agents and modified it to fit my simulation. The different states of the agents:

- strolling: will stroll around the square. Can progress to the state hungry. This will happen randomly, but usually quickly.
- hungry: will move towards a random food stand queue. Will progress to the state queued, when it enters a queue in front of a food stand.
• queued: is in line, and moves forward whenever an agent in front of it moves forward. Will progress to the state served whenever it is the first agent in the queue.

• served: is being served. Shopkeeper should show some kind of behavior that the agent is being served. Will progress to the state eating after it is served. This will happen randomly in between 10 and 30 seconds.

• eating: will walk around the square, eating. Basically means cannot become hungry. Will progress to the state strolling after a short interval.

In words, what happens is the following: the agents should be strolling around the square, and will become hungry. They will go to a random food stand to get something to eat. The first agent in front of a queue will be served by the agent in the food stand. After a short time period, the agent will then be served and move away from the food stand. Another agent will then take its place and be served. The agents that have just had something to eat will stroll around a bit, before becoming hungry and trying to find a food stand again.

To increase the feeling of the participant of being in a simulation, I gave the agents the same model that the participant has.

4.3 Simulations

The above thinking resulted in the two following two simulations for the experiments:

1. Computer controlled agents queuing up nicely in front of the shops.

2. Computer controlled agents rushing to the front of the shops.

The two simulation as explained above would play out in a way comparable to those shown in figures 4.4 and 4.5 (both top-down view). The agents would start at either side of the square and would either form a nice queue in front of the shops or rush to the front of the shops, depending on which simulation I would run. Next, the participant would have to order something at the shopkeeper. The ‘correct’ way to do this for the first simulation would obviously be to queue nicely and wait his/her turn. For the second scenario I was just interested in observing and had no thoughts about the right way to do that.

4.4 Controls

I also changed the controls to work like this:

• Use arrow keys to move around

• Use the ‘Enter’ key to interact with the shopkeeper

• Turn on/off mass rushing by using the ‘r’ key
Figure 4.4: Overview of typical view in scenario 1
Figure 4.5: Overview of typical view in scenario 2
• Turn on/off the quicktest feature by using the ‘q’ key
• Turn on/off the queuing lines by using the ‘l’ key

I only used the ‘r’ and ‘l’ keys myself, the first to change the scenario between the line queuing and rushing scenario’s, and the second to turn on and off lines in front of the shop where people should line up. The quicktest ’q’ key turned up/down the speed of the simulation, as explained below in the section about issues.

4.5 Issues and Faults

I encountered a lot of issues, some minor some major. Some I could solve to my satisfaction, while others I had to give up on because they were too fundamental to change. Fortunately for most errors I could find a workaround.

One tip I have for jMonkey users: do not keep the name of your main.scene the same as your main.j3o after converting it to a binary file. If you accidentally convert it to a binary file again then you lose all manual changes you made to the main.j3o.

A minor adaption to the simulation was that I setup the simulation to startup with the first person participant view. The idea was that the participant feels immersed in the environment immediately, and starting with a third person view did not help. Also, a first person participant view gives the participant a better awareness of collisions.

In the simulation, the original idea was to place two lines for every queue, to signal the borders of the queue. After looking at the video footage from the recordings of the train queuing behavior, this was changed to a line saying where the queue should begin in front of the shop. These seemed handy at first to indicate waiting locations, but it soon seemed they were not needed, because the first robot in the queue would just queue here anyways and that should be indication enough of the start of the queue.

I could have used a walking pad. However, the correctly programmed one was undergoing repairs at the time of my experiments, and it would take me too much time to program the other one. It also probably was not good enough for accuracy and might cause the participant to become irritated with the controls instead of focusing on the experiment. Because of all these reasons and because I knew probably all people that would perform the experiment were familiar with cursor navigation, I used the keyboard arrow controls.

Bug fixing and testing took up a lot of my time. A common problem was that solving a bug, often by means of a workaround, would create more bugs. Then I had to find a solution to that problem or go back to the original one and fix that by using another workaround. One thing that helped with testing was that I implemented an easy quicktest feature to speed up my testing. By pressing the ‘q’ key (as explained above in the section about controls), I could turn up the speed of the simulation: this increases the walking speed of the robots and
Agents tended to rotate strangely in place sometimes when moving to a (new) spot in the queue: they would rotate to face the opposite direction of the shop, and then turn back to face directly towards the shop. This was an error in the code which I managed to fix by not fixing the direction the robots would look when first standing still to the opposite direction of the shop.

To make the scenario look more life-like, I gave the agents and shopkeeper human skin, while before they had robot skin. This new skin is the same skin that the participant has. This caused performance issues because these human-like models were a lot heavier to animate than the robot models. My laptop could not keep up with even 10 robots walking around, but the desktop PC I used in the lab fortunately could with the 20 robots that I wanted in my simulation. The images 4.6 4.7 both show a scenario, one featuring the old and one with the new robot models.

Another important issue with the robot animation was that the agent models often lost their arms and legs for a short period of time in particular situations. This happened because sometimes the agents would move a bit forward in the queue and then stand still again, move forward again, and stand still again. Unfortunately, this occurred a lot of times in a short time period. For some reason, the animation would bug because when the animation changed from standing still to walking, the arms and legs would blink out of existence for a split second, long enough for a human to see. Because I thought trying to change the animation itself would cost a lot of time (I looked into it but could not find the problem quickly). I solved this by adding a time delay before the animation changes between walking and standing still. This caused the agents to sometimes look like they were moving while standing still, but at least they
did not lose their legs anymore. I could also have looked at changing the code of the robots’ behavior in the queue, but I hoped that by making changes to the animation it would fix this problem and cost less time.

One of the bugs I encountered with behavior in the rushing scenario was that agents queued after the first agent in line, instead of in front of the shop. This was not intentional, but I kept it this way because

- I did not have enough time to fix this bug

- if the agents all rushed in front of the shop itself they would stand at the sides of the agent being served, making it impossible for that agent to move out of the queue and let others queue instead, creating a deadlock.

To fully solve this would require a major rewrite of code, which I did not have time for. And it was not too big a hinder to play out the scenarios in the experiments, so I left it at that.

The interaction with shopkeepers bugged out with the participant. For some reasons it worked in earlier versions, but did not work with the final software. I found this bug while doing the first experiment, but it had no major effects on the experiments: I just told the participant that the experiment was completed (which it also was anyways).

My goal with the simulations was that I would create them in such a way that the participant can do the experiment by just starting the scenario and seeing how it plays out. However, because the participant had to have a goal and the controls would have to be explained anyways, I would just tell the participants beforehand what the controls were and how to do the experiment.

In the end, I did not use the Hofstede Dimensions for determining rushing behavior, also because of time constraints. I could have made the rushing key
instead set one of the Hofstede Dimensions (probably Uncertainty Avoidance) from 0 to 100 and use that as a determinant for rushing behavior, but with just the two scenarios I used, using the Hofstede Dimensions feels kind of superficial. Using them with more scenarios instead might actually give the Hofstede Dimensions a better reason to be the determinants of behavior in the simulation.
Chapter 5

Experiments

This chapter details the experiments: the setup, my hypothesis and observations.

5.1 Setup

So we have our two simulations, one with no rushing and one with rushing from the start. I made sure the immersive interactive environment was setup. And the program was ready to run. I setup a videocamera on a tripod to film the participant’s actions and reactions.

I created a user manual, see figure 5.1 so that all participants would have the exact same information before taking part in my experiment. I asked Divesh Lala to translate it to Japanese so that my Japanese participants could read it in their native language, as I noticed that often their English was not that good. I wanted to avoid any miscommunication due to the language barrier.

I also created a script for myself so that the things I would say to each participant would be more or less the same, to avoid a participant entering the experiment with different information. Of course not everything was in it, but it included the main points that I had to be sure I had carried out. I went through my script step by step, and ticked off every point for each participant whenever I had done it. I have included the script in the appendix 9.1.

I believe that it is important to ask participants for approval to film them and to post movies in which they figure on a public website (YouTube in this case). This means I asked all participants to sign a consent form for two things, so that I would be sure I had their consent when filming them during the experiments and putting their films on YouTube:

- Approval of camera
- Has read (+understood) manual

Only one person rejected my idea of me posting his/her film material on YouTube.
I made sure that I had printed the relevant forms: the user manual, green/blue/red pieces of paper and consent form.

5.2 Hypothesis

For every experiment you create a hypothesis: why are you doing your experiment, and what do you want tested? The experiment is used to test the hypothesis and this should be another step in finding answers to your research questions. My hypothesis is:

- Most participants will like simulation 1 better
- Most participants will think simulation 2 is more frustrating
- Most participants will take a shorter time to play simulation 2

Simulation 1 is closer to reality of queuing in Japan and is probably more comfortable for most people anyways (less stress). A Japanese person might be able to feel socially awkward in the RobotCrowd world, just as surely as people feel emotion in a virtual world. In simulation 2, the agents’ behavior is more chaotic so I can imagine people getting more frustrated with that.

I thought up the shorter play time hypothesis because I think people will be more adapted to the world the second try and therefore do the task I give them a lot easier (ordering something at a stall).

I will test my hypothesis by observing the participants, writing down both observations and key metrics (time elapsed and number of ‘enter’ key clicks),
and by having the participants fill in a questionnaire after having done my experiment.

5.3 Execution

I did all the experiments on two consecutive days: 8 and 9 March. After starting the experiment, I would let the participant walk around for one minute so he or she could get comfortable with the controls. Then I held up a piece of paper showing the color of the stall I liked them to queue for (which had the queue I thought most suitable for the experiment), see 5.3.2. I never talked with a participant about anything concerning the experiment until that person was done (filling in the questionnaire), except which was necessary, so that they would not know anything about the experiment before actually doing it.

https://www.youtube.com/watch?v=-rEyKkqrKpY shows an experiment carried out by Yoshimasa Ohmoto-sensei, with both simulation 1 and 2. In this experiment he queues in both scenarios.

5.3.1 A Typical Experiment

The experiments, barring bugs or errors, played out in the following way:

1. Welcome the participant, ask him/her to read and sign the consent form, and ask me if they had any questions about it
2. Ask the participant to read the user manual
3. Ask the participant to stand in the middle of the immersive interactive environment
4. Give the participant instructions about the controls and the actions I asked them to take (that after about one minute I would hold up a piece of paper with the name of the color of the stall and that I would then ask them to order something there)
5. Press ‘play’ on the video camera
6. Start the simulation
7. Wait about one minute (while the computer agents got into place and the participant could get used to the simulation and the controls)
8. Write down all my observations
9. Hold up a paper showing the name of the color of the stall I would ask them to queue for
10. Wait until the participant finished the simulation (ordered something from the stall)
11. Tell them the first simulation was done and ask them to wait outside so I
could setup the second simulation

12. Write down the key metrics (time elapsed and number of ‘enter’ key clicks)

13. Ask the participant to stand in the middle of the immersive interactive
environment

14. Tell the participant the instructions were the same

15. Start the simulation

16. Turn on rushing by pressing the ‘r’ key

17. Wait about one minute (while the computer agents got into place and the
participant could get used to the simulation)

18. Hold up a paper showing the name of the color of the stall I would ask
them to queue for

19. Write down all my observations

20. Wait until the participant finished the simulation (ordered something from
the stall)

21. Tell them the second simulation was done

22. Ask the participant to fill in a questionnaire and if they would like some-
thing to drink and/or eat

23. Press ‘stop’ on the video camera

24. Write down the key metrics (time elapsed and number of ‘enter’ key clicks)

25. Tell the participant the experiment was done, ask them if he/she had any
questions, and thank the participant for his/her time

I brought some bottles of soda, water and some cookies to give to the par-
ticipant as a token of appreciation for joining my experiment. It often makes
them feel valued.

5.3.2 Choosing the Correct Stall

For me it was important to choose the correct stall for the participant to queue
for, because a queue could be:

- bugged (which did happen sometimes)
- too short (hardly having a queue)
- too long (making the participant stay in the queue an extra long time for
  no reason at all)
My solution for this was to give the roofs of the shops different colors (as written in the previous chapter), and get the participants to queue in front of the stall with the best queue, give the above issues. I printed three sheets of paper with the name of the color of the shops’ roofs in both English and Japanese as shown in figure 5.2. One minute into the simulation, I would hold up one of the papers so that the participant would queue for that stall.

Image 5.3 shows queuing in scenario 1, and 5.4 shows line cutting in scenario 1.

The participants took on average about 213 seconds for simulation 1 and 140 seconds for simulation .

5.4 Evaluation

5.4.1 Observations

I had 14 participants in total, 7 Japanese and 7 foreign. For simulation 1, 7 people cut the line. For simulation 2, two participants obviously cut the line, and the rest first waited in front of it. For some reason the amount of robots in front of the stall gave the participants the idea that they should wait behind them and see what happens.

The interaction in simulation 2 often bugged: what the robots did often seemed unclear. A lot of (random) actions of agents could set up a deadlock, where agents would wait for each other to move. Fortunately this did not happen very often, but it did occur in two cases where I had to reset the scenario and restart the scenario from the beginning, and 2 more cases where I just left it
Figure 5.3: Experiment with simulation 1, queuing

Figure 5.4: Experiment with simulation 1, line cutting
after it bugged.

### 5.4.2 Questionnaire Results

See 9.3 for the questions in the questionnaire. The final results of the total questionnaire are shown in appendix 9.4. Some of the more important facts are displayed below.

Table 5.1 shows that most people preferred simulation 1 over simulation 2.

<table>
<thead>
<tr>
<th></th>
<th>Simulation 1</th>
<th>Simulation 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preferred simulation</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>More efficient simulation</td>
<td>9</td>
<td>4</td>
</tr>
</tbody>
</table>

Table 5.1: This table shows which simulation was preferred and deemed more efficient

The next table, table 5.2, shows the level of excitement that participants had while participating in the experiment with either simulation 1 or 2. Participants were 0.357143 more excited with simulation 1 and 0.428572 more frustrated with simulation 2.

```
<table>
<thead>
<tr>
<th></th>
<th>not at all</th>
<th>a bit</th>
<th>moderately</th>
<th>a lot</th>
<th>extremely</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excited, sim 1</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>2.785714</td>
</tr>
<tr>
<td>Frustrated, sim 1</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>2.285714</td>
</tr>
<tr>
<td>Excited, sim 2</td>
<td>2</td>
<td>6</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>2.428571</td>
</tr>
<tr>
<td>Frustrated, sim 2</td>
<td>2</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>2.714286</td>
</tr>
</tbody>
</table>
```

Table 5.2: This table shows which simulation was preferred and deemed more efficient

Table 5.3 shows the differences in excitement and frustration between scenario 1 and 2 that most people were more excited by simulation 1 and more frustrated by simulation 2.

```
<table>
<thead>
<tr>
<th></th>
<th>Simulation 1</th>
<th>Simulation 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>More exciting</td>
<td>8</td>
<td>5</td>
</tr>
<tr>
<td>More frustrating</td>
<td>4</td>
<td>7</td>
</tr>
</tbody>
</table>
```

Table 5.3: This table shows which simulation was more exciting and which was more frustrating

In the end I did not do anything with the counted enter presses.
5.5 Evaluation

I only had a few participants, 14 in total. This means that the results of my experiments are not valid statistically and I can only make assumptions about the outcomes of my experiment. Nevertheless, I can say some interesting things about it that I have not said before.

In simulation 2, the agents’ behavior looked a bit random to the participants and to me. This was because the agents clustered behind the first person in the row in front of a stall, but unfortunately I could not solve this, as I explained in the previous chapter.

The data saying simulation 1 was more exciting and less frustrating than simulation 2 is not very reliable, as simulation 1 was done first in all experiments, so because of that participants might have been more excited by simulation 1 and more frustrated by simulation 2. Also, the differences are not that big, as shown in table 5.2. I started with simulation 1, so that the supposed ‘culture shock’ would happen when participants were already familiar with the world and the controls, so would be more immersed in the simulation. Also, I did not have enough participants that I thought it would be wise to also test the reverse situation (first simulation 2 and then simulation 1), as I was already lacking participants to really say something about the results of the situation of first simulation 1 and then simulation 2 second.

I should have run a dummy test (do the experiments with the two simulations myself), so that I could spot some potential issues with running the experiments themselves. That I did not do this caused the simulation to be less optimized than I would have wanted it the first time I ran it: after the first simulation of the first experiment I halved the time robots are waiting to be helped by the shopkeeper, because it just took too long. And there are always some issues that you do not see until they are happening. Scenario 1 froze for, this was because the participant pressed ‘p’ for pause. It took me some time to find out what happened until I could resume the simulation.

The Japanese participants were not less likely to not cut the line, in fact they tended to try to cut the line about as often as the participants from other countries did.

There were 7 people that cut the line in simulation 1. Simulation 2 bugged a lot with robots moving away or, so unfortunately I cannot say a lot about my observations.

5.5.1 Hypothesis answer

To get back to my hypothesis:

- Most participants did prefer simulation 1. In general they were more excited by simulation 1 than by simulation 2.

- Most participants thought simulation 2 was more frustrating than simulation 1, so that was correct too.
- Actually only 2 participants took more time playing simulation 2 than simulation 1, one of which only had a 1 second difference. This means that my hypothesis is correct.

So all my hypothesis turned out to be correct.

Using Virtual Simulations

Participants thought that a virtual simulation is real enough to make it look and feel like a good simulation. However, in 7 cases in the first simulation people cut the line, so I can only conclude that my virtual simulation is not good enough to make it look like a real simulation where people automatically go to the back of the line. Realism is very important in a virtual reality simulation, and is often in those tiny details that are so hard to capture.
Chapter 6

Research Answer

Using the answers to my hypothesis of my experiments, I answered my research questions.

The first research question I had thought up was the following:

*How will people react to a socially uncomfortable situation?*

Of course the constraints here are the social uncomfortable situations of simulation 2 (rushing). Most of the time the participants waited for a bit to see what was happening and then decided to just go to the front of the queue when they could. They had their mission, just as they could have in a real-life situation, and adapted quickly to the unusual social situation. Another constraint of my answer is that this simulation does not approach reality because of being buggy and some errors with the second simulation and I can only draw conclusions from what I observed in my experiments.

My second research question was this:

*Which way of queuing will people think is preferable and more efficient: In a line or rushing?*

So most people found queuing in a line both preferable and more efficient. I have to say that especially my rushing simulation (simulation 2) was a bit buggy, so that my simulation might not have been the best attempt at simulating a rushing queue. The people adapted to an uncomfortable social situation pretty quickly, but I have my doubts if my simulation was close enough to reality as a lot of people cut the queue.

*Can a virtual environment be suitable for learning about human social behavior?*

I already answered this research question partly in the section 5.5.1. My simulation was probably not yet what I would call good enough to learn about human social behavior because in half of the simulations with the line-up queue the people tried to cut the line (bad social behavior). All participants answered
the research question “Do you think simulations such as these can be used to measure response of humans to social situations?” with ‘yes’ or ‘yes if realistic enough’, indicating that everyone thought these simulations can be used for learning about human social behavior too. So my final answer is yes.

6.1 Final Presentation

I did a final presentation mainly for the lab. I gave a talk of about 30 minutes, with about 30 minutes of Q&A, using these tips from Nishida-sensei:

- Go and talk slowly
- Use lots of examples
- Do not make it too hypothetical
Chapter 7

Conclusions

So this chapter is basically a summary of some of the elements in the previous chapters.

I did research on crowd behavior and specifically queueing behavior, creating a program that simulates crowd queuing behavior. I used this simulation to do experiments showing people prefer socially accepted behavior. I did some research on Hofstede Dimensions that applied to queuing behavior, but due to time constraints could not further progress on that.

In general people preferred simulation 1 above simulation 2 on every front (preference, more efficient, more exciting, less frustrating). So I can say this means people prefer queuing in a line above queuing in a rushing situation. But I only had 14 participants for my experiments, so my outcomes are not statistically valid. Also, my simulations had some drawbacks, as in that they might not have approached a real-life situation good enough to give real social tensions a role (made obvious by half of the participants trying to cut the line in simulation 1).

Some of the limitations of my simulations came up:

• Agent behavior was sometimes buggy or not realistic enough
• Animations were only realistic to a point
• Crowd rushing was buggy
• My simulation had no actual interaction between individual agents except for collision avoidance and group behavior

7.1 Future Research

There are many possible future projects. Some of the options that include improving realism in the existing simulation are:

• Improve realism and carry out the experiments and try to find out how much realism is needed to make sure nobody cuts the line in simulation 1
• Add interaction between player and crowd/shopkeeper to make it look more realistic

• Improve crowd simulation behavior by adding some kind of interaction between the robots more than the queuing behavior

• Improve the queuing behavior, especially in the rushing simulation by making sure robots queue in front of the shopkeeper and move out of the way of the robot that has been served

• Improve individual agent behavior by for example adding seemingly random, but human, behavior to robots

• Improve realism in navigation by adding movement options like strafing

When taking a look at the simulation itself there are other options such as adding more different scenario’s with things like:

• A pushing situation: someone pushing the participant, or another person

• Someone cutting the line

• Slow rushing: rushing starting half-way through, perhaps based on cultural dimension (probably UAI: “Uncertainty Avoidance”)

• Opening of a new counter

• Other line going way faster than the line the participant is in

• Circumstancial behavior: another line goes faster than your line, for example because of a slow cashier or a slow person in the line before you

• Anti-social behavior: jumping the queue, or people ignoring the queue altogether

It is important to focus on just 1 parameter, and changing this parameter to change behavior. Perhaps you can use polite vs impolite, or social vs anti-social behavior (depending on the social context). You can also give agents a probability to be impolite/anti-social, the chance of which is influenced by this probability parameter and perhaps other impolite behavior around the agent. This could however make the simulation more random, so it will be more difficult to draw conclusions on experiments with it.

Other research with queuing could focus more on the relation between the Hofstede Dimensions and queuing: is there a correlation between UAI and queuing behavior in cultures?

What is important to remember is that one should always make a comparison between simulations and draw conclusions based on observations of experiments done with those simulations. Also, when participating in the second scenario, people are always a bit less patient, as they know the controls and the world
already. This means that when carrying out an experiment a lot of times, be sure to reverse the order of the simulations for about half the experiments (so that simulation 2 is done first in an experiment).
Chapter 8

Evaluation

8.1 My Stay

There were a couple of things that I want to say about my stay. It is not that handy to do experiments in vacation times, this makes it harder to find participants. Fortunately I could find the amount of participants I wanted. Asking friends and people around the lab really helps.

Four months is a short time for a stay in a foreign country. I needed 2 weeks to adjust, 2 weeks to determine my research, had 2 weeks of vacation, 2 weeks (literature) research, 1 week of filming and checking out locations, 4 weeks of programming, 2 weeks of experiments and 1 week to finish up my research and do my final presentation. Add another random week here or there and it is already a full 4 months. Of course not everything happened this way, but did.

Making choices early is hard, but necessary to get good results and maintain focus. blabla

8.2 Thank You

I want to thank Prof. Toyoaki Nishida (Nishida-sensei) from Kyoto University 8.1 for providing me with the opportunity of staying with his lab and doing research. I want to thank Prof. Anton Nijholt from the University of Twente for bringing me into contact with Nishida-sensei. I want to thank Divesh Lala for helping me make my time enjoyable and talking me through some of the harder parts of life abroad and research. And I finally want to thank the (former) lab's secretary Ayako Izutani for making all the administrative parts of my stay seem so easy.
Figure 8.1: Photo of Yoshida Campus of Kyoto University
Bibliography


Chapter 9

Appendix

9.1 Script

This is the script that I used for my experiments:

1. Ask the participants if he/she has questions
2. Tell the participants that there are cookies at the end
3. Ask participants if I may film him/her and if I may put that film on YouTube (labaccount). Ask him/her to write down name + yes/no
4. Give the participant the participant’s manual; ask him to sign that he/she has read it
5. Put the participant in place and turn on the camera
6. Turn on scenario 1
7. Show red/blue/green paper after about 60 seconds (time it)
8. Write down observations + time/number of enter presses
9. Turn on scenario 2
10. Show red/blue/green paper after about 60 seconds (time it)
11. Write down observations + time/number of enter presses
12. Let participant fill in questionnaire
13. Write down participant number + date + time on questionnaire
14. Ask if he/she has questions
15. Tell the experiment is over
16. Give drink/cookie/chocolate
9.2 Observations

My observations with the experiments are shown in figure 9.1.

9.3 Questionnaire

After the experiment I asked my participants to fill in this questionnaire:

- What is your age?
- What is your country of birth?
- Were you excited with the first scenario? not at all // a bit // moderately // a lot // extremely
- Were you frustrated with the first scenario? not at all // a bit // moderately // a lot // extremely
- Were you excited with the second scenario? not at all // a bit // moderately // a lot // extremely
- Were you frustrated with the second scenario? not at all // a bit // moderately // a lot // extremely
- Which queuing scenario were you more comfortable with?
- Which queuing scenario do you think is more efficient?
- Did you think the other people in the simulation were humans or computer controlled robots?
- Do you think simulations such as these can be used to measure response of humans to social situations?

9.4 Questionnaire results

The results of the questionnaire are shown in figure 9.2.
Figure 9.2: Questionnaire results

<table>
<thead>
<tr>
<th>Date Time</th>
<th>Age</th>
<th>Country</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
<th>Scenario 3</th>
<th>Scenario 4</th>
<th>Other</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/06/2012</td>
<td>18-41</td>
<td>Germany</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>scenario 1</td>
<td>False, has been missing for the last 10 years</td>
<td>simulation valid, yes, with limitations: simulations will always miss small events but the big events are present.</td>
</tr>
<tr>
<td>3/06/2012</td>
<td>16-29</td>
<td>Japan</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>scenario 1</td>
<td>False, has been missing for the last 10 years</td>
<td>simulation valid, yes</td>
</tr>
<tr>
<td>3/06/2012</td>
<td>18-41</td>
<td>Russia</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>scenario 4</td>
<td>False, has been missing for the last 10 years</td>
<td>simulation valid, yes</td>
</tr>
<tr>
<td>3/06/2012</td>
<td>18-41</td>
<td>Brazil</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>scenario 4</td>
<td>False, has been missing for the last 10 years</td>
<td>simulation valid, yes</td>
</tr>
<tr>
<td>3/06/2012</td>
<td>18-41</td>
<td>Germany</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>scenario 1</td>
<td>False, has been missing for the last 10 years</td>
<td>simulation valid, yes</td>
</tr>
<tr>
<td>3/06/2012</td>
<td>18-41</td>
<td>Japan</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>scenario 1</td>
<td>False, has been missing for the last 10 years</td>
<td>simulation valid, yes</td>
</tr>
<tr>
<td>3/06/2012</td>
<td>18-41</td>
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<td>4</td>
<td>2</td>
<td>3</td>
<td>scenario 2</td>
<td>False, has been missing for the last 10 years</td>
<td>simulation valid, yes</td>
</tr>
<tr>
<td>3/06/2012</td>
<td>18-41</td>
<td>Brazil</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>scenario 4</td>
<td>False, has been missing for the last 10 years</td>
<td>simulation valid, yes</td>
</tr>
<tr>
<td>3/06/2012</td>
<td>18-41</td>
<td>Germany</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>scenario 1</td>
<td>False, has been missing for the last 10 years</td>
<td>simulation valid, yes, but might be difficult to make sense of as they would not want to</td>
</tr>
<tr>
<td>3/06/2012</td>
<td>18-41</td>
<td>Japan</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>scenario 1</td>
<td>False, has been missing for the last 10 years</td>
<td>simulation valid, yes, but might be difficult to make sense of as they would not want to</td>
</tr>
<tr>
<td>3/06/2012</td>
<td>18-41</td>
<td>Russia</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>scenario 2</td>
<td>False, has been missing for the last 10 years</td>
<td>simulation valid, yes</td>
</tr>
<tr>
<td>3/06/2012</td>
<td>18-41</td>
<td>Brazil</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>scenario 4</td>
<td>False, has been missing for the last 10 years</td>
<td>simulation valid, yes</td>
</tr>
<tr>
<td>3/06/2012</td>
<td>18-41</td>
<td>Germany</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>scenario 1</td>
<td>False, has been missing for the last 10 years</td>
<td>simulation valid, yes</td>
</tr>
<tr>
<td>3/06/2012</td>
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<td>18-41</td>
<td>Brazil</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>scenario 4</td>
<td>False, has been missing for the last 10 years</td>
<td>simulation valid, yes</td>
</tr>
</tbody>
</table>

Legend:
- scenario 1: void, has been missing for the last 10 years
- scenario 2: void, has been missing for the last 10 years
- scenario 3: void, has been missing for the last 10 years
- scenario 4: void, has been missing for the last 10 years

Simulation valid: yes