Canteen Dilemma Protocol

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## Background

The Canteen Dilemma intends to show what happens when people try to coordinate their actions without common knowledge. ‘Common knowledge’, as defined in the research literature, is much more than simply saying that something is known by all.

It also implies that the fact that it is known is also known by all, a sort of agreement to the infinite degree. Even if your colleague knows your arrival time (+/- 5 minutes), it still is unclear what you know she knows about what you know about what she knows about your arrival time. She might arrive at 8:40 and know that you cannot arrive any later than 8:45. But if this is the case, you might think she arrived at 8:50, making her think that you arrived at 8:55, making you think that she arrived at 9:00. Bam!

Even if you know your colleagues arrival time (+/- 10 minutes), it is still unclear what you know about what she knows about what you know and so on. If you arrive at 8:50, your know your colleague could arrive at 8:40, where she could go either to the canteen or the office, or at 9:00 where she has to go to the office. If you go to the canteen, you might risk she arrived at 9:00 and went to the office. If you really don’t want to risk going to the canteen while your partner goes to the office, you have to go to the office at 8:50 as well. If you arrive at 8:40, your colleague could have arrived at 8:50 at the latest. If she reasons like you, she would go to the office, meaning you should do the same - even though you both arrived before 9:00. But even if you arrived at 8:30, where your colleague could have arrived at 8:40 at the latest, if your colleague reasons like you, she would go to the office at 8:40, meaning you should go to the office as well. The same line of reasoning can be repeated infinitely through backwards deduction. This means that if you don’t want to risk going to the canteen while you colleague goes to the office, you have to go to the office even if you arrive at 8:00!

Thus, Common Knowledge - in its ultimate sense - implies not only that people know some piece of information, but also that you can be absolutely confident that everybody knows that everybody know it, and so on. The canteen dilemma shows that without Common Knowledge you must eventually conclude that you never can meet in the canteen! At least if you do not want to risk losing any hard earned bonuses.

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## Research Questions

(which research question(s) do we want to be answered by the experiment?, what are/is our hypothesis?, What should we conclude if/if not our hypothesis are corroborated?, etc…)

Hypoteser.

Begrebet common knowledge. De fleste mener at der vil være common knowledge af at man ankommer inden kl. X, hvis X er tilstrækkeligt stor i forhold til det faktiske ankomsttidspunkt. Måske skulle man droppe følgende formulering i beskrivelsen: ”Every morning you arrive at work between 8:30 am and 9:10 am.” Det er ikke afgørende for spillet eller historien, det er kun afgørende at vide at man ankommer med højst 5 minutters afstand. Hvis man dropper den formulering kan man nemlig stille spørgsmål som ”Is it common knowledge between you that you arrived before noon?”. Hvis de f.eks. ankom 8.30, vil de fleste nok sige ja, hvilket viser at hverdagsbetydningen af common knowledge ikke matcher den teoretiske.  
Ræssoneringsdybde. De fleste deltagere vil ræssonere til nogenlunde samme dybde, og den dybde ligger omkring 2-3, altså ”jeg ræssonerer om dig som ræssonerer om mig”, men ikke dybere. Det ville være interessant at få indblik i den gennemsnitlige ræssoneringsdybde i dette spil.  
Begrænset ræssoneringsdybde er ikke kun et spørgsmål om hvad hjernen normalt kan klare, men vi tror også at det er nok at ræssonere til dybde 2-3. Hvis man tror det er sikkert at gå i kantinen når det er tilstrækkelig tidligt, så har man ikke forstået at man ikke kan afskære ræssoneringsdybden. For at tjekke den hypotese er det vigtigt at spørge ind til folks sikkerhedsniveau samt strategi, se forslag til spørgsmål nedenfor. Hypotesen er at den ubegrænsede iteration som er nødvendig i common knowledge ikke er tilstede i det fleste mennesker tænkning og intuition. Så vi tror at visse beslutninger er helt sikre uden de er det.

## Experimental Design and Setup

### Instructions to player

This is the introductory text to each player:

You will be playing this game with another person pretending to be your colleague. Every morning you arrive at work between 8:00am and 9:10am. Your colleague will arrive either 10 minutes before you, at the same time as you, or 10 minutes after you. \*Example: You arrive at\* \*\*8:40am\*\*: \*Your colleague can arrive at\* \*\*8:30am\*\* \*or\* \*\*8:50am\*\*. If you arrive before 9:00am, you have time to go to the canteen for a cup of coffee. If you arrive at 9:00am or after, you should go straight to your office. You should only go to the canteen if your colleague does. At the beginning of each round you will know only your own arrival time and you will have to decide whether to go to the canteen or to your office. You will also be asked to estimate the probability of you both doing the same ting.   
Payoff and penalties: You start the game with {{ Constants.endowment }} and will have to pay various amounts of penalties in each round, depending on how well you both do. Your challenge is to have as much money left as possible when the game ends, after which the remaining amount is payed out to you. The game ends after {{ Constants.num\_rounds }} rounds, or when you or your colleague has no more money left. As a general rule you will minimizes you losses by doing the same as your colleague (preferably going to the canteen) and by giving an honest estimate of the chances of doing so.  
If you are interested in the details of how the penalties are calculated, here are the scoring rules:  
  
1. If you guess correctly that both of you went to the canteen before 9:00am, you pay a \*\*small\*\* penalty proportional to how <strong>uncertain</strong> you were, e.g.:  
 \* -0.69 if you gave it a 50% chance.  
 \* -0.29 if you gave it a 75% chance.  
 \* -0.01 if you gave it a 99% chance.  
  
2. If you guessed correctly that both of you went to your offices, no matter what time, your penalty is doubled and proportional to how uncertain you were, e.g.:  
 \* -1.39 if you gave it a 50% chance.  
 \* -0.58 if you gave it a 75% chance.  
 \* -0.02 if you gave it a 99% chance.  
  
3. If you are wrong, and one of you goes to the canteen while the other goes to the office - or if any of you goes to the canteen at 9:00am or after, your penalty is doubled and proportional to how certain you were, e.g.  
 \* -1.39 if you gave it a 50% chance.  
 \* -2.77 if you gave it a 75% chance.  
 \* -9.21 if you gave it a 99% chance.

### Questions, Supplementary Questions

1. It is {{ subsession.day }} morning and you arrive at your workplace at {{ player.arrival\_time|floatformat:“2” }} am. Where will you go?
   * Canteen
   * Office
2. How certain are you that your colleague has made the same choice as you? [Answers are based on a 5-point Likert scale with equal intervals from 50% to 99%: No certainty (50%), Slightly certain (62,5%), Somewhat certain (75%), Quite certain (87,5%), Very certain (99%)].
3. What strategy did you use while playing this game? [Free text answer]
4. Only if game is lost: Whose fault was it? The game is over. Do you think it was your fault it is over, your colleagues fault, or do you think it was because of some other reason? [Yes/No, or writing other reason in free text answer]
5. Choosing possible cut-off point Assuming you could decide a cut-off point with your colleague prior to the game, meaning that either of you would only go to the office if you arrive at this time or later, what time would you select? [Buttons with 8:00, 8:10, 8:20 … 9:10]
6. Question about simple common knowledge You arrived at [last round arrival time], do you know that it’s safe for you to go to the canteen, that is, do you know you will meet your colleague there? [Yes / No][Alternative suggestion] Given your play-style, are you always sure to meet your colleague when you go to the canteen? For example when you arrive at [last round arrival time]? [Yes / No]
7. Question about real Common Knowledge Given your play-style and your arrival time at [last round arrival time] as an example. Consider if you know that you both arrived before 9. Now consider if you know that your colleague knows that you both arrived before 9. And consider if you know that your colleague know that you know that you both arrived before 9? Imagine this process infinitely repeated, are you always sure to meet your colleague if you choose to go to the canteen, for example when you arrive at [last round arrival time]? [Yes / No][Alternative suggestion] Given your play-style/strategy and arrival time [last round arrival time], consider whether you know with certainty that you both arrived before 9 (i.e. + 10 minutes to your time) which makes it safe to go to the canteen. If this is the case, consider if you know if you colleague is also certain that you both arrived before 9. If this is the case, consider if you know, that your colleague knows, that you’re certain that you arrived before 9. Imagine this process iterated infinitely, meaning you know your partner knows, that you know, that your partner knows, etc, that you both arrived before 9 and can safely go to the canteen. Given your play-style/strategy, do you know, that your partner knows, that you know, etc. in the sense described above, that you are sure to meet your colleague when you choose to go to the canteen? For example/including when you arrive at [last round arrival time]? [Yes / No]

### Treatments / Conditions

### Payoff Structure

### Study type

#### AMT settings

(qualifications, Inclusion and exclusion rules, when, how long, consent form, etc…)

## Theoretical Approach and Methods

## Ethical considerations

(Approval by the Institutional Review Board, Anonymity and data management, etc…)

## Additional considerations

(Time plan, Total Costs and financing, etc..)

## References