

How I found the value of Math: A personal tale

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A SHORT INTRO ABOUT ME..



Oslo, Norway

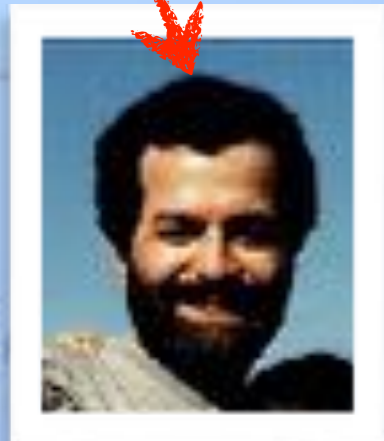
Gothenburg, Sweden

Sapporo, Japan

Berkeley, USA USA

San Jose, Costa Rica

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mom



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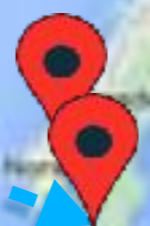
simula research laboratory



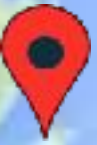
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CHALMERS



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Tecnológico
Costa Rica



intel

SIEMENS
Siemens Business Services

My work trajectory

South Pacific Ocean

South Atlantic Ocean

"Can you do Addition?" the White Queen said.

"What's one and one and one and one and one and one and one and one and one and one and one?"

"I don't know," said Alice. "I lost count."

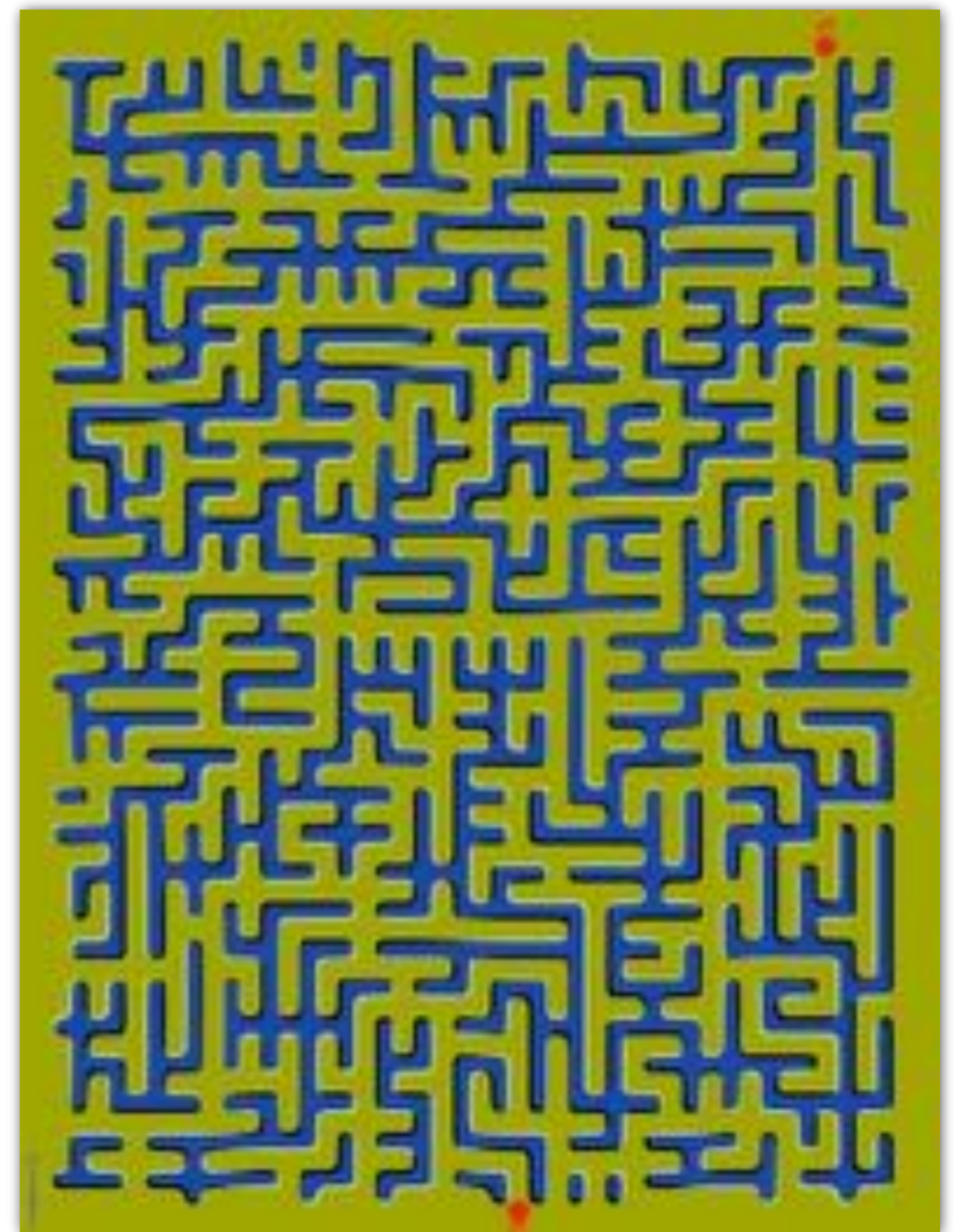
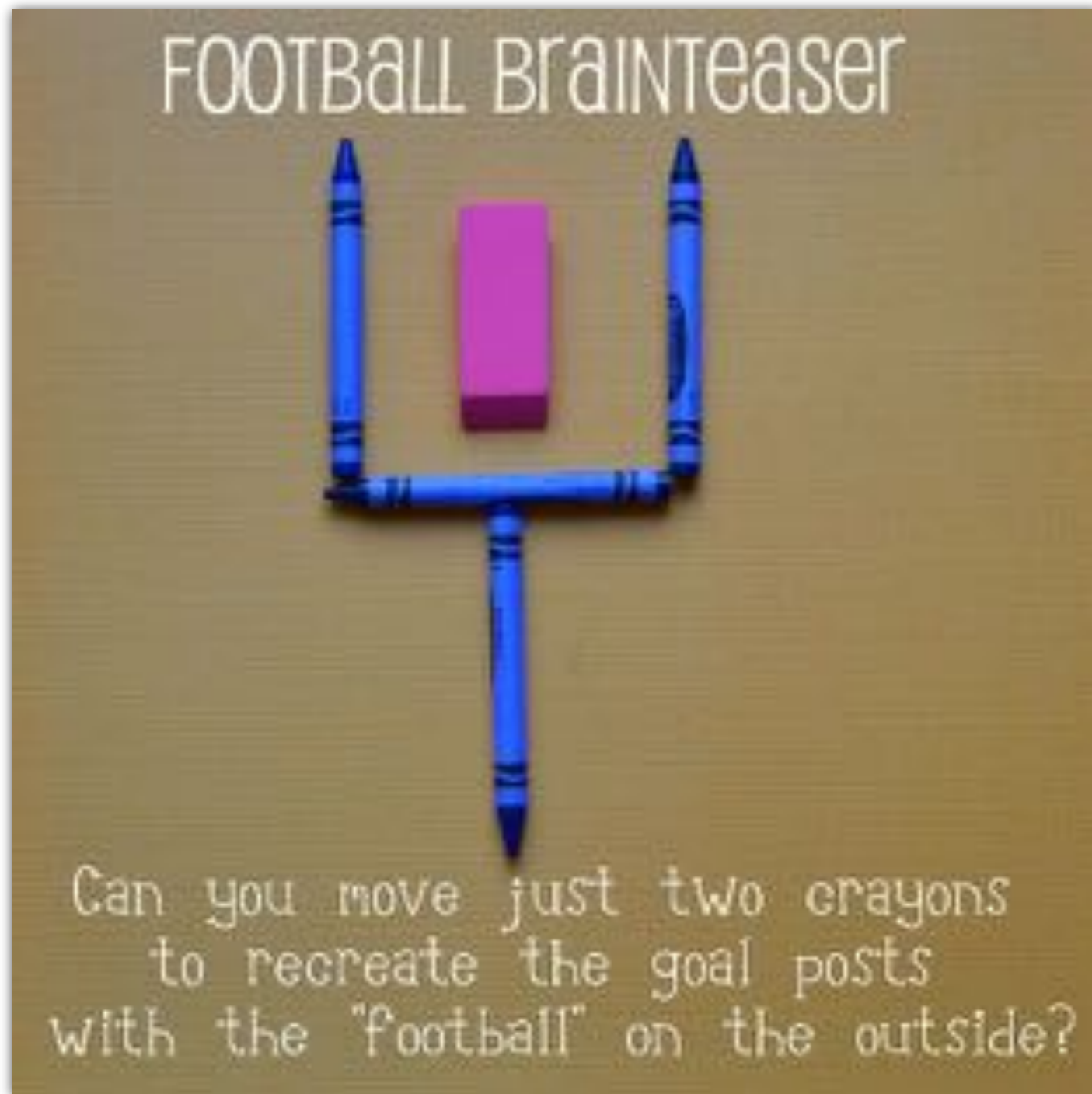
"She can't do Addition," the Red Queen interrupted.



Me at the end of high school.



I always loved brainteasers...



start

end

and mazes



This is the Costa Rica version of:



NTNU – Trondheim
Norwegian University of
Science and Technology

TEC
Tecnológico
Costa Rica

Tecnológico de Costa Rica

<http://www.tec.ac.cr>



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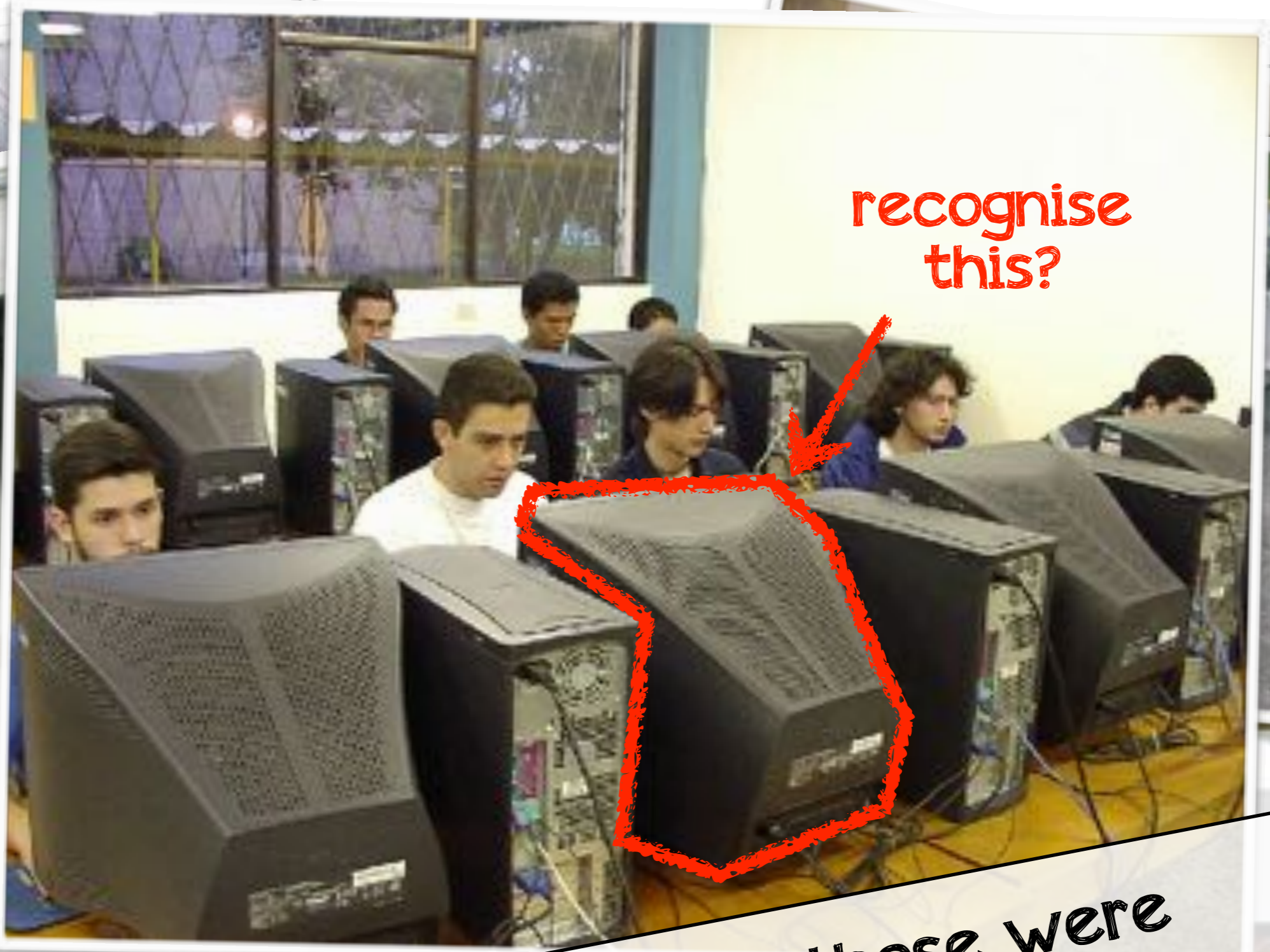
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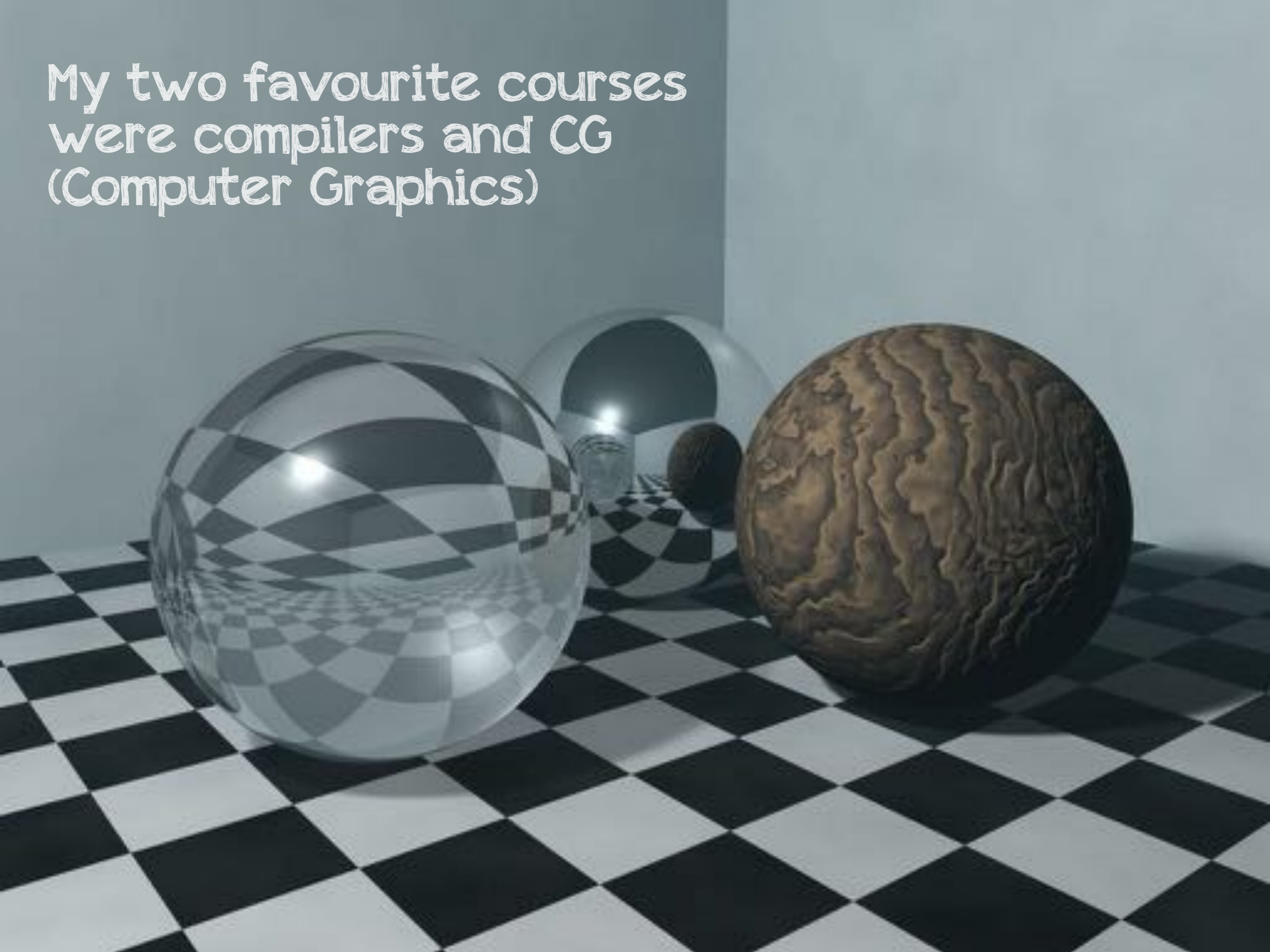


recognise
this?

ohh yes! those were
the days...

Tecnológico de
Videos shared publicly in Y

My two favourite courses
were compilers and CG
(Computer Graphics)



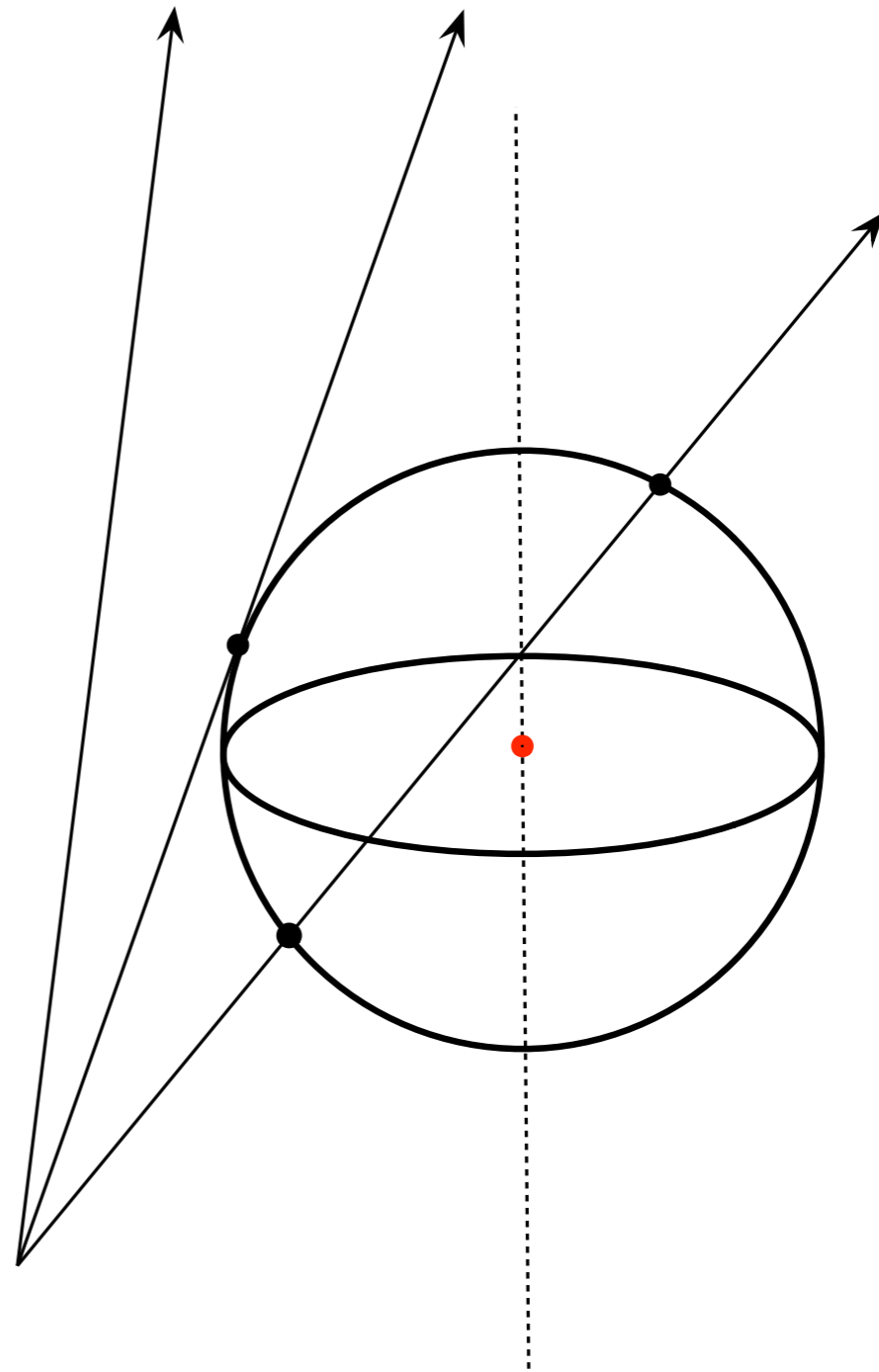
...for the first time in my life, I realized
that math can be used for something
fun and cool...



Ray Tracer (rendering technique for CG) uses intersection functions.. (equations)

what if I want to
render a sphere?

$$ax^2 + bx + c = 0$$

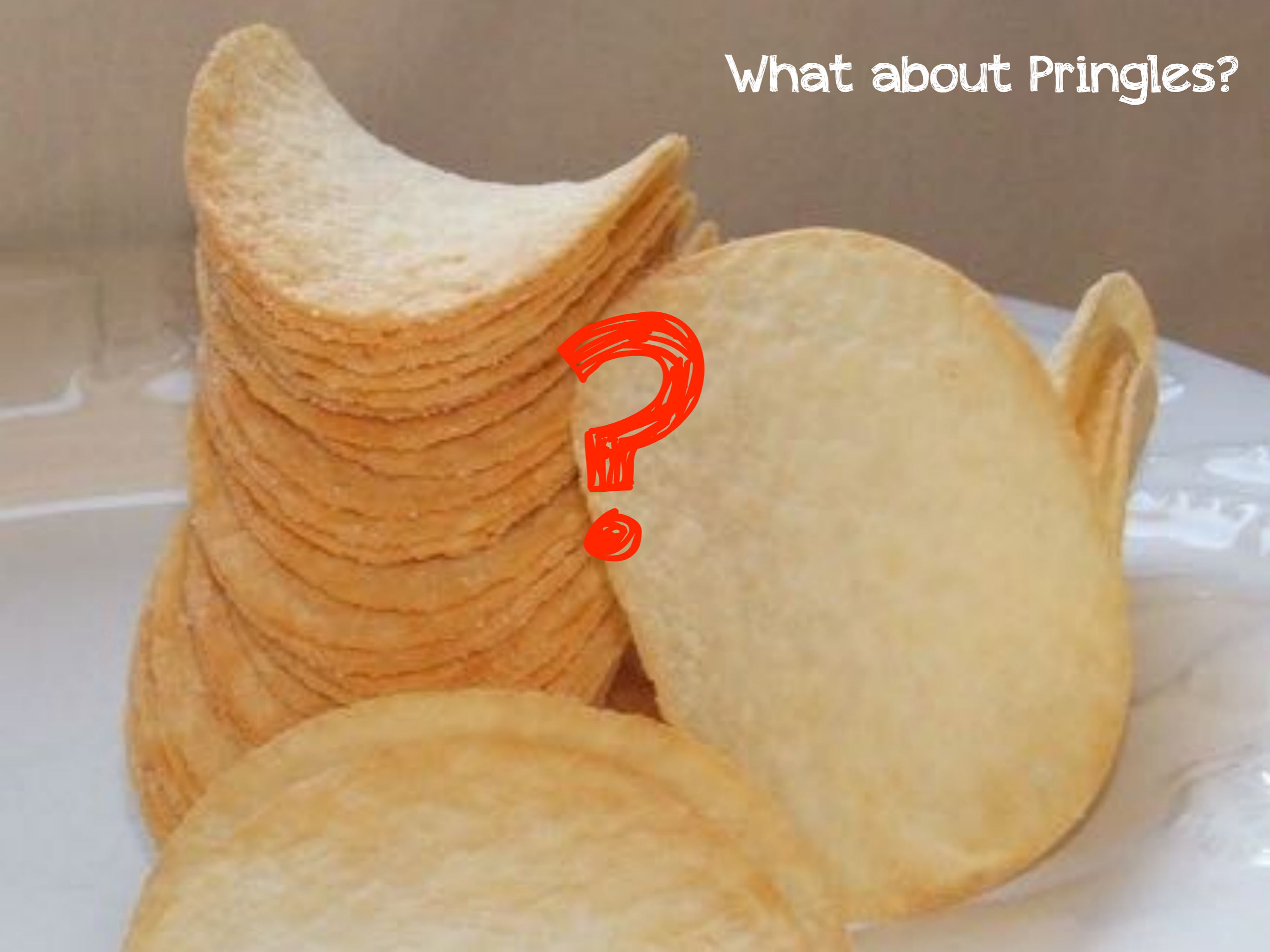


What if I wanted to render a cone?

$$x^2/a^2 - y^2/b^2 + z^2/c^2 = 0$$

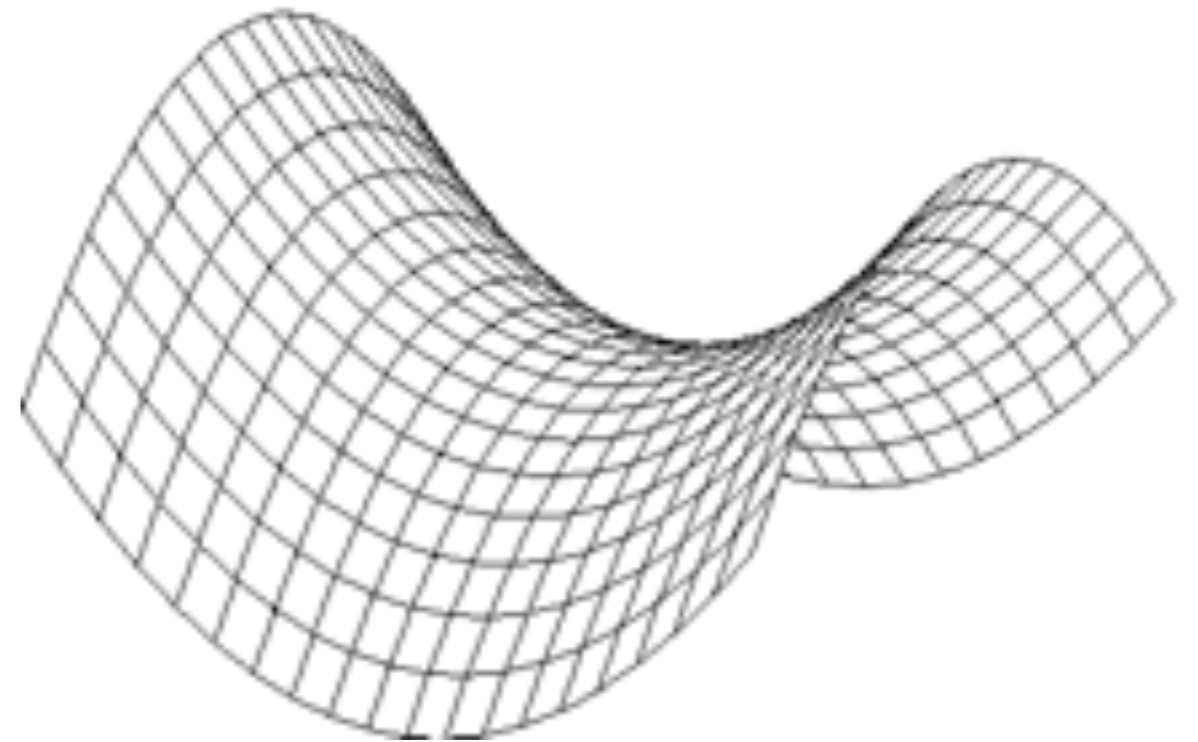


What about Pringles?



There is in fact an equation that describes Pringles...!

$$\frac{x^2}{a^2} - \frac{z^2}{c^2} - 2y = 0$$



Btw, this is called:

hyperbolic
paraboloid

Let's go even more deeper into "junk food"



What about donuts?

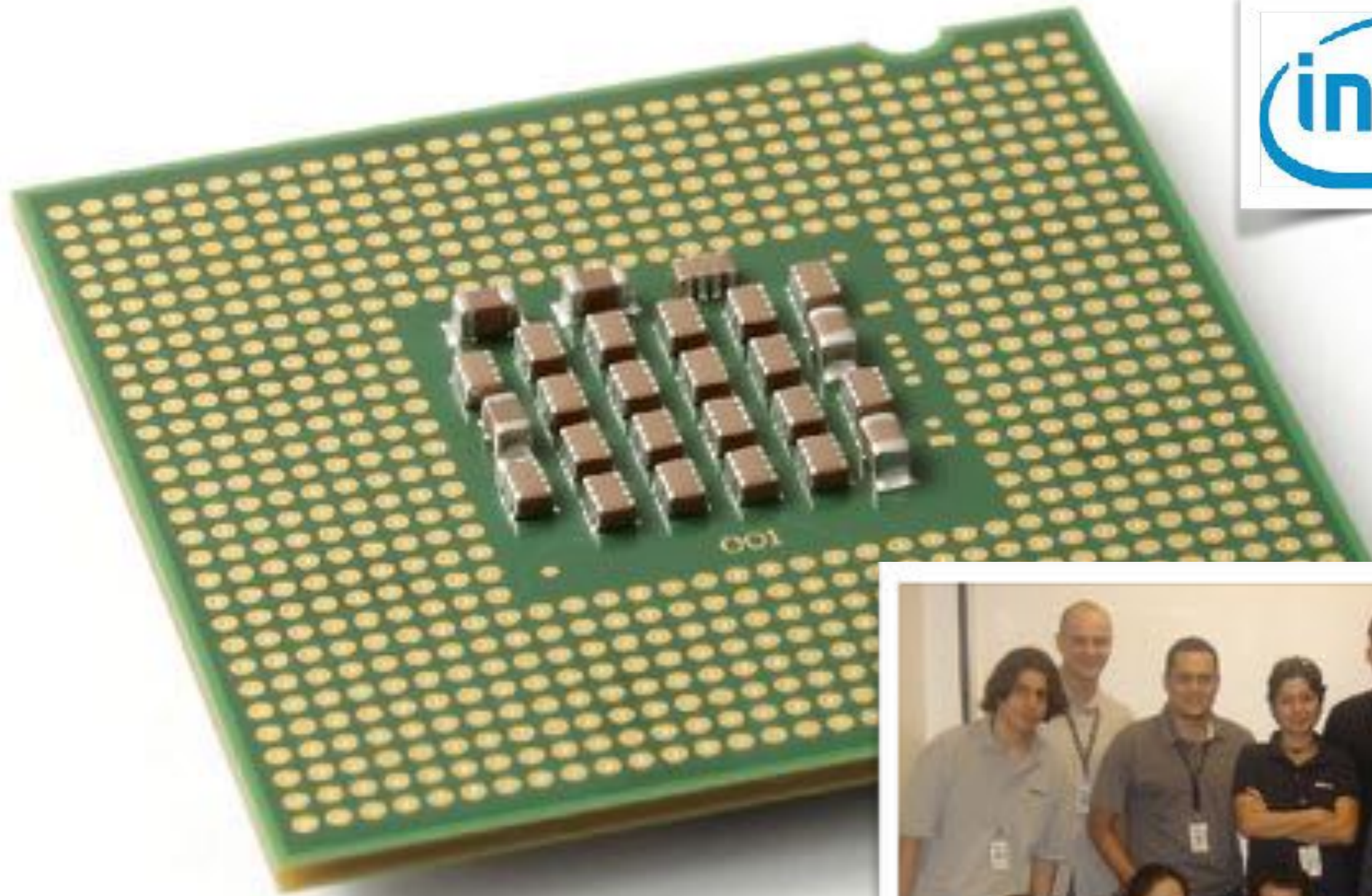


OK, some are more complicated than others...

$$a_4 t^4 + a_3 t^3 + a_2 t^2 + a_1 t + a_0 = 0$$
$$a_4 = r^2 = (d \cdot d)^2$$
$$a_3 = 2\alpha\beta = 4(d \cdot d)(p \cdot d)$$
$$a_2 = \beta^2 + 2\alpha\gamma + 4\mathcal{R}^2 d_z^2 = 4(p \cdot d)^2 + 2(d \cdot d)((p \cdot p) - r^2 - \mathcal{R}^2) + 4\mathcal{R}^2 d_z^2$$
$$a_1 = 2\beta\gamma + 8\mathcal{R}^2 p_z d_z = 4(p \cdot d)((p \cdot p) - r^2 - \mathcal{R}^2) + 8\mathcal{R}^2 p_z d_z$$
$$a_0 = \gamma^2 + 4\mathcal{R}^2 p_z^2 - 4\mathcal{R}^2 r^2 = ((p \cdot p) - r^2 - \mathcal{R}^2)^2 + 4\mathcal{R}^2 p_z^2 - 4\mathcal{R}^2 r^2$$

Btw, this one is called

toroid



My first job as Software Engineer was at Intel..



But I easily get bored, and went on to
look for new adventures...





I did my MSc. thesis in a medical company...



The image shows a screenshot of the Micropos Medical website. At the top, there is a blue navigation bar with the company name "MICROPOS MEDICAL" on the left and a menu of links: "HOME", "ABOUT US", "PRODUCTS", "SCIENTIFIC", "INVESTOR RELATION", "CONTACT", and "NEWS & EVENTS" followed by a search icon. Below the navigation bar is a large banner image. On the left side of the banner, a patient is lying on a treatment table in a radiotherapy room, with a large medical machine (linac) positioned above them. A female medical professional is standing next to the table, looking at a tablet device. On the right side of the banner, the text "RAYPILOT®" is displayed in a large, bold, blue font. Below this, the text "Increased patient safety with real time positioning" is written in a smaller, blue font. A blue button with the text "READ MORE" is located at the bottom right of the banner. Below the banner, there is a paragraph of text describing the company and its product.

Micropos Medical is a Swedish medical device company with technologies for enhanced radiotherapy of cancer. The first product, RayPilot®, is an electromagnetic positioning system that works with existing linacs in order to enable non-ionizing, objective and real time prostate tracking.

The system I worked with, was a support system for enhanced radiotherapy treatment

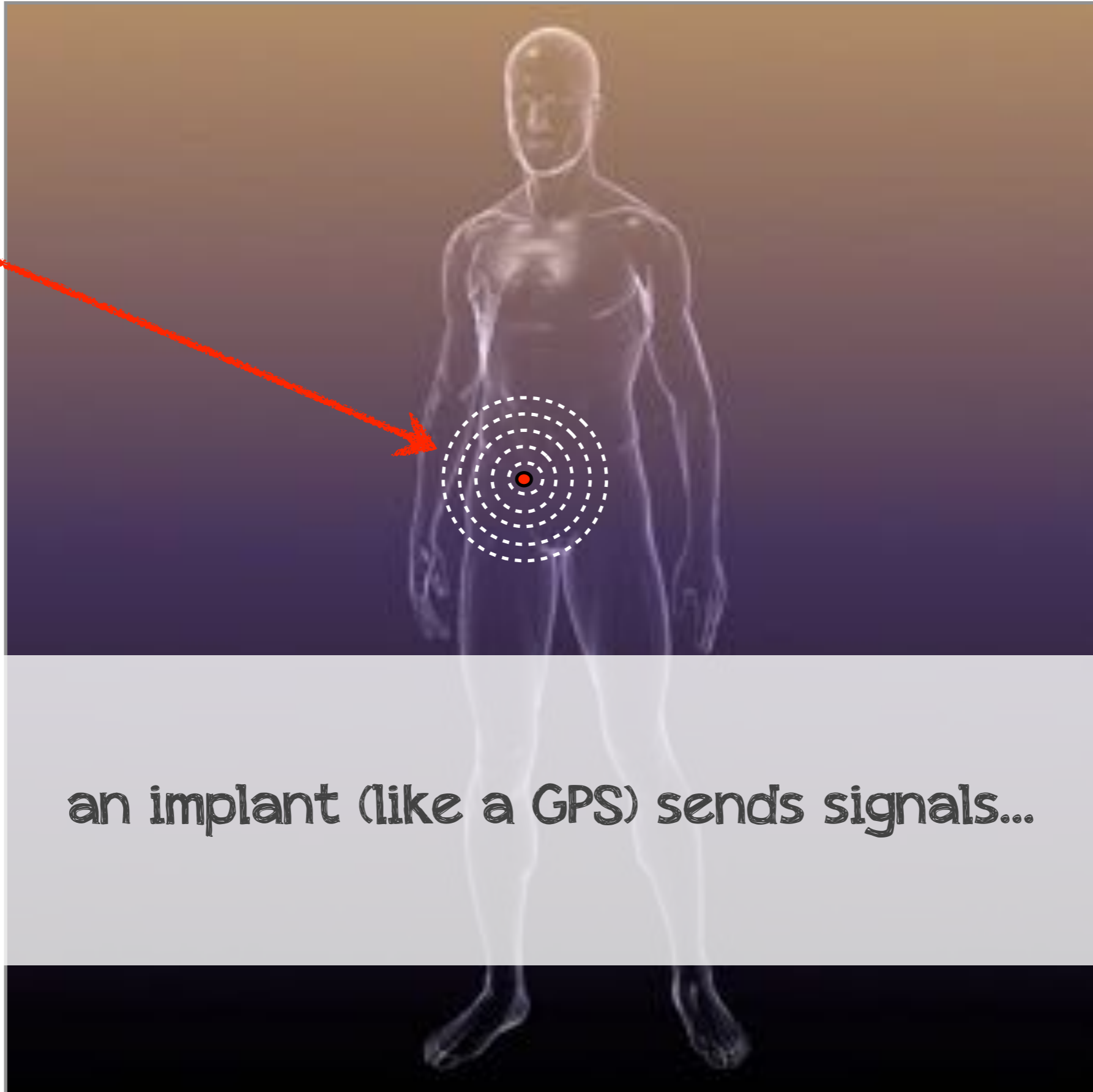


In radiotherapy, is **important** to know where exactly the organ is located..



**organs are
moving targets!**





an implant (like a GPS) sends signals...

a software captures the signals and converts them into a position..



how we tested that the program
was accurate?

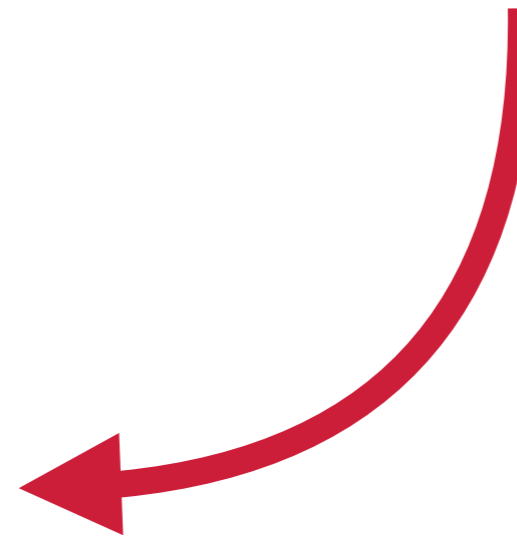
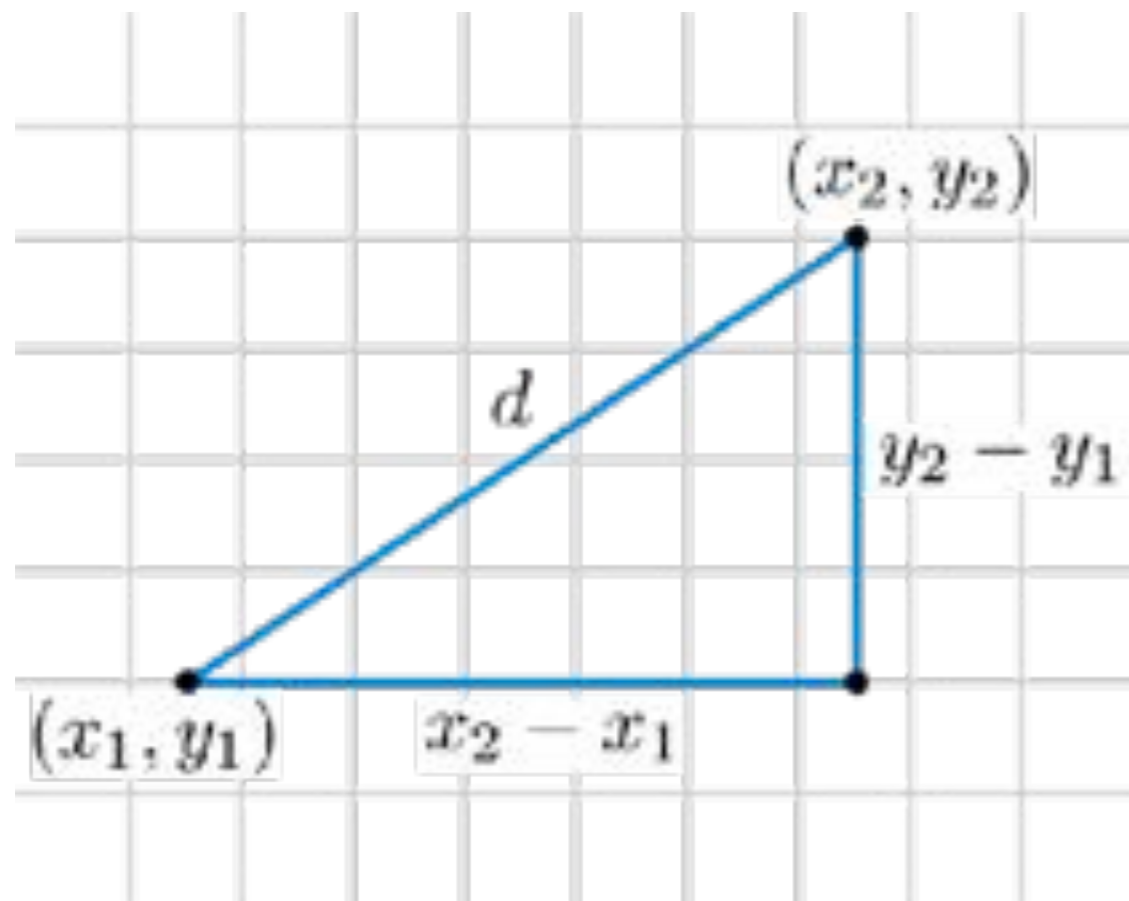


The system should achieve
3D difference or radial
accuracy of 2 ± 1 mm

how we tested that the program
was accurate?

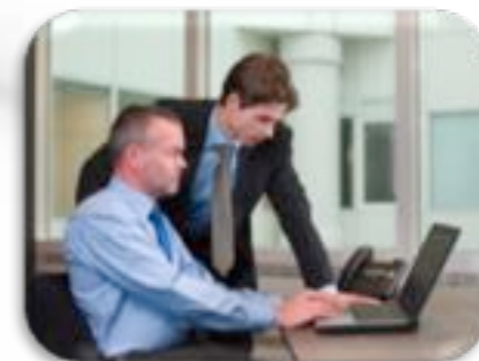
Accuracy was modelled mathematically as

Euclidian distance: $\sqrt{\left(\left(X_p - X_c\right)^2 + \left(Y_p - Y_c\right)^2 + \left(Z_p - Z_c\right)^2\right)}$



It was an amazing experience to work with so many experts..

THE RAYPILOT® SYSTEM CONSISTS OF THREE PARTS:



Mathematicians, Physicists, Doctors,
Nurses, Technicians, Engineers...



...I also realized that math can be used
as a **communication tool**...



... and to create solutions to **save**
lives...



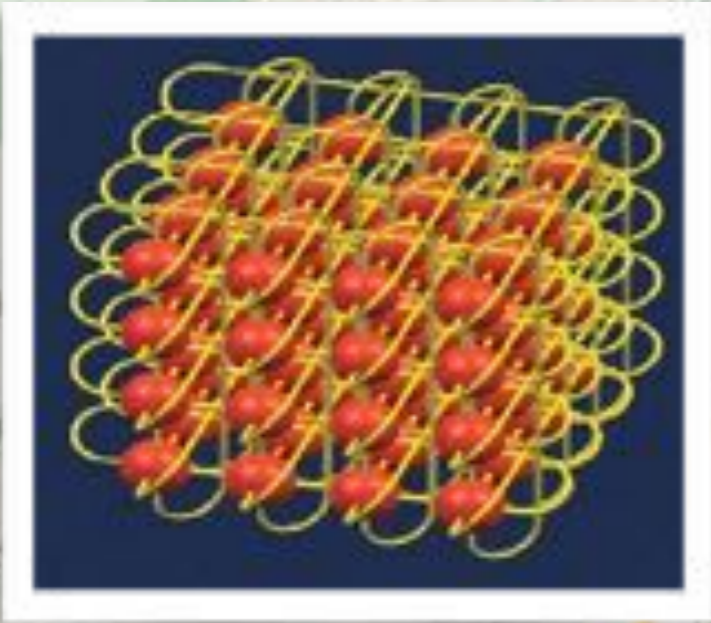
OK... what's next?



I wanted to be
a researcher!



 3 h 4 min
293 km



OK, what did I work with?



```
Public class FormattingConverter
    Implements IValueConverter

    Public Function Convert( _
        ByVal value As Object, _
        ByVal targetType As System.Type, _
        ByVal parameter As Object, _
        ByVal culture As System.Globalization.CultureInfo
        Implements System.Windows.Data.IValueConverter

        If parameter IsNot Nothing Then

            Dim strFormatString As String = _
                parameter.ToString

            If Not String.IsNullOrEmpty(strFormatString)
                Then
                Return String.Format(culture, _
                    strFormatString, value)
            End If

            Return value.ToString
        End Function

    Public Function ConvertBack( _
        ByVal value As Object, _
        ByVal targetType As System.Type, _
        ByVal parameter As Object, _
        ByVal culture As System.Globalization.CultureInfo
        Implements System.Windows.Data.IValueConverter

        Dim objTypeConverter As
            System.ComponentModel.
            System.ComponentModel.ITypeConverter
        Dim objReturnValue As Object

        If objTypeConverter.CanConvertFrom( _
            value.GetType()) Then
            objReturnValue = objTypeConverter.ConvertFrom(
                value)
        End If

        Return objReturnValue
    End Function
End Class
```

```
Public class FormattingConverter
    Implements IValueConverter

    Public Function Convert( _
        ByVal value As Object, _
        ByVal targetType As System.Type, _
        ByVal parameter As Object, _
        ByVal culture As System.Globalization.CultureInfo As Object
        Implements System.Windows.Data.IValueConverter.Convert

        If parameter IsNot Nothing Then

            Dim strFormatString As String = _
                parameter.ToString

            If Not String.IsNullOrEmpty(strFormatString)
                Then
                Return String.Format(culture, _
                    strFormatString, value)
            End If

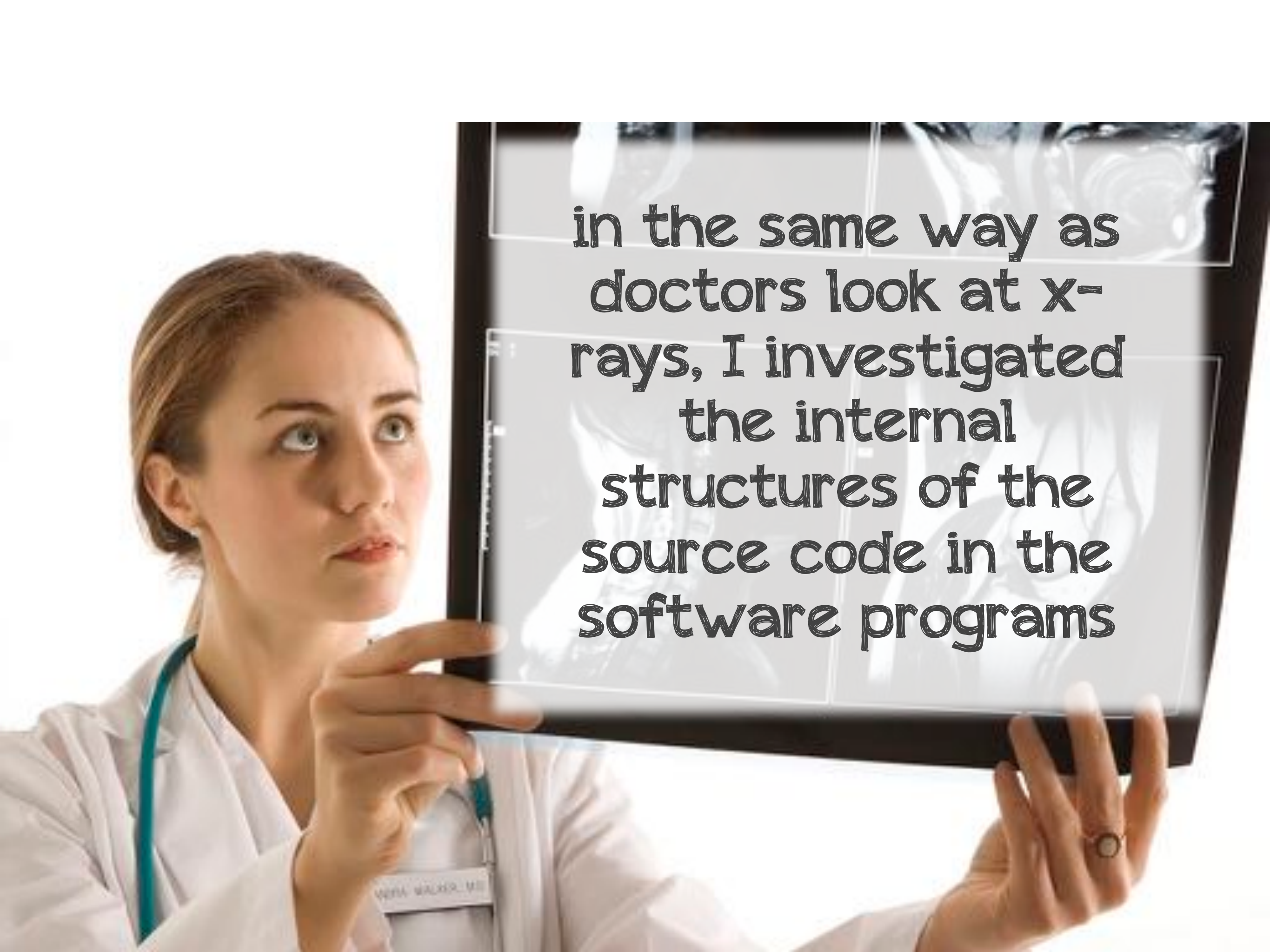
            Return value.ToString
        End If

        Return value.ToString
    End Function
End Class
```

Source code are 'instructions' to a computer that is written by a programmer by using a programming language

```
int num;
Console.WriteLine("Enter number \n");
num = int.Parse(Console.ReadLine());
Console.WriteLine("\n\nValue Type");
Console.WriteLine("-----");
Console.WriteLine("\nPrevious Value:\t{0}", num);
Program.value(num);
Console.WriteLine("\nCurrent Value:\t{0}", num);

Console.WriteLine("\n\n\n-----");
Console.WriteLine("\tReference Type");
Console.WriteLine("-----");
Console.WriteLine("\nPrevious Value:\t{0}", num);
Program.reference(ref num);
Console.WriteLine("\nCurrent Value:\t{0}", num);
Console.ReadLine();
}
```

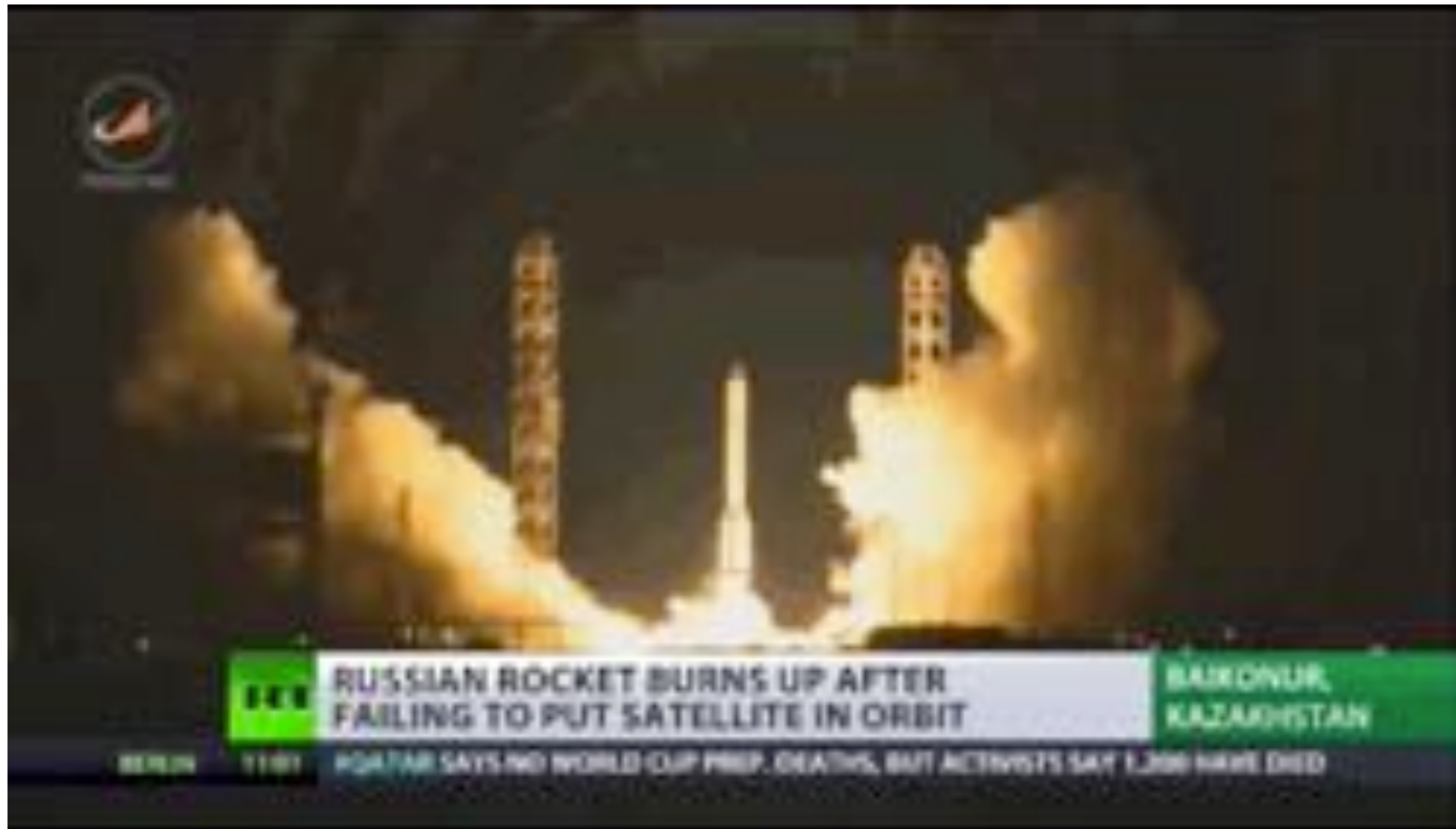


in the same way as
doctors look at x-
rays, I investigated
the internal
structures of the
source code in the
software programs



in my PhD, I found that there was a relationship between some code structures and programmers being confused

And confusions, sometimes, can be catastrophic!





in 2012, I defended
my PhD!

OK... what's next?





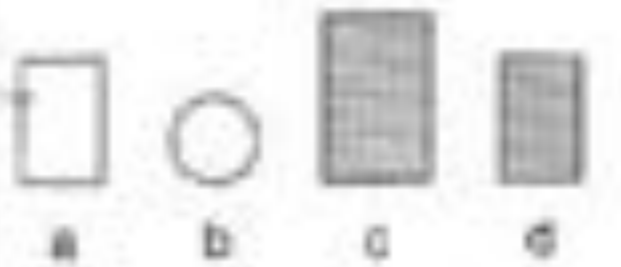
I realized that my skills in
research could be used in
Data Science

But.. What is **Data Science**?



Data is everywhere...

Data Scientists explore patterns in the data..

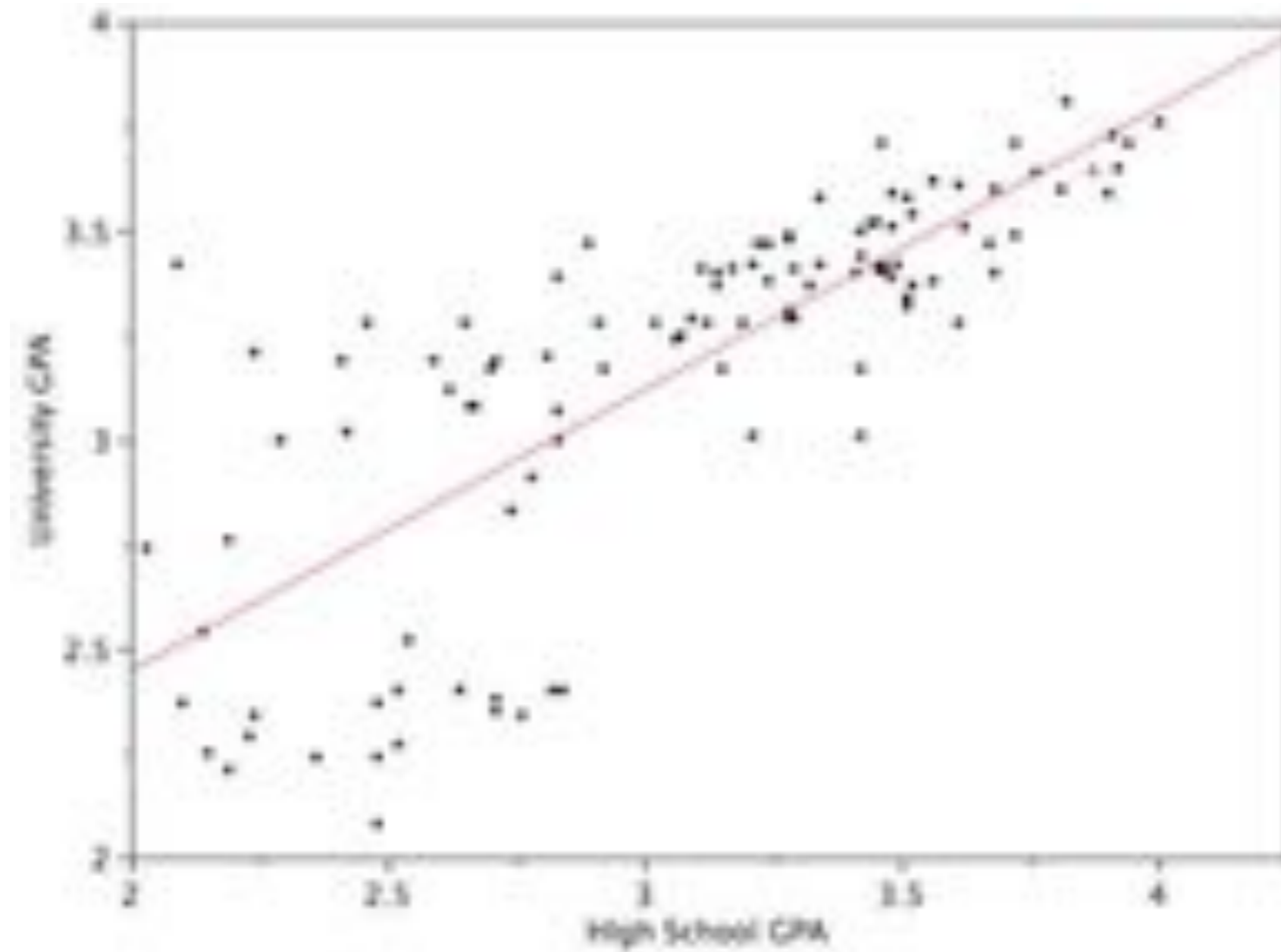


Let's try this small example..



To acquire knowledge...

“Data Patterns” can be used to do predictions



That means, we can predict the happening of an event...



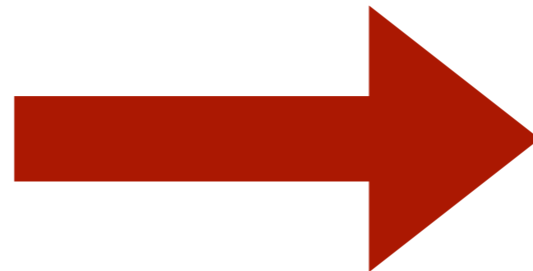
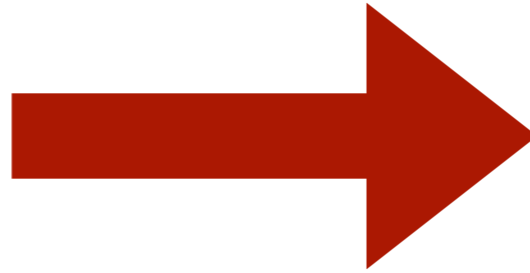
4R

Seek antar sted...

Sted	Wednesday	Thursday	Friday	Shortcuts
Amsterdam	25	24	21	Hour by hour Lang term
Oslo	21	20	18	Hour by hour Lang term
Helsinki	15	15	14	Hour by hour Lang term
Vind	14	15	12	Hour by hour Lang term



We could predict **when** something will occur...



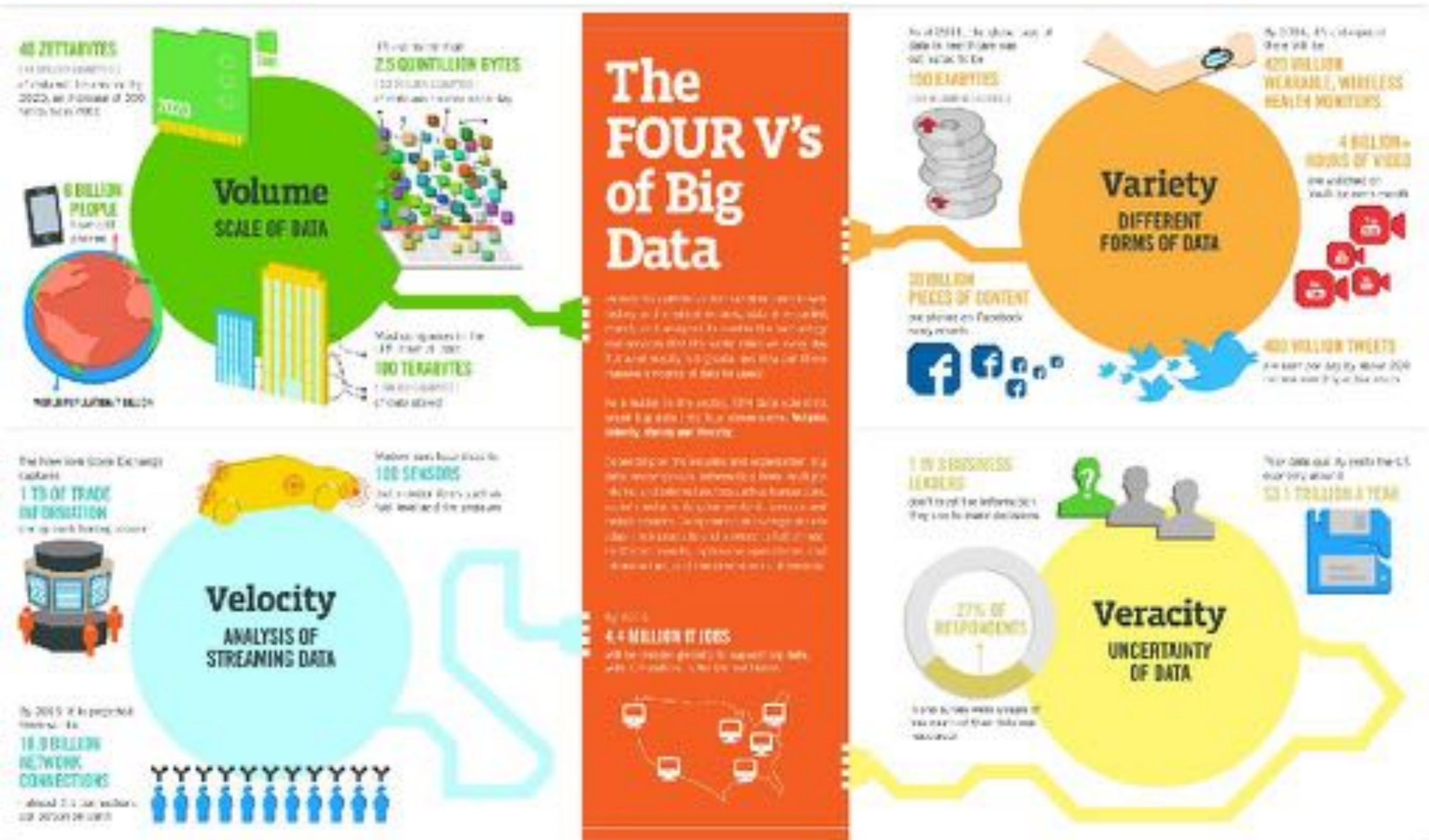


Predict extreme deviations..



Such as this... :-0

The possibilities enabled by data volume and computational power are a **game changer**



Data Science, John Snow and the cholera outbreak in London...



...With Big Data comes
Big Responsibilities...

The Observer

The great British Brexit robbery: how our democracy was hijacked

A shadowy global operation involving big data, billionaire friends of Trump and the disparate forces of the Leave campaign influenced the result of the EU

But honestly, were
Math courses
difficult for me?



“We choose to go to the moon in this decade and do the other things, not because they are easy, but because they are hard, because that goal will serve to organize and measure the best of our energies and skills, because that challenge is one that we are willing to accept, one we are unwilling to postpone, and one which we intend to win.”

- John Kennedy

