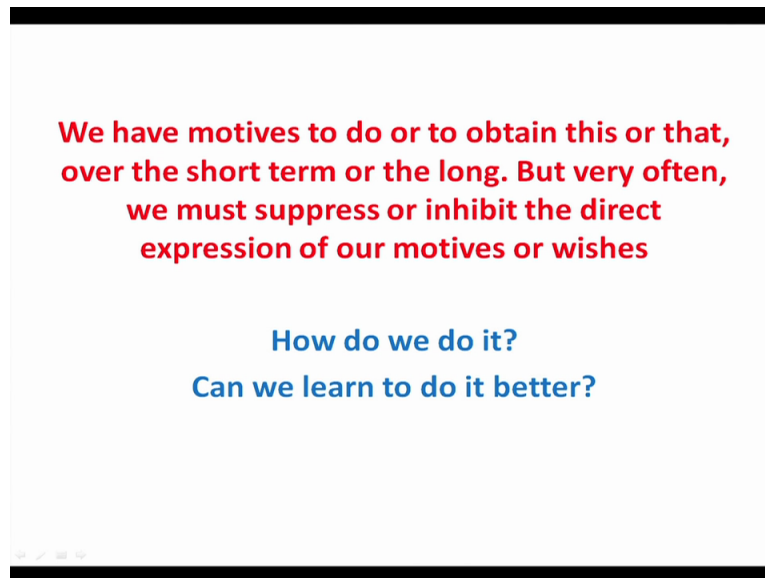


Course on Great Experiments in Psychology
Professor Rajlakshmi Guha
Centre for Educational Technology
Indian Institute of Technology Kharagpur
Module 4
Lecture No 19
The Marshmallow Test

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Hello everybody welcome back to this fourth session on great experiments in psychology and this is the fourth lecture of the week 4. In today's calls we are going to discuss about something very different from what we have discussed before and this test is a very interesting study, the study is a very interesting one primarily because this is a test on temptations, whether we can how we can resist our temptations and how can we express ourselves control. Can we actually understand how our self-control will be 40 years later?

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Self Control and The Marshmallow Test

Walter Mischel (1972)

Now this was shown by Walter Michelle and his colleagues and basically this is famous famously known as the marshmallow test and you will easily come across marshmallow test online if you go through and especially this study was conducted by Walter Michelle in 1972. So this talks about our motives and when we are trying to obtain something whether over the short-term or long-term and very often we must suppress or inhabit the direct expression of our motives or wishes. So how do we do it? And can we learn to do it better? So here is there a particular cause that actually stops us or is there something that inhibits the self-control.

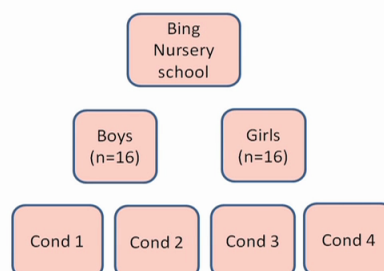
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Walter Mischel, for more than 40 years explored self-control in children with a simple but effective test

His experiments using the “marshmallow test,” as it came to be known, laid the groundwork for **the modern study of self-control**

Subjects and Experimenters

- The subjects were 16 boys and 16 girls attending the Bing Nursery School of Stanford University
- The children ranged in age from 3 years 6 months, to 5 years 8 months (with a median age of 4 years, 6 months)
- The procedures were conducted by two male experimenters
- Eight subjects (4 males and 4 females) were assigned randomly to each of the four experimental conditions



Mischel and Ebbsen, 1970

So this was a very interesting study that Walter Michelle tried out with children and on self-control in children and he explored this for the last 40 years and his experiment using the marshmallow test as it came to be known, laid the ground work for the modern study of self-control. So what is this test about, so what Michelle, Walter Michelle did, was he was actually doing this study on nursery children in Stanford University. So there was this Bings nursery school in Stanford where he worked with 16 boys and 16 girls attending the school and their age range between 3 years 6 months to 5 years 8 months and so with the median of 4 years 6 months and the procedures was conducted by two male experimenters.

So primarily the study was very well conducted, it tells you how what are the major things that needs to be addressed during the conduction of a psychological experiment, so here the procedures were conducted by two male experimenters and eight subjects that is four males and four females were assigned randomly to each of the four experimental conditions. So I have just graphically represented this, so we will talk about the conditions later, so as you can see there were 16 boys and 16 girls selected and they were randomly assigned to the four conditions young children.

So the mean age being 4 years 6 months and the minimum age being 3 years 6 months maximum being 5 years 8 months. It is very important to familiarise them with the experimental situation and to control the other variables confounding the experimental situation, it is also important for us to understand that how they would generally respond in a particular situation,

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Procedure

- The procedures were designed to develop a new method for studying delay behavior experimentally with young subjects
- In the week prior to the start of the experiment, the two male experimenters spent a few days playing with as many children in the nursery school as they could
- These nurturant sessions were designed so that the children would more readily agree to accompany the experimenters to the "surprise room" and, once there, would be at ease
- After obtaining the child's consent to go to the surprise room, the experimenter escorted the child to the experimental room

Mischel and Ebbesen, 1970

So that is why what Walter Mischel and his associates did was, before the experiment before the actual experiment began a week prior to that, 2 male experimenters spent a few days playing as with as many children in the nursery school as they could. So what are you trying to do? They were trying to familiarise themselves with the students with the children so that during the experimental situation, they would not have another confounding variable, affecting their behavioural pattern. So if the child is are responding to a situation in a particular way that should be because of the manipulation of the independent variable and not as because of some other variables that was affecting their behaviour.

So in this case, so this is done with all experiments so in this case also in this experiment also that is why the familiarisation was done with the children and these sessions were designed in such a way so that the children would more readily agree to accompany the experimenters specially to the experimental room which was known as the surprise room and once they were there they would be at ease.

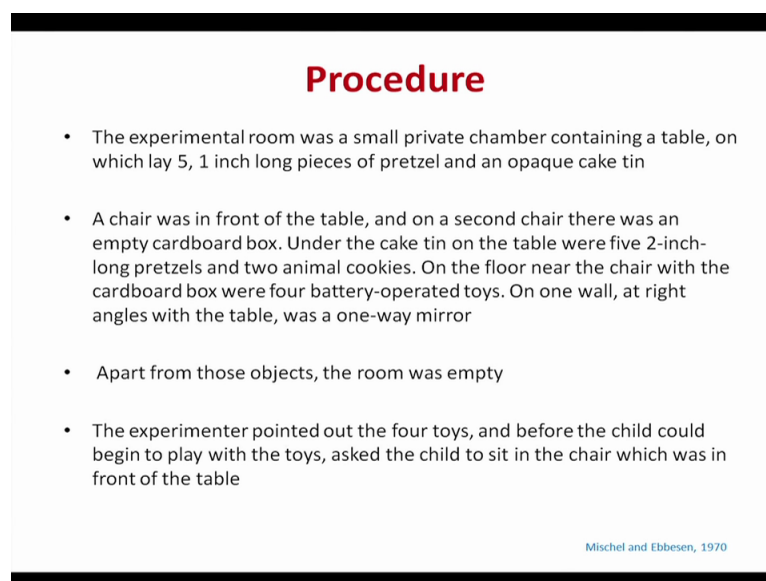
So for most of the experiments in psychology especially if you are if you are one of the psychology students and you are conducting an experiment in psychology, the 1st thing that we assure is the comfort and ease of the subject or the participants who is there for the study. Of course now you must remember am not talking of milligrams studies they are because this could be a counter argument that in Milgram studies they were not being given the comfort.

So one of the reasons and that has been an ethical constraint of the study where the exposure were done to such a situation whether participants were not feeling very comfortable, but as

Milgram argued there that would to deal with obedience you could not see to the comfort and see to the well-being of the participants initially.

Now coming back to this experiment, so what was done is, they from the experimenters the 2 experimenters familiarise themselves with the children so that they would readily agree to go accompany the experimenters to the room, to the surprise room or the experimental room later one that is during the experiment. So after obtaining the child's consent to go to the surprise room, the experimenter escorted the child to the experimental room. Now experimental room is the surprise room that is for the children.

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Procedure

- The experimental room was a small private chamber containing a table, on which lay 5, 1 inch long pieces of pretzel and an opaque cake tin
- A chair was in front of the table, and on a second chair there was an empty cardboard box. Under the cake tin on the table were five 2-inch-long pretzels and two animal cookies. On the floor near the chair with the cardboard box were four battery-operated toys. On one wall, at right angles with the table, was a one-way mirror
- Apart from those objects, the room was empty
- The experimenter pointed out the four toys, and before the child could begin to play with the toys, asked the child to sit in the chair which was in front of the table

Mischel and Ebbsen, 1970

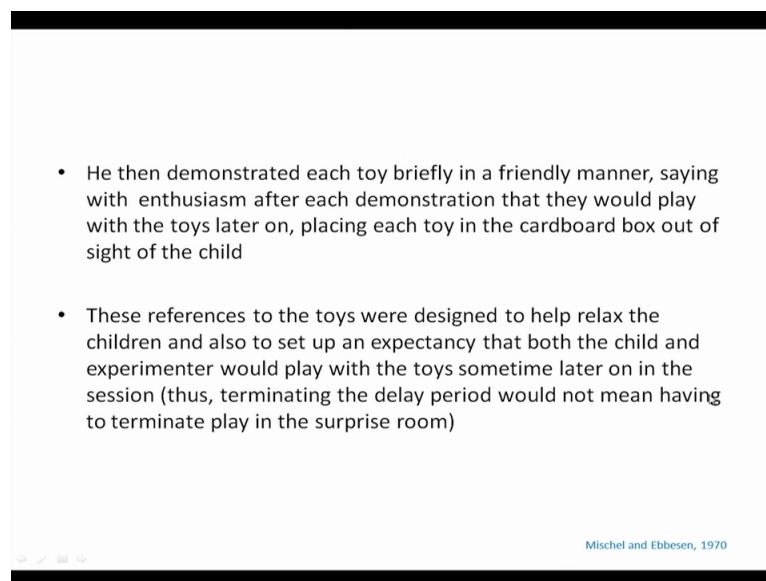
So once during the experiment the subject or the child the participant easily went with the experimenter to the surprise room and what was there in the experimental room? the experimental room was small private chamber containing a table on which lay 5, 1 inch long pieces of pretzel so that's something that it is a sweet that children love eating and an opaque cake tin and so there is nothing else but you will see what stuffs that is there in the room and so there was this small table on which there were 5 pretzels sticks 1 inch long pretzel sticks and the chair was in front of the table and on the 2nd chair there was an empty cardboard box, so the table had this opaque in and the pretzels and there was another chair, no chair was in front of the table and there was another chair on and was an empty cardboard box unit and under the cake tin on the table where 5 two inches long pretzels and 2 animal cookies.

So now remember that these are things that children would love to have, so the experimenter selected things for the experiment that were desirable to the kids, so unless if you are trying

to do an experiment self-control you have to actually build and something that would be a conflict to response inhibition, so these were things that all children would love to have, so here under the cake tin were 2 long longer, so that's 2 inch long pretzel and 2 animal cookies and on the floor near the chair with the cardboard box were 4 battery-operated toys. So on one wall at the right angle of the table was a one-way mirror.

So from where they could actually see to observe the experiment and apart from those objects the room was empty. So as you can see this room or the surprise room is filled with things that the child would love to have. So there were the pretzel sticks of 1 inch long 5 pretzels sticks and there were 2 pretzel sticks two inch long 2 pretzel sticks and 2 animal cookies under the cake tin and there was a box on the floor and along with that there were 4 battery-operated toys and the experimenter pointed out the 4 toys and before the child could begin to play with toys, asked the child is sit in the chair which was front of the table.

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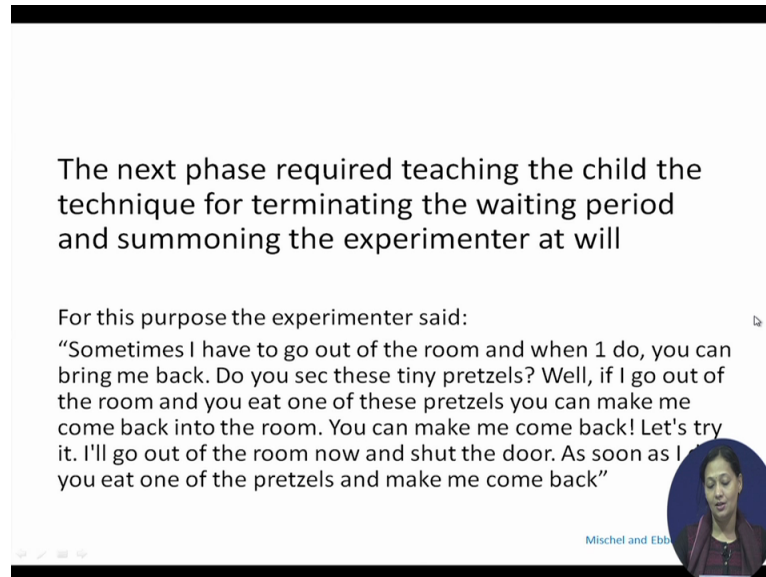


I will show you the photographs, so then the experimenter demonstrated each toy briefly in a friendly manner saying with enthusiasm thereafter each demonstration that they would play with the toy later on, so they he was he was actually trying to do was, he was trying to increase the eagerness of the child about you know and anticipation to actually get those toys, so placing each toy in the cardboard box out of sight of the child.

So he removed all the toys and these references to the toys were designed to help relax the children and also to as I mentioned to setup an expectancy that both the child and experimenter would play with the toys sometimes later on later on in the session, so the child

would be eager to continue the experiment in the expectancy that he would get to play. So thus terminating the delay period would not mean having to terminate play in the surprise room. So we will get to see how the delay period can be terminated.

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The next phase required teaching the child the technique for terminating the waiting period and summoning the experimenter at will

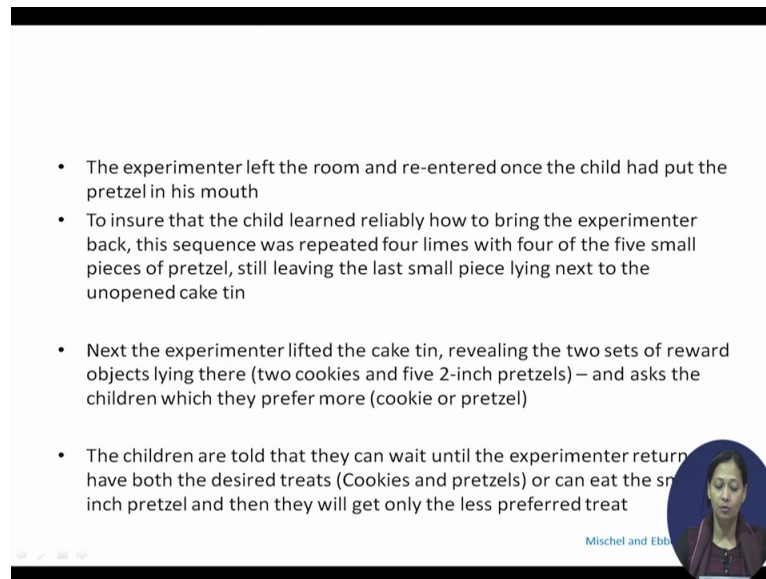
For this purpose the experimenter said:

“Sometimes I have to go out of the room and when I do, you can bring me back. Do you see these tiny pretzels? Well, if I go out of the room and you eat one of these pretzels you can make me come back into the room. You can make me come back! Let's try it. I'll go out of the room now and shut the door. As soon as I do you eat one of the pretzels and make me come back”

Mischel and Ebb

So the next phase requires teaching the child the technique for terminating the waiting period and summoning the experimenter at will. For this purpose what the experimenter did was, he said that sometimes I have to go out of the room and when I do you can bring me back. So if the child wanted to bring the experimenter back to the room he could do it and what how would he do it? So do you see these tiny pretzels? Well if I go out and the room out of the room and you eat one of these pretzels, you can make me come back into the room and let us tried, I will go out of the room now and shut the door. As soon as I do you eat one of the pretzels and make a comeback.

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- The experimenter left the room and re-entered once the child had put the pretzel in his mouth
- To insure that the child learned reliably how to bring the experimenter back, this sequence was repeated four times with four of the five small pieces of pretzel, still leaving the last small piece lying next to the unopened cake tin
- Next the experimenter lifted the cake tin, revealing the two sets of reward objects lying there (two cookies and five 2-inch pretzels) – and asks the children which they prefer more (cookie or pretzel)
- The children are told that they can wait until the experimenter returns and have both the desired treats (Cookies and pretzels) or can eat the small 1-inch pretzel and then they will get only the less preferred treat

Mischel and Ebb

So what is being done is, the child is being familiarise with the situation that you can actually if you want the experimenter to come back, if you want this delay session to end, then he would just need to eat the pretzel, so that is something desirable at would be and that would also act as a ringer for the child. So the experimenter left the room and re-enter once the child had put the pretzel in his mouth.

So this is just the preliminary before the experiment is beginning. So to ensure the child learns reliably how to bring the experimenter back, this sequence was repeated 4 times with 4 or 5 small with 4 of the 5 small pretzels, so still leaving the last small piece lying next to the unopened cake tin. So he actually finished you know just by practising by rehearsing, how the child could get the experimenter back into the room, they had actually finished the 4 pretzels but consciously left the last one there, so and there was also this cake box, where the cookies and the other big pretzels lay.

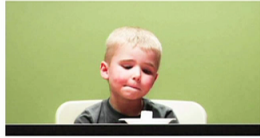
So then after that the experimenter lifted the cake tin, revealing the two sets of rewards so reward objects laying there, so that is the cookies and the 5 2 inch pretzels and asked the children which they prefer more, so the cookies or the pretzel and the children are then told that they can wait until the experimenter returns and have both the desired treats, so that is the cookies and the pretzel or can eat the small one, the small for 1 inch pretzel and then they will get one of the less the less preferred treat.

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- Thus the instructions faced the child with a choice: he could either continue waiting for the more preferred reward until the experimenter returned, or he could stop waiting by bringing the experimenter back. If he stopped waiting, then he would receive the less favored (but more immediately available) reward and forego the more preferred one

Depending on the condition and the child's choice of preferred reward, the experimenter picked up the cake tin and along with it:

- **Condition 1** – picked up nothing else
- **Condition 2** - the more preferred reward
- **Condition 3** - the less preferred reward
- **Condition 4** - both the rewards



The physical arrangement was such that the rewards, if left, were directly in front of the child at about shoulder level

<http://score.addicaid.com/wp-content/uploads/2014/12/marshmallow-test-self-control-Score-Addicaid-3.jpg>

So now what is being done is the child was being instructed on how to get, he is already being trained as to how to get the experiment back in to the room, so what was being done was the preferred things and the less the more preferred and the less preferred reward objects, so the a child could prefer cookie more than a pretzel of pretzel more than a cookie, so it was kept on the tin there and it the child was said there were 4 conditions until about the 4 conditions and hear the child was said that if you wish to end this delay.

I will be out for some time and I will return after some time but if you wish to end this delay we just need to have the small pretzel, the one of the remaining 1 pretzel of the first 5, so and then I will immediately come into the room and once I come into the room you cannot have the preferred thing your preferred reward, so that is if the child preferred the cookie then you cannot have the cookie but you can have the pretzel or if the child prefer the pretzel then you can have the pretzel you can have the cookie but not the pretzel, so it was the preferred item would be kept away but the other are less preferred item would be given to the child.

But if the child did not want they could wait for a while before the experimenter came back or till the experimenter came back the child was told that you would be able to get all both the reward items. So hear what was happening was the with the after the instructions the child face was faced with the choice, so he could either continue waiting for the more preferred reward until the experimenter returned, or he could stop waiting by bringing the experimenter back. So if he stopped waiting then he would receive the less favoured but more immediately available reward and forgo the more preferred one.

So this would be an immediate gratification while so if I want to reward the at least they even if it is the least preferred one I would rather eat the pretzel quickly so that immediately the experimenter comes back and he gives me the reward. So that would be immediate gratification but if the child waited till the experimenter came back then he would get both the rewards is, so the child had 2 options either to wait and get the preferred one as well as the less preferred one or to immediately is to stop waiting and get the immediate reward and this you see how the experiment was conducted, so even the experimenter did not know that which condition is given to the child, so I spoke about the 4 conditions initially and now these 4 conditions one of the 4 conditions the child was introduced to.

So depending on the condition and the child's choice of reference of reward the experimenter picked up the cake tin and along with it, if for the condition one picked up nothing else, so they were there so the cookies and the pretzel that remain there for children who were given the condition one this was there was both the treats were available in front of the child. For condition two the more preferred reward was kept in front of the child and the less preferred reward was taken away. Condition 3 the less preferred award was kept in front of the child and the more preferred award was taken away and in condition for both the rewards were taken away.

So that the child was told that he would get if you waited for till I come back then you will get both rewards, if you do not want to wait and then you just eat the pretzel, I will come and give you the least preferred the less preferred reward. So the now just as I was mentioning right now that the experimenter that is one of the 2 male experimenter who are conducting the study, were also not aware of the condition that the child would get, so till this moment in time the experimenter was not aware. At this point the condition was to be introduced so whether the cookies and the pretzel would be kept in the on the desk or would either of them be taken away or both be taken away.

The condition was introduced the chit of paper so telling the experimenter at this point in time, so basically that also tries to nullify the experimenter bias even while talking because after all we are human beings and when we are interacting with people than they may be a bias that is brought on by our behaviour. So the physical arrangement was such that the rewards, if left, so if the like in condition one if nothing else was picked up, so the rewards so the pretzel and the cookie was there, so it was left directly in front of the child at about shoulder level.

So the marshmallow test you can see this child staring at the marshmallow and you this very interesting experiment and you can actually conduct it on you know your people at home and you will see that whether there is a delay in gratification and that also says about self-control, we will actually come to that very soon.

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Results

- Waiting time was scored from the moment the experimenter shut the door. The experimenter returned either as soon as the child signaled or after 15 minutes—the criterion time—if the child did not signal

Statistic	Available for attention			
	No rewards	Both rewards	Delayed reward	Immediate reward
<i>M</i>	11.29	1.03	4.87	5.72
<i>SD</i>	6.84	2.39	6.57	6.43

Mischel and Ebbsen, 1970

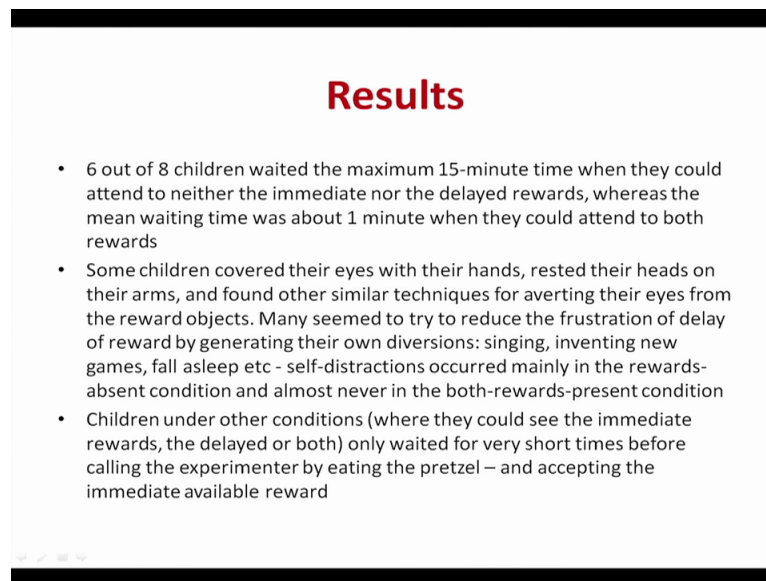
So the results showed that the waiting time was scored from the moment actually the waiting time was scored from the moment the experimenter shut the door and the experimenter returned either as soon as the child signaled or after 15 minutes. So that was a time period that was the criterion time, if the child did not signal, so is the child did not eat up the pretzel and call up call back the experimenter then this experiment would end by 15 minutes of time, but for so the it was very strange because it was seen that they were no rewards, the children stayed or a mean of 11.29 minutes.

So where the rewards were not placed in front of the child, the children could wait so the delay time was for more than 11 minutes, when both rewards were the on the contrary so if you give 2 rewards in front of the child and made the child look at it I mean you are not making the child look at it but if it is in front of the child so if he looks at it then the delay time was only 1 minute 0.03 seconds. If the delayed reward was kept then it was 4.87 and for the immediate reward it was, so immediate reward was the least preferred less preferred reward, so that was 5 minutes 72 seconds and the delayed reward was a preferred reward.

So if both the rewards were kept, then the least time was you know they could control the delay and so within a very short span of time that indicates that in very short span of time

they the children said that well enough is enough and they ate up the pretzel and wanted the reward even if it is a less preferred one and for the if the more preferred reward was kept you will see that after the 1.03 that is the next lowest score. So that indicates that that is the next lowest time for which the delay could be kept and if the less preferred reward was kept in front of the child then the child could actually stay on for 5 minutes or 72 seconds of mean time and as I mentioned earlier that if the rewards were not kept in front of the child, the child could delayed for 11.9 minutes.

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Results

- 6 out of 8 children waited the maximum 15-minute time when they could attend to neither the immediate nor the delayed rewards, whereas the mean waiting time was about 1 minute when they could attend to both rewards
- Some children covered their eyes with their hands, rested their heads on their arms, and found other similar techniques for averting their eyes from the reward objects. Many seemed to try to reduce the frustration of delay of reward by generating their own diversions: singing, inventing new games, fall asleep etc - self-distractions occurred mainly in the rewards-absent condition and almost never in the both-rewards-present condition
- Children under other conditions (where they could see the immediate rewards, the delayed or both) only waited for very short times before calling the experimenter by eating the pretzel – and accepting the immediate available reward

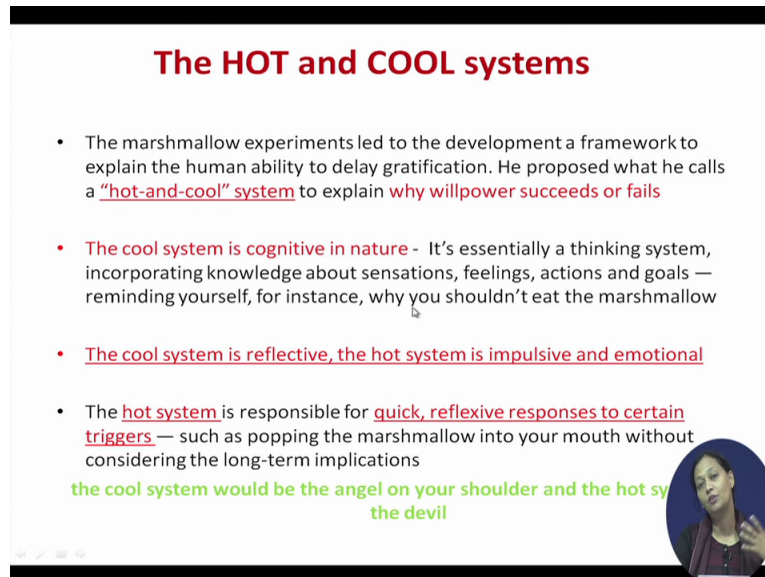
So the results show that 6 out of 8 children waited the maximum 15 minutes time when they could attend to neither the immediate nor the delayed reward, whereas the mean waiting time was about 1 minute when they could attend to both rewards as we saw from the scale from the results section.

Some children covered the eyes, so how did they actually stay away from the reward so some children covered the eyes with their hands, rested their heads on the arms and found other similar techniques of averting their eyes from the reward, so from the desirable object. So they tried to distract themselves from the desirable object and many times they were also invented games of their own or like playing with the hands and feet, singing or even falling asleep and one child did fall asleep during the session.

So and many seen to try to reduce the frustration as I mentioned by generating new diversion or distractions and children under the other conditions so that is where they could see the immediate rewards, the delay or both only waited for very short time before calling the

experimenter by eating up the pretzel and accepting the immediate available reward. So if it was visible in front of the child then the waiting period was lesser.


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The HOT and COOL systems

- The marshmallow experiments led to the development a framework to explain the human ability to delay gratification. He proposed what he calls a "hot-and-cool" system to explain why willpower succeeds or fails
- The cool system is cognitive in nature - It's essentially a thinking system, incorporating knowledge about sensations, feelings, actions and goals — reminding yourself, for instance, why you shouldn't eat the marshmallow
- The cool system is reflective, the hot system is impulsive and emotional
- The hot system is responsible for quick, reflexive responses to certain triggers — such as popping the marshmallow into your mouth without considering the long-term implications

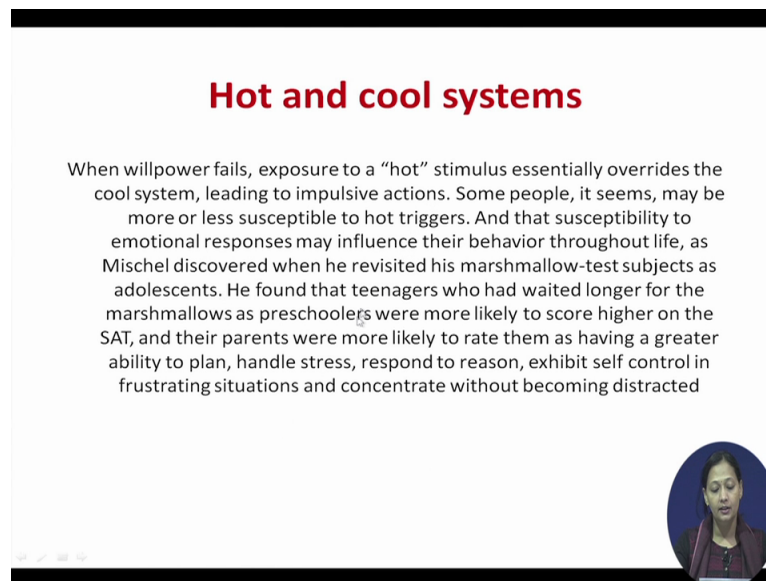
the cool system would be the angel on your shoulder and the hot system would be the devil



So basically you know further experiment were conducted by Walter Michelle and his colleagues and this led to a new concept of the hot and cold system and the development of a framework displaying the human ability to delay gratification and Walter Michelle proposed the hot and cook system to explain why willpower succeed or fails. So the cool system is more cognitive in nature so it is essentially a thinking system, incorporating the knowledge about sensation, feelings, actions and goals reminding yourself, for instance, why you should not eat the marshmallow.


So if it tells the individuals of cool system actually like a control system trying to stop the person from going beyond the telling the person what is right and wrong and hot system is responsible for quick response and reactions or responses to certain triggers, so it is more impulsive in nature the hot system is more impulsive nature and it is it bond and immediate gratification, so it does not really care for the long-term consideration or long-term implications, so you know, if you did have a cartoon you could you could explain it as the white angel with a ring on your shoulder who is actually the cool system and the hot system would be something like the devil with horns telling you to do things impulsively.

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Hot and cool systems

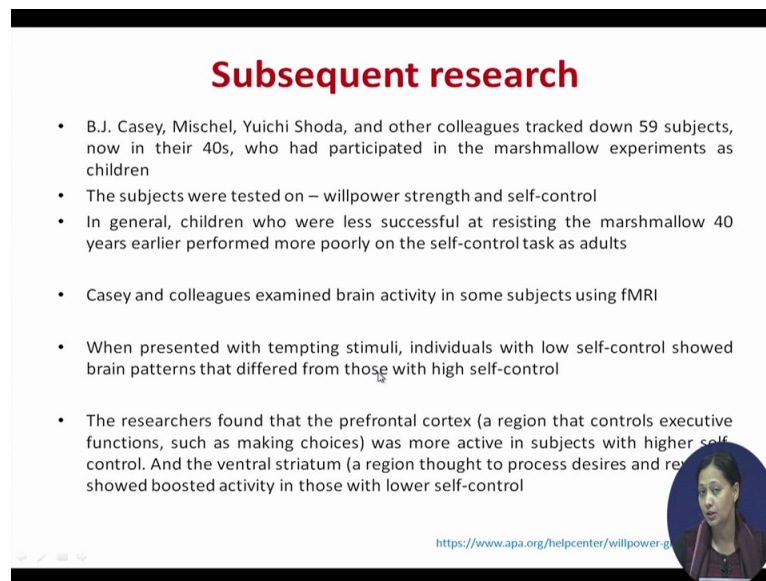
When willpower fails, exposure to a “hot” stimulus essentially overrides the cool system, leading to impulsive actions. Some people, it seems, may be more or less susceptible to hot triggers. And that susceptibility to emotional responses may influence their behavior throughout life, as Mischel discovered when he revisited his marshmallow-test subjects as adolescents. He found that teenagers who had waited longer for the marshmallows as preschoolers were more likely to score higher on the SAT, and their parents were more likely to rate them as having a greater ability to plan, handle stress, respond to reason, exhibit self control in frustrating situations and concentrate without becoming distracted



So basically when willpower fails, this is what Walter Michelle said that it is exposure to hot stimulus that essentially overrides the cold system, leading to impulsive actions and some people, it seems, may be more or less susceptible to hot triggers so there is that that slight innate characteristics of the individual where they are more susceptible to impulsive reactions and that is true if you know in clinical psychology also we see that there are individuals who are really impulsive in nature and who respond very impulsively to they have emotional vulnerability and the respond very emotionally, very impulsively to situations at hand and the arousal system just rises up so if its if it is like as I spoke about the emotional vulnerability.

So the individuals who are too much in love went too much in hate and maybe you know too much involved and absolutely isolated. So they there are swings in behaviour patterns and they are also very impulsive in nature and this susceptibility to emotional responses may influence the behaviour throughout life as Michelle discovered when he revisited his marshmallow test subject as adolescents and we will just come to that right now.

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Subsequent research

- B.J. Casey, Mischel, Yuichi Shoda, and other colleagues tracked down 59 subjects, now in their 40s, who had participated in the marshmallow experiments as children
- The subjects were tested on – willpower strength and self-control
- In general, children who were less successful at resisting the marshmallow 40 years earlier performed more poorly on the self-control task as adults
- Casey and colleagues examined brain activity in some subjects using fMRI
- When presented with tempting stimuli, individuals with low self-control showed brain patterns that differed from those with high self-control
- The researchers found that the prefrontal cortex (a region that controls executive functions, such as making choices) was more active in subjects with higher self-control. And the ventral striatum (a region thought to process desires and rewards) showed boosted activity in those with lower self-control

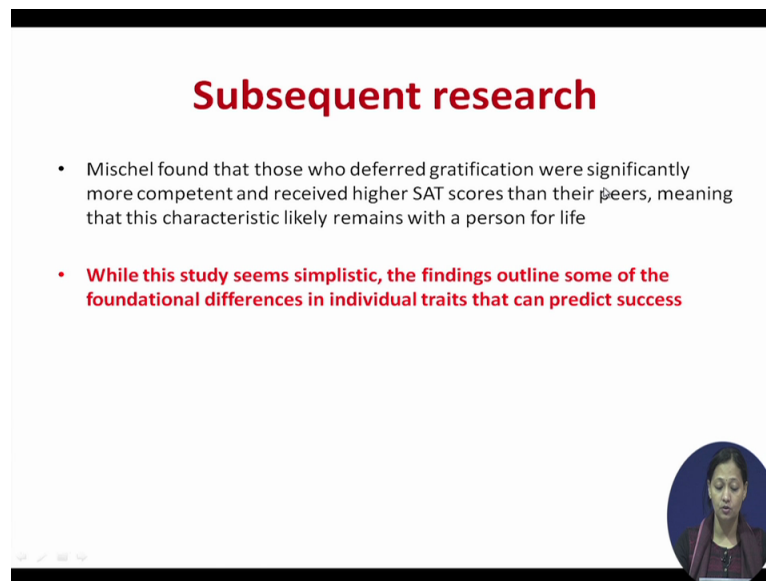
<https://www.apa.org/helpcenter/willpower-g>

So with this this experiment, it was such a simple experiment carried out and later on subsequent research followed it and Walter Michelle carried out his conducted this research or more than 40 years and Casey Michelle in Shoda another colleagues tracked down the 59 subjects, who are now in the 40s and who had participated in the marshmallow experiments as children, and the subjects were tested the participants and those children had been grown up now and they were in the 40s were tested on willpower, strength and self-control.

And in general children who were less successful at resisting the marshmallow 40 years earlier performed more poorly on the self-control task as adults and Casey and colleagues examine brain activity in some subjects using F MRI and when presented with tempting stimuli, individuals with low self-control showed brain patterns that differed from those with high self-control.

So just imagine that this had actually carried out the pattern had remained for 40 years for more than 40 years and the researchers found that the prefrontal cortex was more active in subjects with higher self-control and the ventral straitum which is a region for processing desires and rewards, showed boosted activity in those with lower self-control.

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Subsequent research

- Mischel found that those who deferred gratification were significantly more competent and received higher SAT scores than their peers, meaning that this characteristic likely remains with a person for life
- **While this study seems simplistic, the findings outline some of the foundational differences in individual traits that can predict success**

So Michelle also found that those who were deferred gratification 40 years earlier were more were more competent and received higher SAT scores than their peers that, meaning that this characteristics likely remains with the person for life. So while this study as I is I mentioned you know this was such a simple study, but it showed at you know if you if you display the delayed gratification even for such a small thing as a pretzel or marshmallow.

Then you know this this the small this behaviour is also indicative of your self-control years later and actually there is the brain pattern of that individual also indicated that you know of these individuals indicated that there is significant amount of activity which is different in the high self-control people as compared to the low self-control people.

Now as I mentioned that these studies very simplistic but the findings outlined some of the foundational differences in individuals that can predict success. The week's lectures with this study and specially you know as I mentioned that self-control study is this study is very important especially because it was carried out in such a simplistic fashion considering all the experimental methodology and this was this is also predictive of future so the predictive validity of this experiment is also very high.

So it could actually predict the future self-control measures and delayed gratification so thus is been found as one of the major characteristic of individuals displaying better self-control. So you could also try out some of these experiments that we spoke about in this session these sessions and I would like to in the next session I would like to talk about some of the things that you have not covered in the great experiments so stay tuned in. Thank you.