

EVENT SUMMARY:

The Future of Housework: How Robots are Reshaping Family Life

Joint talk by Dr Lulu P. Shi and Dr Yumiko Oda

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Dr Lulu P. Shi's Talk:

Today I'm going to talk about the future of unpaid work. I have two strains of research going on, one is more on education technologies. If you have any questions on that, I'd be very happy for you to ask, but otherwise the focus of today's topic is more on unpaid work. This is joint work with my Japanese colleagues at Ochanomizu University and Hitotsubashi University, and we started this project about two years ago, so I'll have two sets of findings today that I want to present.

For the first part, the basic question here is, how much time are we likely to save with automation technologies? With smart technologies or automation technologies, we mean things like robots, but also things like AI. So it's quite a rough definition of what we mean here. How did we come to ask this research question? There's a lot of research on automation in the labour market, and there's some anxiety about robots stealing our jobs, but there's actually not so much research focusing on unpaid work. However, we do spend a lot of time doing unpaid work.

Just looking at the OECD numbers in the UK, almost half (43%) of our time is spent on unpaid work. It's lower in Japan; however, it's still a big chunk of our life. We wanted to know how technology can affect that side of our life.

The second motivation for this project is that we wanted to contextualise predictions because how predictions are usually done is by taking predictions as an objective number. For example, if experts say you can save half the amount of the time, we take that as an objective sort of truth. However, from a more sociological perspective, we want to take predictions as also a social fact, so not only as 'this is what will happen', but also to contextualize that in a social situation, understanding what the backgrounds are of these experts, which can determine their predictions. So these were the two motivations.

I'm not going to spend too much time on the methodology part, but basically we did a DELPHI survey, which involves experts in the field of technology and unpaid work or work in general. It had two rounds. First, we started with survey conceptualisation, then we invited these experts to join, and we asked them to predict how much time you can save in the next five to ten years with smart technologies. These are people who have tech backgrounds. We asked them to predict the time saved for seventeen different housework and care work tasks. These seventeen types of work were taken from a time use survey. These tasks cover everything that we do, basically, at home.

This is how the survey looked. In the first part we had a short description about how we define this task, and the example here is teaching your child. Then we described the scenario that they should imagine: this is your current pay, this is the current time you spend on doing housework and paid work, and we then asked them to choose each of these options to do this work, and lastly rank them from extremely unlikely to extremely likely. We asked whether you would want to use smart technology or hire someone to do it, or do everything yourself or perhaps ask your partner. So that is the setup of this survey. This is a Likert scale and this is the outcome variable that we're going to use in the end to analyze the results.

Just back to the method here: we had two rounds. First, the expert answered all the questions. Then we looked at the means and distributions of the responses. We wanted to find the extreme outliers, those who say only a very tiny amount of work or a very big amount of work is going to be automated. We reached out to them to understand their justifications for that. So that was the only qualitative part of this. Otherwise it was a quantitative study.

Then we had a second round with exactly the same questions. But this time we provided some of the experts' qualitative justifications so that they could understand how other people think about this. In the end, we saw some convergence of the predictions. The right-hand side shows you the makeup of the experts that we reached out to. We had 65 in total, slightly more in Japan than in the UK. We wanted to have a gender balance, and we also had people across different industries working on tech and time-saving technologies related to doing housework.

Here are the results. In the next five years, automation is predicted to be about 27 percent, and in the next 10 years it's higher: 39 percent. I remember when we were publishing this, these percentages were what the newspapers tended to pick up on. But this is actually only half of the story that we wanted to tell. Of course, this is interesting, but we were also very much interested in understanding the context; that is, who were the people making these predictions?

Here, just to show you the breakdown of the automation that we looked at, these are the 17 different tasks ranging from grocery shopping, dishwashing, gardening, to more care work, like care for adults, interacting with your child, escorting your child and so on. The vertical bar shows the percentage of automation that is being predicted. So what is quite obvious is for all the housework, that is, more routine work, the predictions are much

higher for automation. Care work is predicted to be more difficult to automate. That's something that we kind of also predicted, but it's nice to see that this is indeed the case.

So now I will break down how the experts actually predicted this by contextualizing their backgrounds. We used experts' predictions; here is Japan, and this is for the UK. The light blue bars are female experts and the dark blue bars are the predictions of male experts. What I thought was interesting is that in the UK, male experts have a much higher prediction than female experts. The picture is exactly the other way around in Japan. We thought that was very interesting. We thought that the UK picture makes a bit more sense because we know that men are usually more optimistic about technology than women. But we don't see that in Japan. So we then looked into the qualitative answers given by the experts to find some answers. It turned out that in Japan, actually both male and female experts said that the likelihood for automation is very low because it's going to be very expensive. Therefore, it's not worth automating this task. However, there would be more male experts saying this and female experts would say: 'Yes, it's going to be very expensive, but it's worth it.' We thought that was quite interesting because it has to do with labour divisions. Women tend to do all the housework and more and more also go to the labour market. This is known as the double burden of women. So that was a justification for most of the female experts who say, yes, it's going to be really expensive, but it's worth it.

Here are some of our conclusions. The future of unpaid work is likely to be maybe around 40% in the next 10 years. We also found that the context really matters. That is, we shouldn't be taking predictions as the objective truth, but we need to embed them into a social context, understanding that experts do predictions based on their own lived experiences. That's one of the main takeaways from our side as social scientists in this study.

So this entire study had two parts. The first part is about the experts' predictions. The second part was understanding the willingness of people using this sort of smart technology when they are out in the market. The research question here is understanding the willingness to use smart technologies in homes, especially looking at teaching. Would you use AI to teach your child? The reason that I'm looking into teaching is because, actually, housework is predicted to be more automatable than care work, but teaching was kind of an exception: teaching was the highest predicted to be automatable in comparison to other sorts of care work. That also relates to the other part of my research, which looks into digital education, so that is why the findings that I'm going to show you are especially related to teaching your child, and how willing people are to do that.

Some of the hypotheses are listed here. I thought that the parents' socioeconomic background must matter. Also to consider were the parents' time and financial resources, as well as the price-productivity ratio of the robots. Parents' attitudes towards technology in general also matters.

It was a vignette experiment, so we asked everyone to imagine this hypothetical situation where they have to do this housework that is teaching your child. We had over 3,000 of the vignettes about teaching your child. The average age range was 19 to 70. We also asked about their backgrounds and their education. So what was their highest education? This is the sample of people that we asked. This was only in the UK, not Japan. You can also

see a breakdown of male and female as well as single and cohabiting respondents. So it was all quite hypothetical. They had to imagine this future scenario where they have this smart technology and they could rate whether they want to use it or not. The analysis was basically using the variables that matched the hypothesis.

These graphs show the willingness of people to use smart technologies across these 17 tasks that I presented at the beginning. The horizontal line is the 17 different tasks, ranging from housework to care work. What I circled here is what we're interested in here, so for example teaching a child. I always have these two different figures for cohabiting respondents and single respondents because it does really matter. There's always this difference between them. That's why you always see the two sets of different results. For the cohabiting respondents, the willingness to use a robot or smart technology to teach a child is significantly there. So people are willing to use that. But you don't really see that for the single people. So, there are some differences. Also quite interesting, especially now, for the cohabiting respondents is that you see quite a lot of willingness to use robots for housework, but not so much for care work, and this is sort of replicated here, except for teaching your child, which is quite interesting.

This is another comparison between education levels. One of the hypotheses is that it depends on your own education level whether you want to use smart tech to teach your child. Again, the differences are there between the two groups, between the cohabiting groups and the single respondents. What we can see for the cohabiting respondents is that people with A-Levels, one of the lower educated people, and those with graduate degrees, who are the very highly educated people, are the two groups who tend to say: 'Yes, we want to use smart tech to teach our children.' For single respondents, there are not really significant differences between the education groups.

The next thing that I checked for was the resources that you have. This is in terms of your time and also your financial resources. Again, the differences are there between the cohabiting and single respondents. For the cohabiting respondents, we can see that the hours of your own work, that is, the more you work, the more you are likely to say yes to using the smart technology, which makes a lot of sense. What was also significant was your partner's wage, so the higher the earnings of your partner, the more likely you are to say yes, which also kind of makes sense. What also matters is the price of the robot. The lower the price, the more people are willing to get it.

There was also a choice of hiring someone to do this task. The higher the human wage to do the same task that is teaching your child, the more you're willing to use a robot because there's this difference. But for the single respondents, we can only see a significant effect size for the robot price. So it doesn't really matter how much you earn, it doesn't really matter how much time you spend on doing housework or paid work, it's really just the price of the robot, which is quite interesting. I think that is something worth looking into, the different dynamics between couple households versus single households.

Here, I think the difference is quite interesting, but we also need to think about that, especially in cohabiting households, there are gender dynamics. Usually women do more housework than men. So the next check that I did was to compare whether there are any gender differences in terms of their responses. Again, we see more differences for the cohabiting people than for the single people, which makes sense. For the cohabiting respondents, even though the differences between female and male respondents for the different working hours are not significant, men are more likely to say yes to using smart technology to teach their child, whereas the effect size for women is not significant, and that's also true for if you work 12 hours. In general, men are more willing to use smart tech to teach children than women. That is not observed here in single respondents, which I think is really interesting because part of the difference is likely to be explained by gendered roles in the household.

Another criterion that we varied was the productivity of the robots. Robots can have different levels of productivity, so we say the robot with high productivity can save 50 minutes of your time, up to 100 minutes of your time. Of course, the higher the robot's productivity, the more people are willing to use it. But what we're interested in here is more the gender difference. Again, we can see that across robot productivities, men are more likely to want to use robots than women. Again, this is not the case for single people.

Just to wrap up the conclusions here, the most stable factor is the price of the robots. The higher the price, the less likely you are to choose it. Cohabiting people and single people showed very different answers in this survey. We do see gendered decision making, especially for the cohabiting people. Furthermore, we asked questions about people's attitudes towards technology. We asked: do you trust technology? Do you think that there are problems with data privacy? We also saw some correlations, like, for example, the more skilled people are with tech the more likely they're using it.

Thank you very much for your attention.

Dr Yumiko Oda's Talk:

Dr Lulu presented the macro level of the future of technology adoption, and I would like to zoom in on the everyday micro-interactions in technology adoption. Let me introduce my research motivation. This type of robot is not very common now, but every time we try to integrate technology into the house, there are big debates. There is a positive side that technology will make housework more efficient or that it makes things easier. However, the negative side is whether such a high-tech device is worth buying for such an easy task. This type of contradiction, in some years, will cease and become neutralised. But how will this contradiction come to end? This is my research motivation.

These debates continued throughout the post-war period in Japan. For example, in the 1950s, the president of Sanyo Electronic stated that the greatest difficulty in popularising washing machines was the public perception that modern young wives were all about making things easy. It also created discourses that maintained gender

norms, that they don't make household chores easier but instead make more time to spend on your children. This type of strategy was employed and continues to be even now. For example, Panasonic advertised dishwashers as more efficient for washing, but the campaign didn't work, and they returned to advertising it as something that made more time for children. This was the same case for the Roomba advertisement. It said: 'Create more family time with Roomba.' It never said it's efficient, or time-saving. Here you can see they also said: 'We chose Roomba because our baby's playground is the floor.' This shows the change in time spent doing housework and childcare over the last 20 years. Women still spend about five times longer than men on housework. However, time spent on child care has decreased by 50 minutes per day compared to 20 years ago.

Today's main focus is how mothers with children engage with robot vacuum cleaners after purchase. Again, I will clarify the purpose and research question. The purpose of the study is to see how household robots build relationships with consumers. The research questions are how do consumers build relationships with robots in the process of using it? How does the use of robot vacuum cleaners and the relationship built with them affect the division of household labour among family members?

This is a case study based on an interpretive approach, semiotics. In 2002, iRobot launched Roomba in Japan. Since then, the iRobot has gained the number one share in this market in Japan, at 74%, so it is a giant company in Japan. The household penetration rate in 2021 was 7.2 percent. At that time, they said that the image of slacking on household chores is a barrier to its adoption in households. I conducted interviews with 30 married women. The interviews lasted from 60 to 90 minutes per participant, and a total of 350,000 words were recorded, transcribed and coded, and I also used social media platforms like X, Instagram, YouTube and my personal blog to conduct inductive as well deductive analyses.

Here are my findings. In terms of their relationship with Roomba, the women viewed it in three ways: as their servant, their child and their friend. Some viewed it as a servant, like a tool to help them complete their tasks, while others viewed it as a child, like an emotional being they need to take care of. Some, lastly, viewed it as their companion. I will now explain the three types of relationships.

The first type, viewing it as their servant, was more common amongst women raising children who work full time. They appreciate its efficiency and time-saving features, and they use smart functions such as the remote control while away from home, and they're quite satisfied when they operate as instructed. They said: 'It's just AI, so I know its limitations, but if we properly grasp its strengths and use it well, it is helpful without any issues.' They recognise that dysfunction cannot be helped. They devote time and money to ancillary objects for smooth autonomous driving, saying that when they first bought it, it caused a series of troubles such as knocking over plants and sucking up carpets. But by tidying up things on the floor beforehand and securing carpets with tape, they were able to use it without any problem for the most part. They said as long as cleaning time is lessened thanks to the robot, they considered it to be effective. The women associated with this view of robots are 'perfect' women, those that strive to balance work and housework/childcare without relying on their families. In their interviews they said: 'Work is getting hard, but it doesn't mean I can't clean' and 'even if work

keeps me busy and I have no time, I can't help thinking, should I really be leaving the house this messy?' Overall, therefore, there is not much change in the division of household roles, despite the use of robot cleaners.

The next one involves the child relationship. This type is based less on efficiency and more on improving the quality of cleaning in order to take care of the family. So they don't even seek time-saving. They don't use smart functions, but prefer manual use by watching their movement in real-time in the home. They said: 'If I leave my Roomba alone, it eats a variety of things. So basically, I only use it while I can watch it move or when doing other household chores.' They perceive dysfunction as cute or even sometimes feel sorry for them. One woman said: 'My Roomba slips over minor bumps, starts crying if something gets a little tangled up in it or if it gets caught on something, and I find it super charming.' Robots end up becoming care recipients. Originally it was purchased to help care for the family members by cleaning, but by using it in a time-consuming way, the scope of care extended to robot vacuum cleaners. This type of woman is more of a traditional at-home mother. She buys the robot in order to care for the family. One woman said: 'It's hard to reach under the sofa and bed with a normal cleaner, so I bought it when my child started crawling after I noticed them licking various things on the floor.' Again, there is no change in the division of the household workload. They use robots in order to improve the quality and frequency of their cleaning.

The friend is the third and final type: viewing robots as companions. Rather than letting robots clean, robots themselves become involved in the family. One woman said: 'My kids don't listen to me even though I tell them to clean up quite often, but when my Roomba makes a beeping sound and starts moving, they suddenly start cleaning up, saying: "Oh no, he'll eat my stuff."' A lot of users play with the robot in many ways, like putting their cat on it, feeding it, naming it and even decorating it. They view the robot's dysfunction as funny, saying: 'When the Roomba stops and goes missing, I file a search request, and my kids happily go searching for it.' These women associated with this relationship type are known as 'creative' women, and they transform the labour of housework into rewarding work through their own creativity. Robots encourage tidying up while eliciting children's initiative. For example, kids who want to play curling are all trying to keep up with the Roomba while cleaning up with the Swiffer Sweeper. I guess they think they are sweeping, but it's really fascinating because they are defeating the purpose of the Roomba's work. So here it's reconfiguring the divisional role in domestic work. In the process of entertainment, family members have been involved proactively in housework for fun. So it is kind of a start in changing gender roles, but this type might be temporary. Often, family members get bored by the robot. One woman said: 'At first everyone was interested in it, but now my husband complains that it's too loud and the kids are bored with it. They used to fight with their siblings over operating the button, but that's all gone now.' Eventually the wives are the only ones operating the robot. A lot of women said it was like their partner.

Like Roomba, brands leverage the consumer-robot relationship. The consumers who bond with their robots often share the experience on social media. IRobot actively monitors and engages with these posts through retweets and comments. The company also held a Roomba decoration contest. They even went as far as to hold a funeral service for aging or broken units, and it became a yearly tradition. These activities reinforce emotional

connection and encourage community participation. The consumer-robot relationship becomes not just personal, but publicly circulated and brand-enhancing. So the company itself takes advantage of that relationship.

In summary, we have three types of relationships with robots: servant, child and friend. A common thread in all three types is peacefully navigating the contradiction between adapting the social responsibility of household chores and outsourcing them to a robot. They accept themselves as the main actors in household labour and have less need to reduce time despite the advent of robots. What is unique about Japanese consumers compared with US consumers is that American consumers feel that they could increase their free time and improve their well-being, but Japanese users remain in a time-consuming relationship after using the technology in a way that is consistent with traditional gender norms. Thank you.

Q&A with the audience:

Audience member: Thank you very much. That was a great presentation. I was surprised there was not a lot about privacy issues because that is a very big issue, in my opinion, especially when you think about the case of NeoGamma's X1 robot, which is currently used as a robot in many homes in Scandinavia. It collects data and learns via AI while it lives with the families. How do you think that will affect family relations, privacy and the meaning we assign to robots in the household?

Dr Shi: For Roomba, there are privacy issues. Last year, it was in the news that the new types of Roomba that take pictures in the house, these pictures were leaked because people who work on checking these data issues work in this very low-paid section, and they're called data labellers. They work in terrible conditions and they have to see terrible stuff, and they check these Roomba pictures. That was leaked. Some were very intimate pictures, like people sitting on toilet bowls. All of this was made public. So with Roomba, you have these issues.

But also, in terms of just domestic technologies in general, I think there are huge privacy concerns. For example, recently, with my partner, we were looking into baby monitors. We found out that baby monitors can be hacked very easily. There are actually people who hack into baby monitors and talk to the babies, and therefore babies can hear a stranger's voice and end up traumatised. So that's why we decided on this super low-tech radio-based baby monitor rather than a smart technology.

Dr Oda: The privacy issue is quite a big concern in Japan too, but in terms of the consumer side, it is not a very big issue in Japan. They more so appreciate that they can monitor the children with safety.

Jason James: Could that be because Japanese people are more used to technology collecting data about them in general?

Dr Oda: Yes, and for some reason they trust how that data is used.

Jason James: There was an interesting exhibition at the Barbican some years ago about robots, and one of the points they were making is that robots in the West have often been regarded as sort of dangerous and scary things, but in the East they're often regarded as cute and friendly, so there's a slightly different attitude to them in Japan.

Audience member: Thank you very much, that was very thought-provoking. The question I have is with regard to having the robot teach a child. Were people at all concerned over the AI issue of factual bias or morality, ethics? There's a lot of concern over a sort of rewriting of history. Were any of your respondents concerned about a bias that they would rather the child be taught by a human who knew better what the lesson plan was or the teaching materials?

Dr Shi: Yeah, I think that's a really great question. So we didn't capture too many qualitative answers in that study, so we don't know exactly why people would not use that, but the bias question is very important. You're exactly right, AI systems are biased because the real-world data is biased. So by default, it's biased. We don't just talk about bias in the data because it's bias in the wild. We do still see a lot of initiatives, like in the UK for example, where there's an initiative to digitize everything in curricula, using large language models provided by, for example, ChatGPT, which is a very well-known one. But we know that ChatGPT is not bias-free.

There was a study that looked into what the values are of ChatGPT, whether it aligns more with certain values than others. What they did is they fed the World Value Survey into ChatGPT, which is a survey that is conducted across countries asking value-laden questions. It turned out that ChatGPT aligns with American values first, and then UK values, Australian values, Canadian values, basically all the English-speaking values, and aligns the least with African countries, Arabian countries and so on. So we know it's very biased. But then we still think about using ChatGPT specifically for making curricula to save teachers' time because saving teachers' time is the biggest point of discourse in the UK at the moment. I think it's such an important question. Even though we know that these large language models are hugely biased in a very invisible way, we still use them. If we use these AI platforms, we can't really decolonize the curriculum.

Audience member: I just want to continue with the ChatGPT thing – I want to ask the professors: how does your work help us to distinguish between trends of novelty and cultural trends? Also, how do Roomba robots impact domestic service economically for women who rely on it, those with a lower income? Before robots, women would work in houses as maids or cleaners to supplement their income: how does Roomba impact that?

Dr Oda: Currently, the Japanese don't use maid services very much, but now it's increasing because before we had a traditional gender role model that refrained from using maid services. But a lot of women have started working now, and they have gradually begun to use maid services. At the same time as the diffusion of robots, maid services are increasing. So both markets are becoming larger.

Jason James: Your first question was about distinguishing between novelties and cultural trends in other events.

Dr Shi: I don't know whether I have the answer, because I don't know if I'm understanding the question correctly. One's about the short term, and one is about the long-lasting effects. I guess it's too early to say, also, but I think maybe one way to look at it is to what extent are the hypes hyped by narratives. I think an interesting methodology for this case would be to do a narrative analysis or discourse analysis, basically to see who are the people driving these narratives, what are their interests and so on. The surface narrative is very much, 'Oh, this is going to be this, it is going to stay here this is going to be the future', and so on. But if you look behind who is driving these sorts of narratives, the different interests or agendas from different groups are becoming more obvious. Then you can get a little bit of a sense whether this is actually more genuinely driven by the consumer, or whether this is more driven by political and economic interests.

In one of my other pieces of work where I looked at, again, specifically education technologies, I looked at their usage trends. If you remember, during COVID there was this narrative in the public that ed tech or education technologies is going to stay, this is going to be the future. But then that did not happen. So while I was building this usage index, it became clear that, yes, the usage was really high during the pandemic because of the school closures, but after the schools reopened, the usage dropped to a really similar pre-pandemic level. So I think sometimes you just need a bit more time to observe the actual usage trends. But otherwise, I think if you really want to kind of anticipate that, understanding the narratives and the actors behind them can be a really useful way of doing so.

Audience member: Thank you so much for such an insightful presentation. I was wondering if, in your current work, you've looked into the direct health outcomes of robots. Whether it has improved health, like life expectancy or mental health, especially with those living alone.

Dr Oda: Using a robot can create affection for the robot. It won't change your lifespan, but it could potentially improve your mental health. For example, it can be really helpful for those with dementia. Robots can keep repeating the same thing, which can actually help the treatment.

Dr Shi: I haven't done work on that, but there is this really great book called *Robots Won't Save Japan*. So you can kind of guess where this is coming from. It's ethnographic research done in elderly homes in Japan. The author looked exactly also at the kind of mental health aspect and so on. Some of the findings were really fascinating. Maybe you know this seal robot that is there as an accompanying robot. It worked in the beginning quite well, but then it really depends on who was using it. In these elderly homes, you also have many people with memory issues, like dementia. At some point, people had difficulties playing with the robot seal, and they started to peel it. They ended up with just the robot core. So it really depends on who the user is.

Another thing in the book which I found super interesting was that in order to save money the care home bought a robot to do more sport exercises with the residents. It turned out it didn't work because the residents

didn't understand that they needed to copy the robot. So then they actually needed to hire a person to imitate the robot, and then the residents knew what to do. So they didn't really save on labour. They didn't need to hire a personal trainer, but they could hire cheap labour, anyone who could copy the robot. In the end it's not really the residents benefiting from that but the care home that wants to save money. So if you're interested in this, that could be a book for you.

Audience member: Do you envision the government implementing policies to subsidise some technologies of this kind for socially positive outcomes? If yes, how do you see differences among governments tackling this issue in the future?

Dr Shi: Yeah, so governments are really keen to subsidise technology development. I come from the tech area so I think that's where I can talk about a little bit more. So in the UK the narrative is to save teachers' time, and the government really wants to be seen as doing something in that area. Technology is a really easy way to show that they're doing something right, so there's investment in tech rather than into education. Unfortunately the education sector is being defunded, but the tech sector is being funded. It's also really interesting to see where the funding goes, so there are different approaches like following the data or following the money. If you follow the money, the UK government is backing big tech quite a lot, as well as smaller tech, but they are actively encouraging schools to pick up on Google and Microsoft technologies. So that's sort of the UK approach.

In Japan, you have this Giga School project, which is the largest case of the digitalisation of education. Again the government is very keen to be seen as doing something, so very similar to the UK. Actually the UK Department for Education shared their blueprint with the Japanese Minister for Education and Culture. So they use common documents. In Japan it's not only a national effort, so if you look more broadly they are very much internationally connected, and again Google and Microsoft are used a lot here. If you go on the web page of the US Commerce Department, they explicitly state that they are observing the Giga School Initiative very, very closely because it's a big market for us. Before the Giga School Project, Microsoft had the largest share in the Japanese tech market. But after that, Google surpassed Microsoft because Google said: 'We are going to provide everything for free.' So I think this policy and how that goes hand-in-hand with the private tech sector, that is really interesting. There are commonalities but also differences across countries.

Dr Oda: Yes, we have a lot of subsidies in Japan too. In terms of household chores, the government has subsidised households so they can buy robots or use house maid services in order to facilitate women entering the labour market.

Audience member: My first question is, is the robot being powered by solar energy? My second question is, can you control the robot remotely before you go home?

Dr Oda: Yes, so you can use your smartphone to control the robot even if you are not at home. You can monitor how the Roomba works around at home. Using a remote control is quite common. You were also asking about whether they're powered by solar energy. I've never heard of a Roomba being powered by solar energy.

Audience member: Is the robot meant to be used instead of school or as well as school?

Dr Shi: No, this is only intended for household use. In Japan, last year in the media, there was a story about how you can use robots to get children back to school. But that's a slightly different case because the robot was used in schools rather than at home. The story there was that some schools were using robots to be placed within the classroom to fight the problem of children not going to school. It's kind of a big issue in Japan that children don't want to go to school. The idea is that if you have a fun-looking robot in school, children want to come back. Also, these robots can be remotely controlled by children sitting at home. They want to encourage the children to feel safe with the robot first of all virtually on the screen and then, when they feel safe enough, they come back to the school. But it didn't work, unfortunately. It didn't because I think the problem was rather the reasons why children don't come to school. I talked to many parents in Japan and they were saying that their children didn't want to go to school because the discipline is too rigid. So it's not actually about robots. But there's a big push for tech solutionism, which suggests we can solve everything with technology.

Audience member: I don't know what the attitude is in Japan, but I am quite concerned about the number of children now who have very little interaction with their own parents. You see it in toddlers sitting in pushchairs, facing away from the parent, looking at a tablet or a phone. Many children don't eat with their parents, so they're missing out on that interaction with the family. If more and more of the learning is done without the parent being beside them, children are going to grow up unable to talk to adults, not necessarily able to talk to other children, and I find that very concerning.

Dr Oda: Loss of communication between families is quite a big concern in Japan too, but it's difficult to stop this trend. It is very difficult for parents to isolate their children from technology because we now coexist with technology. In some cases, using technology can improve communication. I understand the concern, and I know it's a big issue, but I don't think it's something we can stop, we just have to find a way to coexist effectively with it.

Dr Shi: I think this concern is widely shared with many people, and you see it especially with highly educated and more wealthy people. So there's actually this digital gap: the more highly educated you are, the less likely you are to use this kind of technology. It is an indicator of social inequalities in a sense, that people with less means are more dependent on that.

Jason James: This has been such a fascinating topic to discuss. Thank you very much to our two speakers.