

... and the electrical engineer can talk to plugs



Elena is sitting at her desk, staring at her German textbook. Outside, a sparrow flits through the bushes and two butterflies are dancing through the air. However, not much is happening in Elena's textbook. She's supposed to study punctuation rules and write example sentences to go with them. "Rules, rules and more rules," she mutters.

The birds seem to manage perfectly well without any rules at all. And the butterflies even flutter around wildly without anyone having written flight instructions in the sky. Comma, comma, full stop, Elena thinks. Suddenly, an image forms in her mind: full stop, full stop, comma, dash - and there's the face of the moon. Elena can't help but grin.



Just then, she hears a faint humming sound outside. Mum's electric car rolls into the driveway. She opens the charging flap and plugs the cable into the charging port. Nothing happens. "Is my car having trouble recognising the charging point today?" Elena hears her say. But a few seconds later, the indicator light comes on. "Finally."



A wonderful smell wafts through the house from the kitchen. Dad has already prepared lunch. Elena closes her German textbook.

The commas can wait, she decides. At least until after lunch.

"Mmm, that smells delicious," she says.

Then she grabs some plates and cutlery.

"I'll set the table.

Mum's just come in too."

Soon everyone is sitting together.

Mum puts the soup pot on the table and ladles the soup into the plates.



"With alphabet pasta!" Elena exclaims happily.

Letters float randomly amongst the pieces of vegetables in front of her. A "C" floats next to an "O". An "M" appears behind it, then another, and finally an "A".

With a bit of imagination, it almost spells "COMMA".

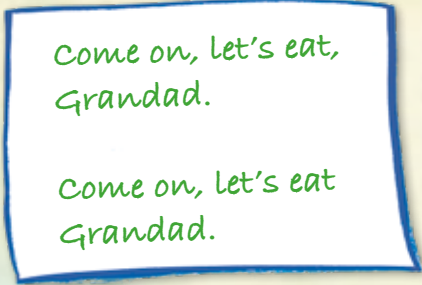


Elena pushes the letters together with her spoon.

"Why do we actually need rules?" Mum replies off the cuff. "For freedom and safety." Elena looks at her. "Huh? I'm talking about comma rules. They've got nothing to do with freedom."

"But they certainly have to do with safety," says Dad with a smile, picking up a piece of paper. On it, he writes two sentences:

Elena reads both sentences. Then she looks at Dad in horror. "In the second sentence, Grandad's being eaten!"



*Come on, let's eat,
Grandad.*

*Come on, let's eat
Grandad.*

"You see," says Dad, "a comma can save lives."

Mum grins.

"Rules are like a common language. They help people understand one another, and in electrical engineering, they ensure that devices work together safely." Mum is an electrical engineer and knows the rules of electrical engineering pretty well.

"Technology doesn't use commas, does it?" says Elena.

"But different devices have to understand each other too," replies Mum.

Elena points to Mum's car outside the window.

"Like your electric car, the charging cable and the charging box?"

"Exactly. Cables, devices, mobile phones, music systems and so much more. They all have to communicate with each other."

"Do you send the charging plug an email?" Elena asks. "Watch out, here comes the electricity. Best wishes, the charger." Dad bursts out laughing at Elena's question.



"Not via emails," says Mum. "But within software programmes and technical specifications, every single character really does matter. One wrong full stop or comma can cause just as much confusion there as it does with the rules for commas."

Elena gazes thoughtfully at her soup. "And who makes all these rules?" "Lots of people all over the world," says Mum.

"My friend Norma works at the DKE – that's the standardisation organisation for electrical engineering in Germany. Many experts work together to develop the rules there; these are then called standards." "So does Norma spend the whole day coming up with new standards?" "Well... no. Nobody comes up with good standards on their own. And she also checks rules that another team has written. If you'd like, we could go and visit her one day." Elena nods straight away. She loves discovering new things.



In the afternoon, she's back doing her homework. She plugs the charging cable into her laptop and watches as the battery icon lights up.

Beside it is her music player which can be charged with the same cable.

On the floor, there's a network cable

with a completely different plug. In the drawer, Elena finds some older charging cables that no longer fit anything. She looks at the cable tangle. Apparently, there are rules. And apparently, there used to be different ones. But first, the rules of commas.



The next morning, the class discusses their German homework. Elena puts her hand up.

"Who actually invented the rules for commas? Did someone just wake up one day and think: 'Today I'm going to make a rule for little dashes'?" The class giggles. The teacher smiles.

"Punctuation marks have developed over a long period of time. Around five hundred years ago, the Italian printer Aldus Manutius played an important role. He used marks that were similar to the commas we use today."

The class still has lots of questions about the rules and what they're used for.

Elena walks to the bus stop with her friends after school. Elena is surprised. Her mum is standing there, waving to her.

"Come on, we're going to visit Norma today."

"Today? Really? Cool!"

"Yes. But we'll stop off to do some shopping first."

Shortly afterwards, they drive to the supermarket.

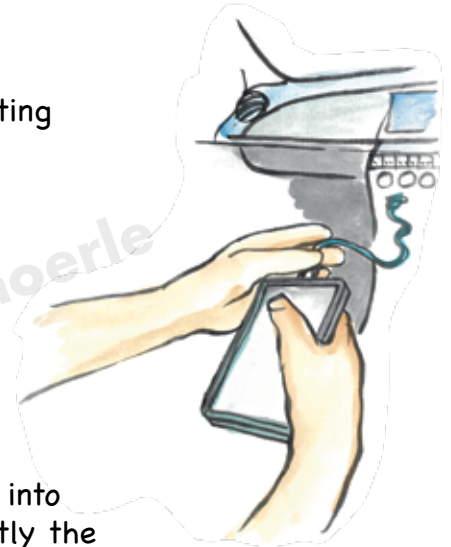
"Whilst I'm shopping, I'll charge our car," Mum explains.

She takes her cable out of the boot, connects the car to the supermarket's charging point and waits until the indicator light comes on. "That's what this is all about later, by the way," she says mysteriously. Elena waits in the car. Mum always takes an astonishingly long time shopping because she inspects every tomato as if she had to pass a tomato judging panel later on.

Elena plugs her mobile phone cable into the car to listen to her music. She looks at the small cable connecting her mobile phone to the car. Then she gazes thoughtfully out of the window at the large cable for the electric car.

When Mum comes back with the shopping, Elena points to her mobile's screen.

"Look, Mum! When I plug my mobile into the car, it charges too. Is that exactly the same electricity that's used to charge the electric car?"



Mum gives it a moment's thought.

"Basically, yes. But your mobile only needs a tiny bit of electricity, whereas the car needs a huge bucketful."

"Oh, I see! So electricity needs rules too, to make sure my mobile doesn't get too much." Elena grins.

"Exactly," laughs Mum, "lots of them, in fact."

Elena unplugs her mobile.

"Right, now my cable can have a rest and doesn't have to follow any rules at all."

Mum adds:

"But only until you plug it in again!"



INFO

Connections can transmit electrical power in a wide range of amounts: the watt (W) is the unit of measurement for power. It indicates how much energy can be transmitted in one second. Standards help to ensure that everything fits together safely.

Connections	The standard	Electrical output/Capacity
 Charger → mobile device, e.g. a mobile phone or tablet	IEC 62680 (USB-C)	up to 0.04 kW
 Sockets → electrical appliances in the home	IEC 60884	up to 3.7 kW
 Charging box → electric car	IEC 61851-1, IEC 62196-2	up to 22 kW
 Fast charger/ultra-fast charger → electric cars	IEC 61851-23, IEC 62196-3	up to 350/400 kW
 Megawatt charger → electric lorries	IEC TS 63379	up to 3,750 kW

Half an hour later, they arrive at a modern building. Norma comes out to meet them.

"You must be Elena. Your mum told me that you ask questions that adults sometimes find hard to answer."



Elena isn't quite sure if that's a good thing, but she decides to go for it. "And I've heard that your mum talks to plugs," Norma adds, laughing out loud.

"Mum told me that plugs, cables and devices talk to each other," Elena explains quickly, "and she said you know the standards for that inside out."

"Oh yes, I know all about that," says Norma, "and I find plugs and cables so fascinating, especially the ones for electric cars. Come along, I'll show you why."

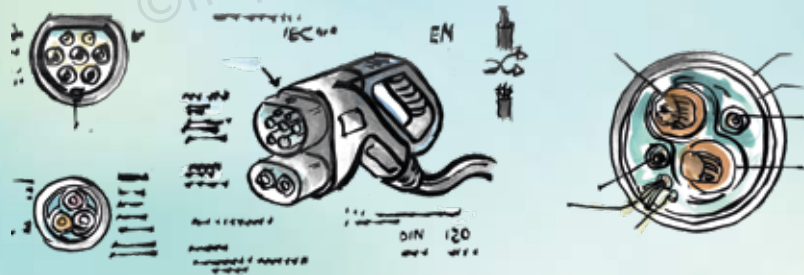
They enter a room filled with cables, devices, sockets, plugs and large diagrams on the wall. Norma picks up a plug.

"It doesn't look all that exciting, does it?"

"Yes, you're right," says Elena.

"Then have a closer look," Norma encourages her.

Norma points to the contacts inside the huge plug.
"This is a CCS plug for electric cars. Can you see the thick pins?
An incredible amount of electricity flows through them – so much
that the cables inside even have to be cooled so they don't over-
heat! The car and the charging point talk to each other via these
little pins here. The car says, 'I need power!' And the charging
point replies, 'Right, I'll send you exactly as much as you can
handle!'"



Elena listens attentively. Then she takes a close look at the plug.
"But there's a company name on it. Does that mean the plug
belongs only to that company?"

Norma smiles. "That might just be the most important question
of the day.

Actually, the plug doesn't belong to anyone in particular.
Any company is allowed to make it. The standard simply ensures
that everyone speaks the same language, so that the plugs fit
together safely."

And then she adds: "The standards also ensure that I can charge
my car when I'm travelling from the south to the north, or when
I'm driving abroad."

Elena looks at the CCS plug again. "Now I understand what is
meant by freedom." "What do you mean by that?" asks Norma.
"The standard doesn't decide WHO makes the plug. It just means
that anyone can make it anywhere."

"So who creates the standard then?" Elena asks.

"Lots of people. Come on, I'll show you."

Norma leads Elena into another room. People from different countries can be seen on the big screen.

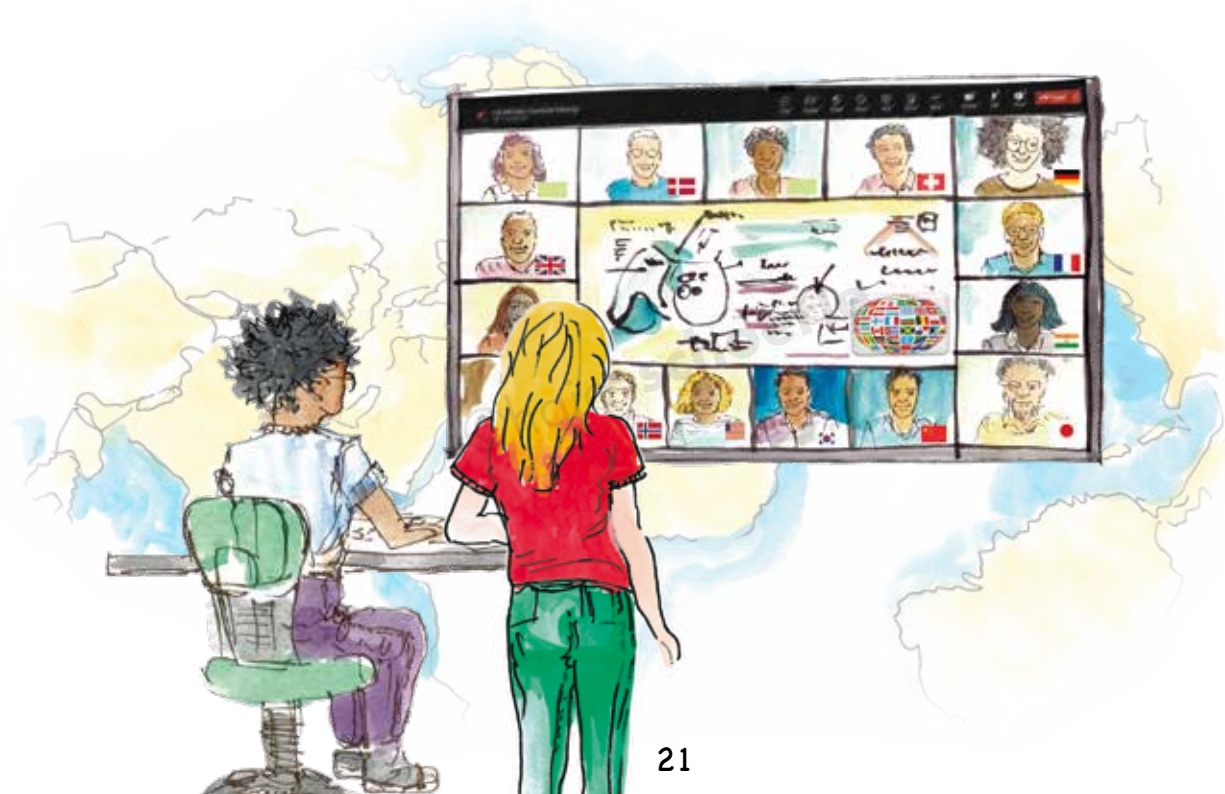
"Look. That was our meeting yesterday. They all bring their knowledge to the table and work together to figure out how something can be made safe and usable for everyone."

Elena is amazed. "Just because of a plug?" Norma laughs.

"Yesterday we spent almost the whole afternoon talking about a tenth of a millimetre."

"Just for that?" Elena asks.

"When millions of people use a plug, that very tenth of a millimetre turns into something huge," adds Norma.



"And how long does that take?" "Sometimes it can take days or weeks." Elena is horrified. "Why so long?" Norma smiles. "Because in the end, everyone gets to build the plug. That's why everyone needs to be confident beforehand that the solution really does work."

A woman on the screen laughs. A man shakes his head. Someone scribbles down a note. Then suddenly everyone nods. Elena grins.

"Ah, now they've agreed!"

"Yes," says Norma. "And that's exactly how yet another part of a standard comes into being."

They walk back together into a room filled with equipment, plugs and cables. Norma points out the various plugs and cables. "That's quite a lot of cables and plugs," Elena remarks. Norma explains:

"And you need to be prepared today for questions that won't come up until tomorrow."

And, seeing the questioning look on Elena's face, she adds: "Today, the car asks, 'Can you supply that much electricity?' In a few years' time, there'll be cars that charge even faster. We need to be prepared for that today."

"Wow," says Elena, "so you're already thinking about tomorrow today."

"Exactly," says Norma, beaming with joy.

"And we've been given the task of checking and measuring everything again in detail."

Elena looks at the cable once more.

"I'm actually glad there are rules now."

Mum looks at Elena with a happy smile and then says to Norma: "Now I've got a whole new perspective on the standards too. Thank you for taking the time to see us at such short notice today."



On the journey home, Elena looks out of the window. Outside, she sees display boards, traffic lights, street lighting, solar panels on rooftops and wind turbines on the horizon. Energy is flowing everywhere.

"Actually, things talk to each other everywhere," says Elena quietly. Mum glances briefly from the steering wheel into the rear-view mirror and says, "And standards help them do that. For freedom and safety." Elena nods thoughtfully. "And for understanding. Standards are like a language that all devices in the world speak. So that, in the end, everything fits together." Mum smiles.

"So, can you talk to plugs now too?"

"Hmm." Elena smiles and leans back.

"I think I can listen to plugs."



Medical technology:
Safe for patients and staff
Standard: IEC 60601-1

Ensures that medical electrical equipment – such as patient monitors – operates safely and that patients and medical staff are protected.

There are even specific rules for computed tomography (CT) scanners, set out in IEC 60601-2-44



Electrical appliances:
Protection against electric shock
Standard: IEC 60335-1

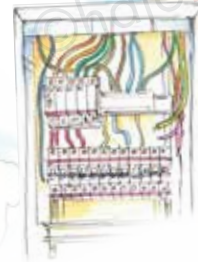
Helps to protect people from dangerous electric shocks, for example through insulation or other protective measures.

And there is a specific standard for electric toothbrushes: IEC 60335-2-52



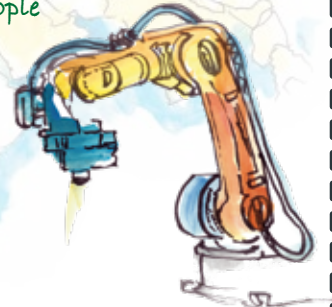
Household technology:
Safe electricity in buildings
Standard: IEC 60364

Helps to ensure that electrical wiring and installations in buildings are planned and installed safely – so that people are protected from electric shocks and hazards such as fires.



Industry and automation:
The 'safety brain' of technology
Standard: IEC 61508

Helps ensure that safety systems detect faults and respond correctly – so that machinery and facilities do not put people at risk.



Now it's your turn: 6 steps to creating your own standard

1. Identify the problem (The trigger)
What isn't working at the moment, or what's causing chaos?
Describe why a shared rule can help.
2. Bring the team together (The committee)
Get everyone who needs to be involved round the table.
No one decides on their own!
3. Write down the draft (The rule recipe)
Work together to write down the initial rules:
How can we do this safely? How will it work for everyone?
4. Try it out and ask for feedback (The objection phase)
Show the draft to the others. Ask: Is anything missing?
Will this work in everyday life?

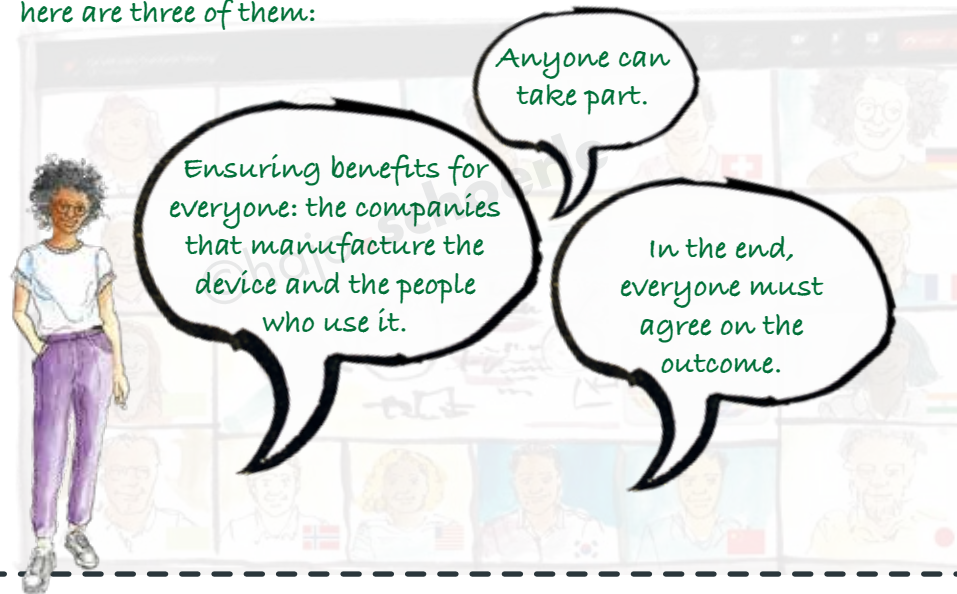
5. Reaching an agreement (Consensus)
Discuss the feedback and keep adjusting the rule until absolutely everyone is in agreement.
6. Finalising the rule (The final standard)
Give the rule a name and write it down. From now on, everyone will know exactly how it works!

Suggested ideas for your own standard (or your own ideas):

1. Interacting with one another: The Fair Football Rule: Ensures that everyone can play, players are chosen fairly and nobody commits a foul.
2. Sustainability idea: The Class Light and Paper Rule: Sets out when the lights go out and how paper is reused.

Standard check: A good standard ensures safety (nobody gets hurt) and freedom (everyone can take part)!

There are a total of ten rules for drawing up standards;
here are three of them:



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