ON4CRD

Volume 72

The NE555: two timers, one project



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Illustrations created with assistance from artificial intelligence.

Two rhythms meet



Lucas returns with the oscilloscope recordings from volume 71. Henri places two NE555 timers on the workbench mat.



The first circuit will set a slow rhythm; the second will generate a faster audio tone.



"Together, they could announce a stage of the workshop," suggests Lucas.



Henri adds one condition: each circuit must first work on its own and be understood.



The project will remain a tabletop device powered by an isolated 5 V supply, with no connection to a transmitter.

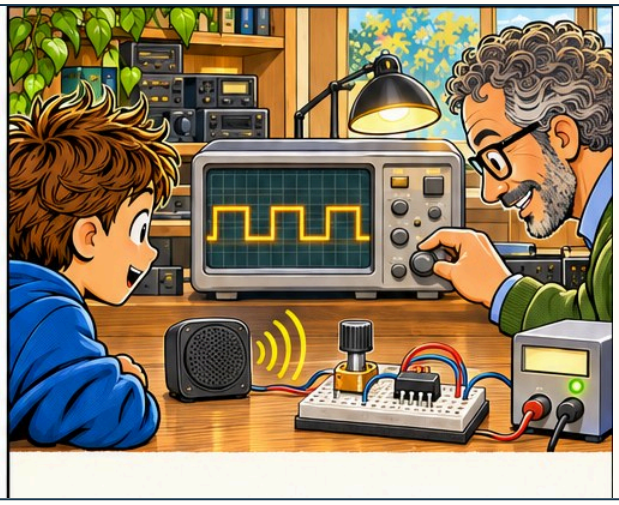


Lucas opens two columns in his notebook: rhythm and tone.

Choose a specific function



They are preparing an intermittent sound signal for a demonstration at the club.



The cadence should be slow and the tone recognizable, with a modest sound level.



The device can also remain silent and show the cadence with an LED.



Lucas distinguishes this workshop signal from a safety alarm or certified equipment.



They write down what the stop command does and what the indicator light shows.

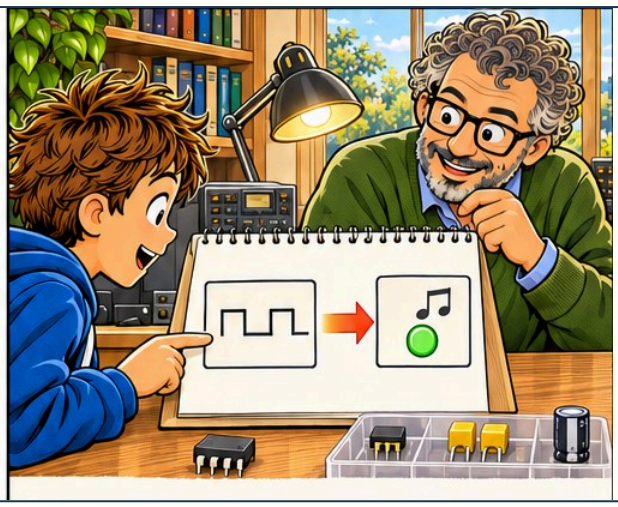


Henri keeps the list short so that each requirement can be verified.

One function per block



Lucas draws a block for cadence and another for tone.



An arrow leads from the slow rhythm to the enable input of the second circuit.



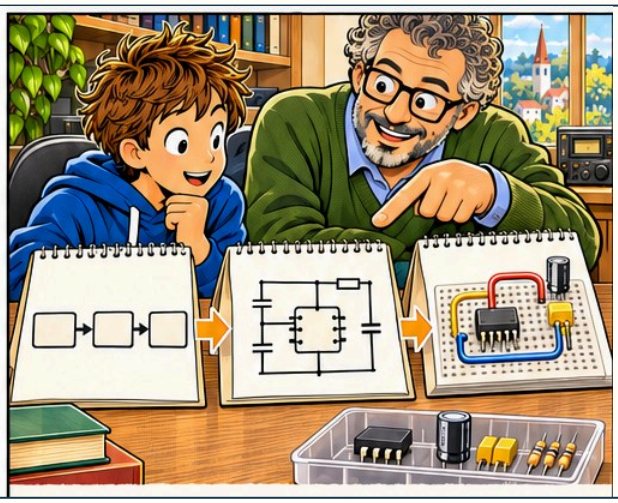
They share a power supply; the current return paths are planned too.



Henri separates control, sound generation and the indicator light.

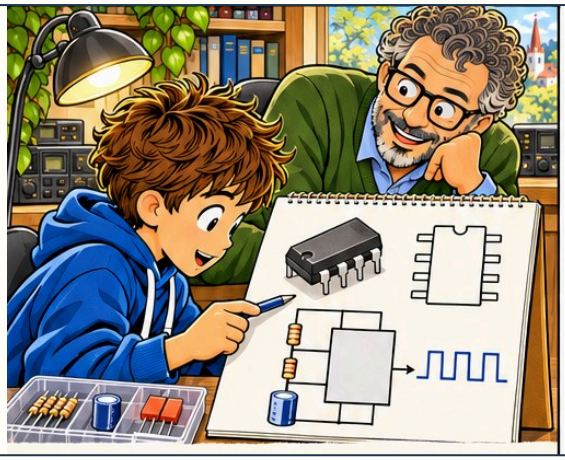


The two outputs will never be directly connected to each other.

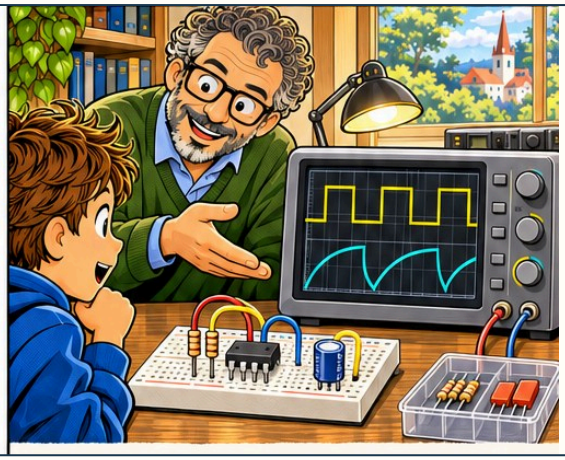


The functional diagram precedes the electrical diagram and wiring.

Building on earlier lessons



Lucas recalls the NE555 thresholds, its pins and the current paths in the standard astable circuit.



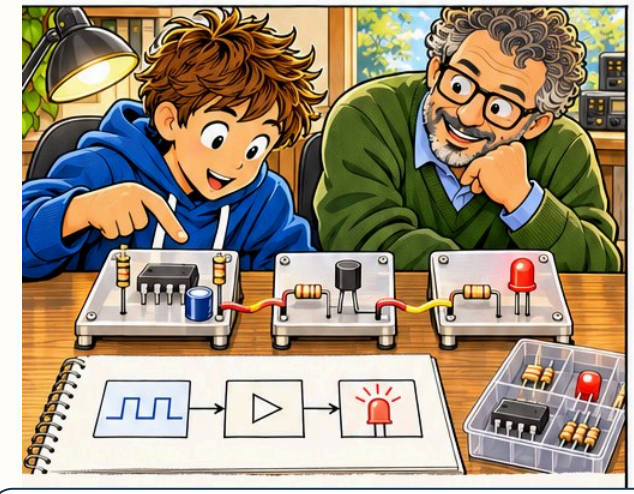
Henri asks him to show the difference between the rectangular output and the capacitor voltage.



The units and approximations of the calculation remain recorded in the notebook.



They keep the instructions and oscilloscope recordings from the two previous volumes as references.

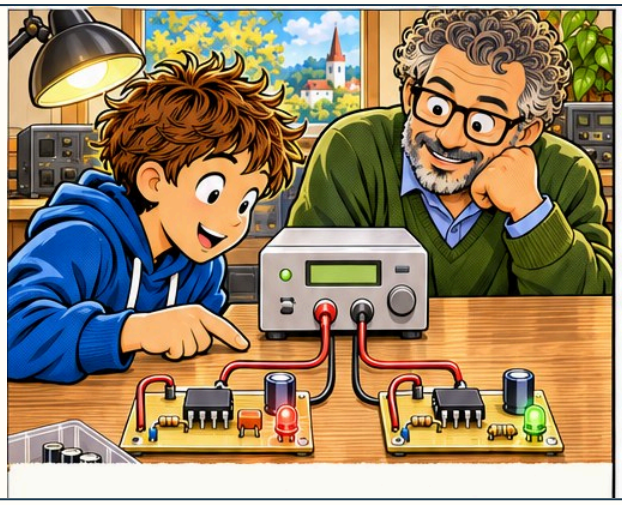


The new project combines familiar functions rather than hiding the details in a box.



Lucas prepares a check sheet for each block.

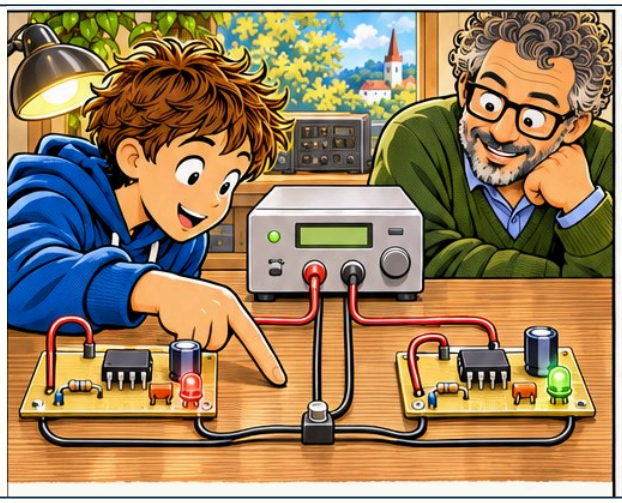
One supply for two timers



An isolated, regulated 5 V supply must power both circuits and their small loads.



Lucas checks the polarity and sets a current limit suitable for the circuit.



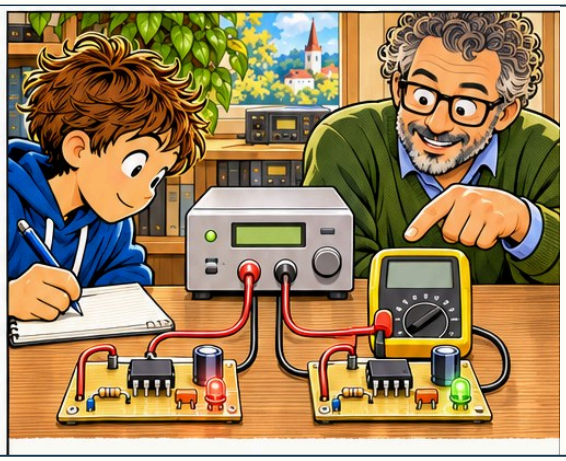
The common ground connects the signal references of the two blocks.



Henri plans short return paths so load currents do not disturb the timing network.



No cable connects to the mains, an antenna or a transmitter PTT input.



They will check the total current consumption before considering another supply.

Local decoupling for each timer



Each NE555 has a 100 nF decoupling capacitor close to its supply pins.



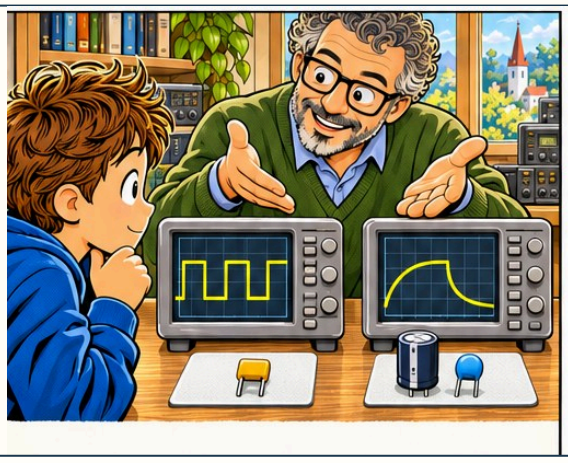
A reservoir capacitor can supplement the shared supply according to the needs of the circuit.



Lucas respects the polarity of components that have one.



The CONT pin of each timer keeps the decoupling shown in its schematic.



Henri distinguishes the supply decoupling capacitors from the capacitors that set the timing.

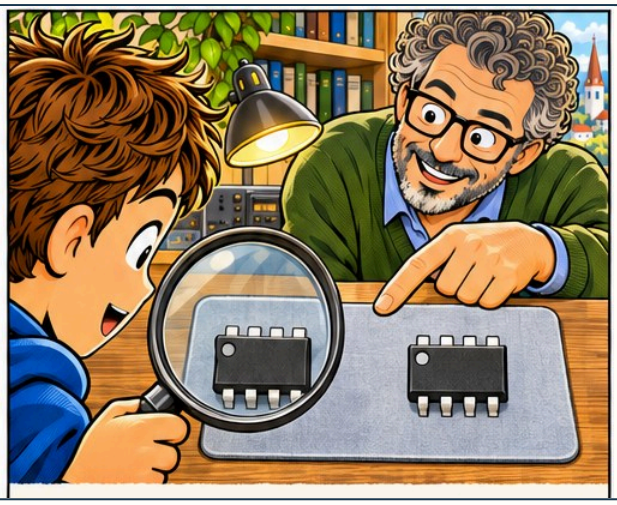


The schematic shows each function before Lucas populates the breadboard.

Two notches, two checks



With the power off, Lucas places the two DIP8 packages across the breadboard centre gap.



He locates pin 1 on each timer using the top view.



Henri has him check the eight connections of each timer separately.



Placing the packages close together does not make their timing networks interchangeable.

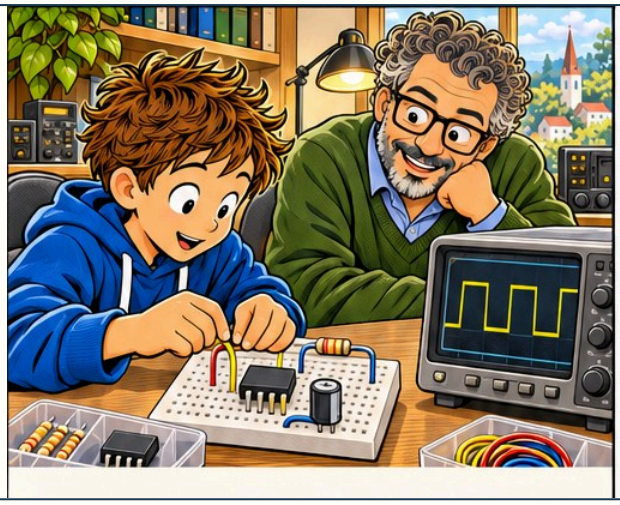


They label the blocks A and B in the notebook to avoid ambiguous descriptions.

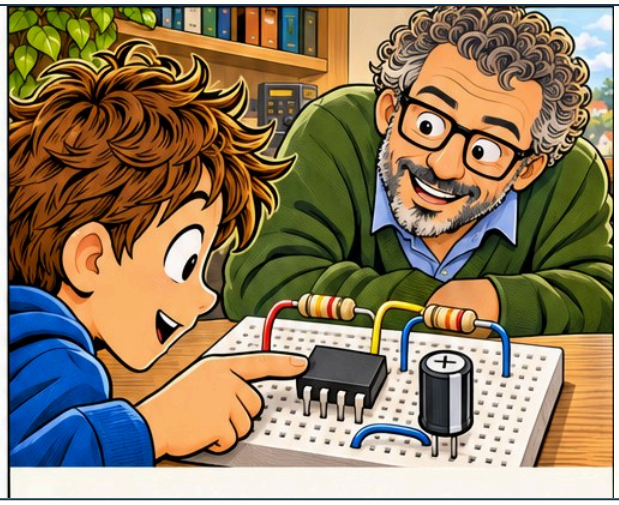


Four pins on each side: the check repeats before any connection.

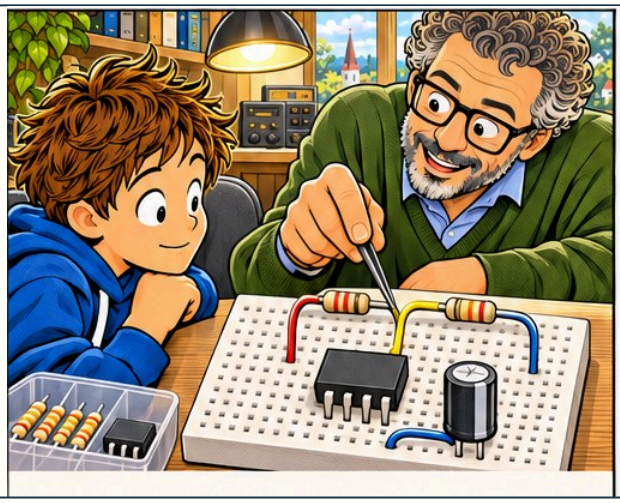
Start with the slow rhythm



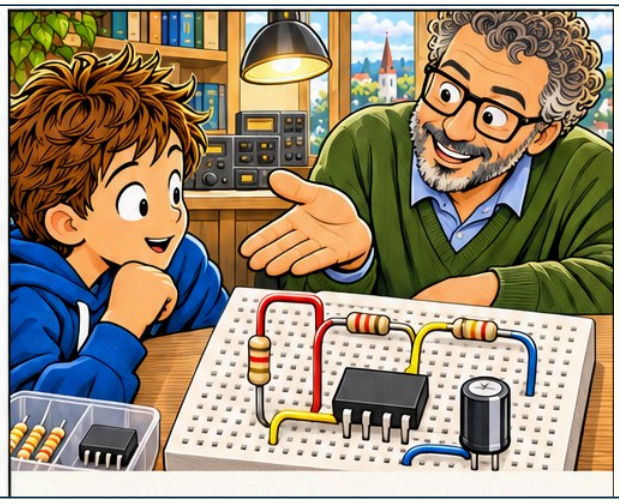
Block A will be a standard astable with RA = 10 kΩ, RB = 68 kΩ and C = 10 µF.



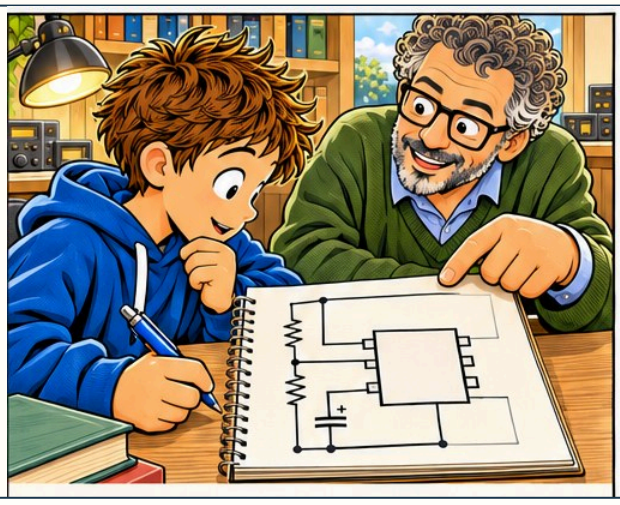
If the capacitor is polarized, its positive lead connects to the node at pins 2 and 6.



Pin 7 joins RA and RB; their other ends follow the standard schematic.



RESET stays at a defined high level to let block A oscillate.



Lucas checks these paths on the diagram before wiring.



Block B is still in its storage box; only one function is on the breadboard.

Predicting the rate



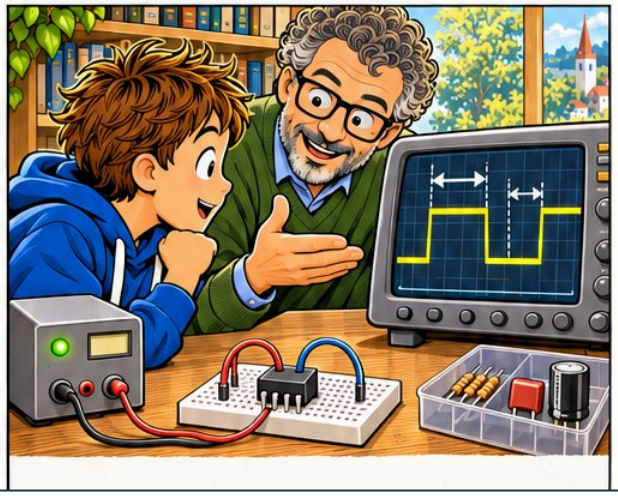
For these nominal values, Lucas calculates a high time of about 0,541 s.



The low time is about 0,471 s, giving a period of about 1,012 s.



The nominal frequency is therefore close to 0,988 Hz.



The duty cycle is approximately 53,4 %; the cadence is not perfectly symmetrical.



Tolerances and capacitor leakage will vary the actual result.

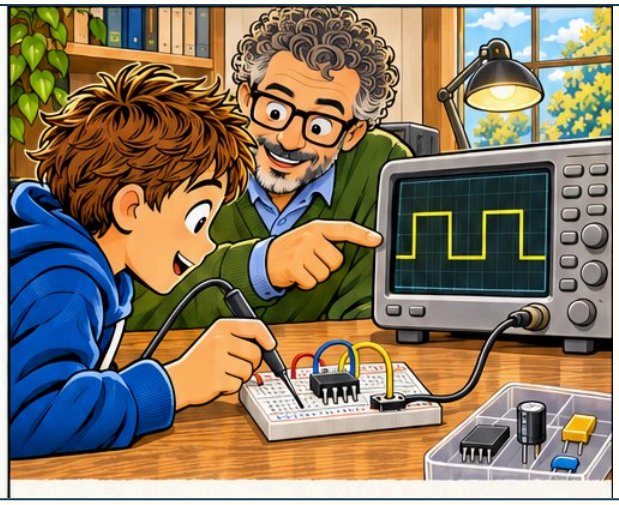


Henri leaves room for measurements, without copying the calculations into this column.

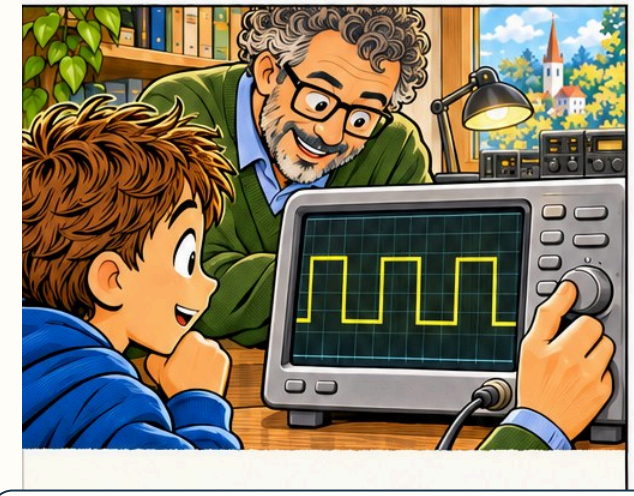
Test block A on its own



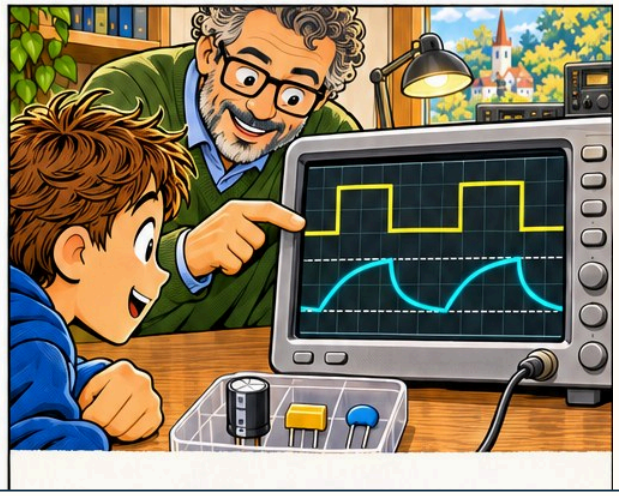
Lucas checks the supply, pin connections and RESET before switching on.



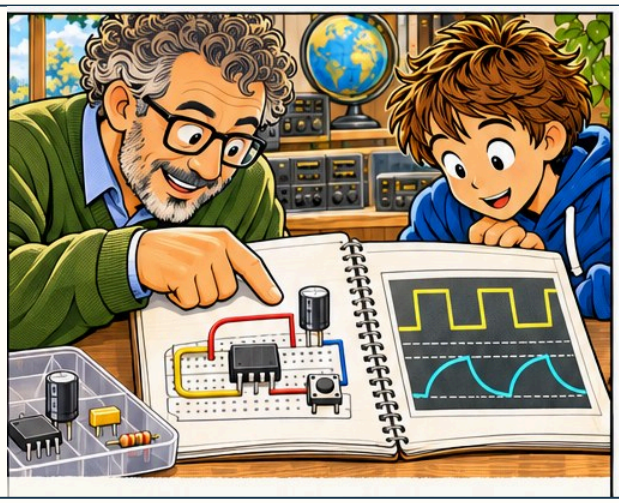
He observes the output of block A with a suitable probe and a short ground lead.



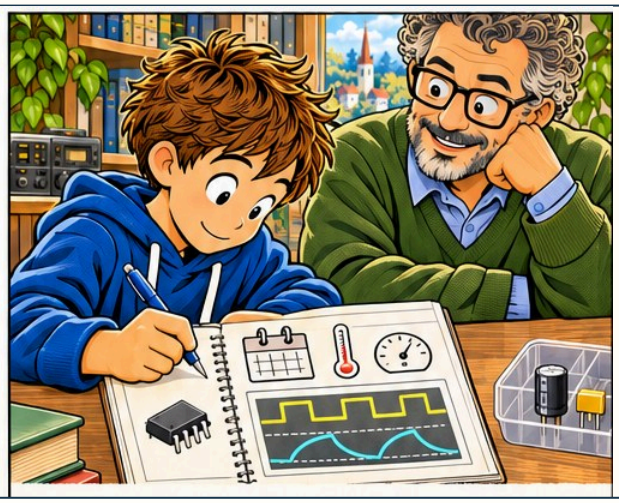
The time base is set to show several slow cycles.



The capacitor voltage rises and falls between the two approximate thresholds.



Henri checks that the traces correspond to the circuit actually wired.



Block A receives its first reading, with the date and measurement conditions.

An indicator for the rhythm



An LED with its series resistor indicates the status of the slow output.



Lucas chooses a modest current compatible with the circuit and the LED.



The indication helps to see the cadence, without replacing the measurement of durations.



Henri points out that brightness does not measure accuracy or frequency.



The series resistor stays in place during every light pulse.

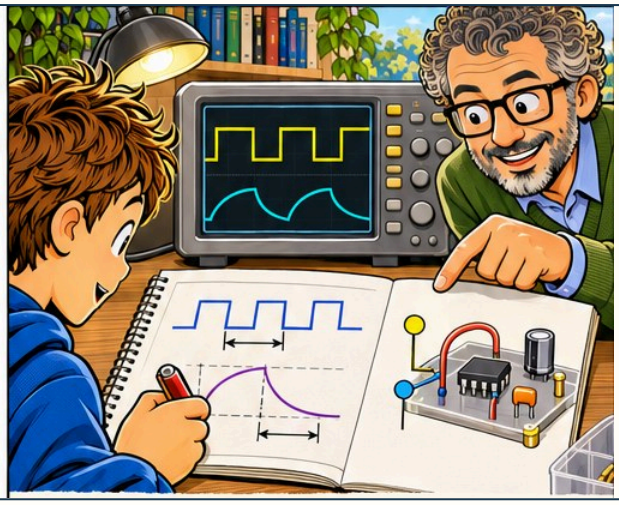


Lucas retains this LED for silent testing of the project.

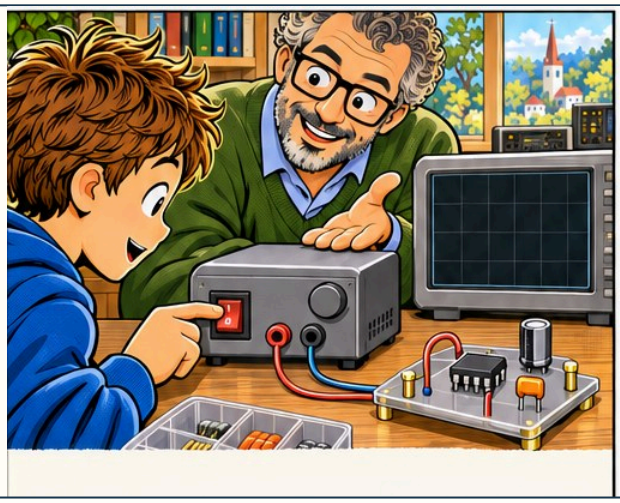
Record what works



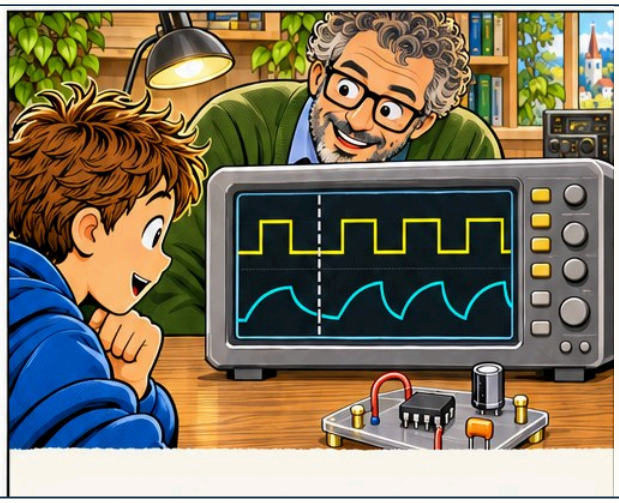
Once block A is checked, Lucas draws its wiring and records the components actually fitted.



He records the observed times and the points where the probes should connect.



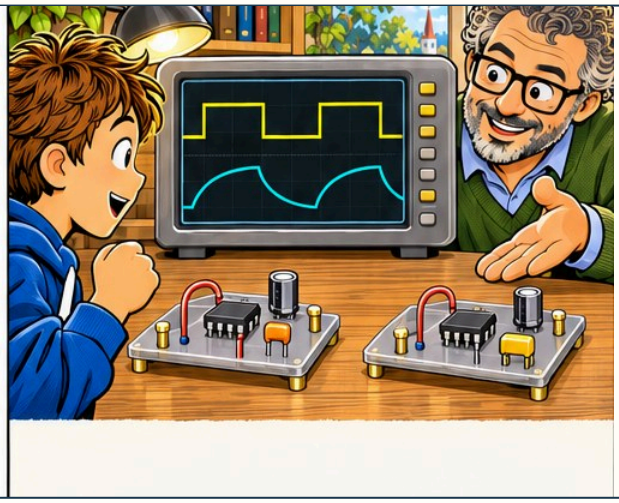
Henri asks him to switch the power off and on again to study startup.



The first cycle may differ from steady-state cycles; it is described separately.

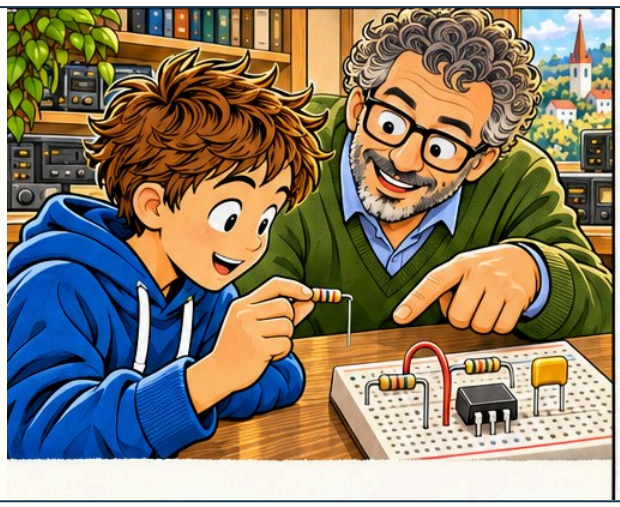


The sheet specifies what was observed and what remains to be characterized.

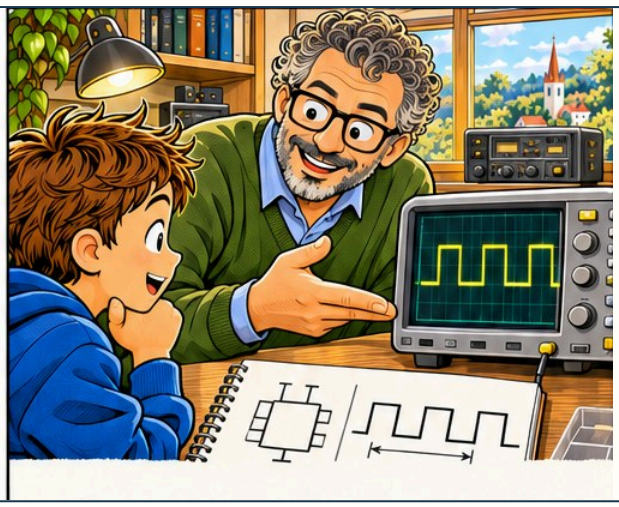


The slow pace becomes a reference that the second block should not mask.

The tone on another breadboard



For block B, they choose RA = 1 kΩ, RB = 10 kΩ and C = 100 nF.



The nominal calculation of the classic astable gives a frequency close to 687 Hz.



Its timing network is separate from that of block A.



RESET is first held high to check block B alone.



Lucas checks the orientation and decoupling of the second NE555.



The slow-rhythm block remains disconnected from the control input during this test.

The tone waveform



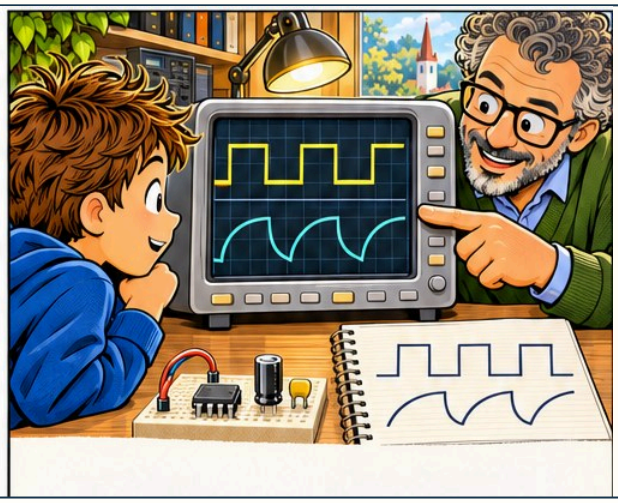
Lucas adapts the time base to the faster output of block B.



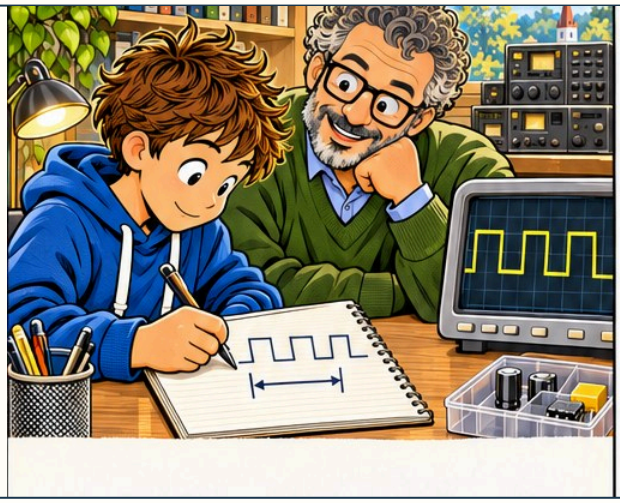
A period close to 1,455 ms is expected with the nominal values chosen.



Henri also asks him to read the high and low levels with the intended load connected.



The output stays rectangular; the capacitor voltage follows rounded curves.



They note the actual frequency rather than promising the value of the calculation.



Block B in turn receives a reference waveform recording.

Choose a suitable transducer



Henri selects a passive piezoelectric transducer suited to the drive circuit and project voltages.



An active buzzer has its own electronics; it does not behave like this passive transducer.



Lucas consults its documentation instead of relying on its round shape.



A low-impedance loudspeaker must not be connected directly in its place.



Their audio stage is designed for a quiet, close-range demonstration.



The transducer part number belongs in the bill of materials.

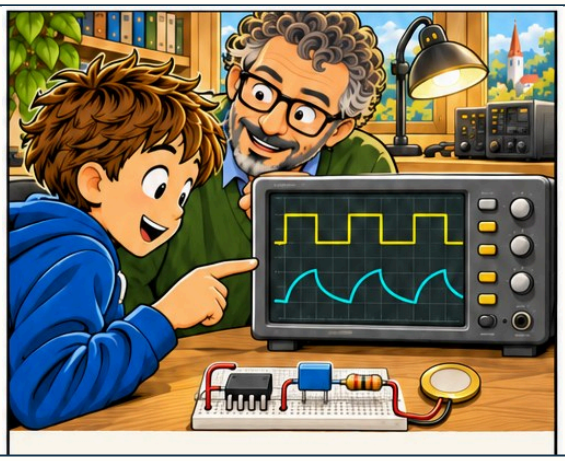
The path to sound



The schematic provides a non-polarized coupling capacitor and a series resistor for the passive transducer.



The values of this stage depend on the model chosen and its capacitive load.



The capacitor blocks the DC component; it does not transform the rectangle into a sinusoid.



Henri checks the applied voltage and load seen by the output of the NE555.



Lucas does not replace this stage with an improvised direct connection.



The notebook keeps the schematic of the stage actually checked with the selected transducer.

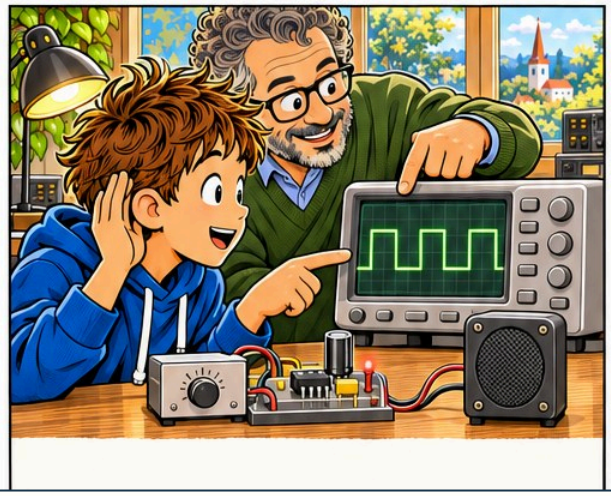
A sound that leaves room to talk



Lucas switches on block B with its intended audio stage and starts at a low sound level.



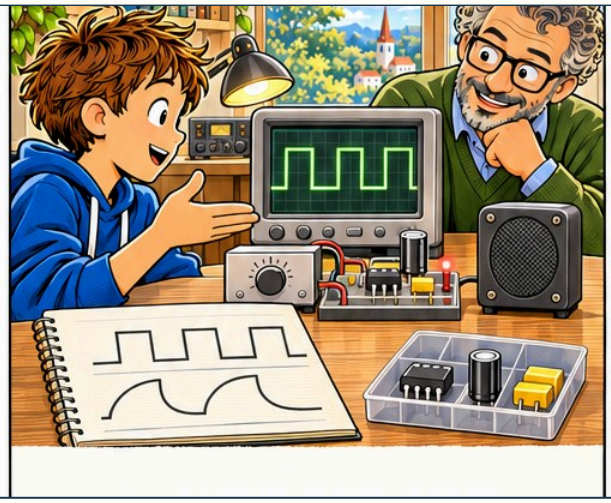
The transducer remains away from the ears and the test lasts only as long as necessary.



Henri makes him compare the presence of sound and that of the electrical signal.



Low sound intensity may come from the transducer, coupling or frequency.



The sound level is not a measure of the quality of the timer.

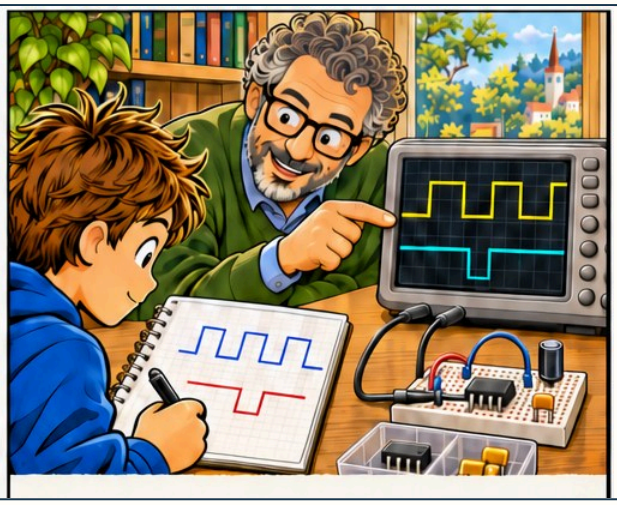


They provide a silent setting so observations can continue without disturbing others.

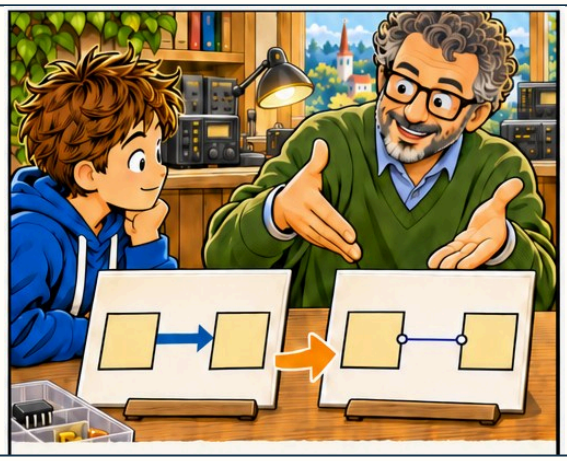
Before linking the breadboards



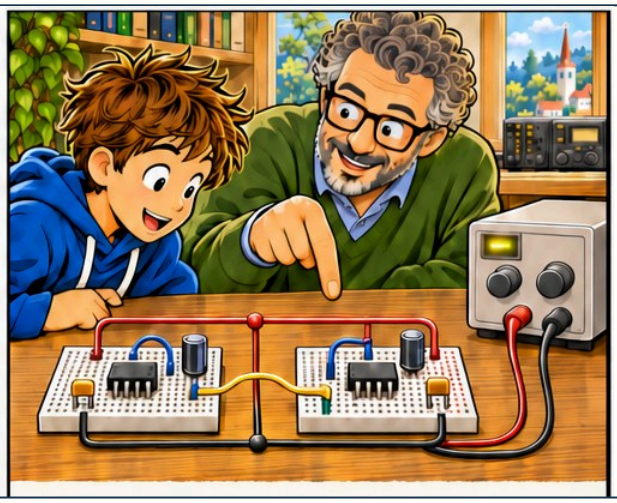
Lucas checks the two worksheets: the slow rhythm works, and so does the tone.



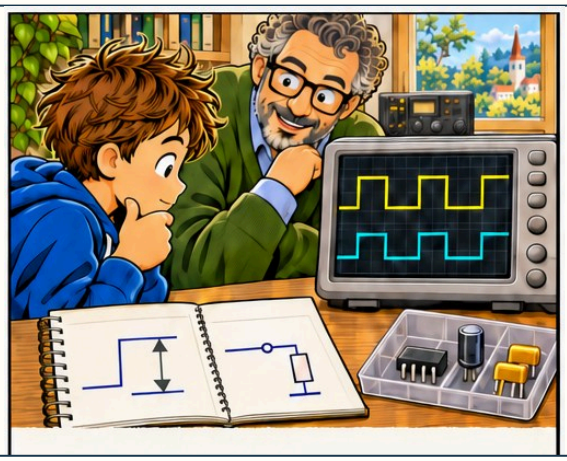
He records the high and low levels of output A and the RESET requirements of block B.



Henri reminds him that a functional arrow must become an electrically compatible connection.



The two blocks share ground and the same isolated power supply.



They wait until the interface levels and loading have been checked before linking the blocks.



Lucas draws this connection on a separate sheet before taking a wire.

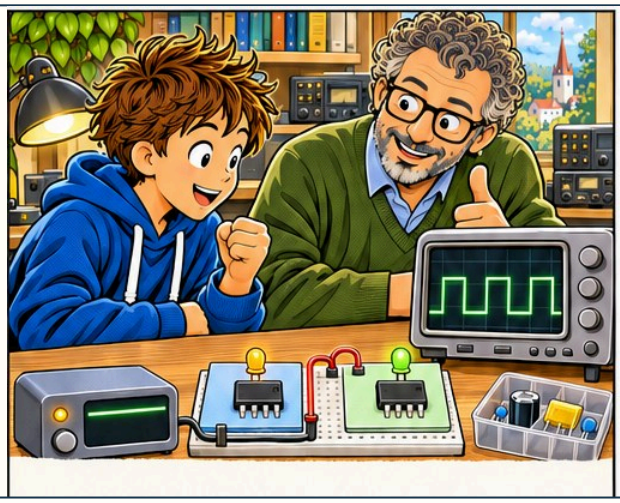
Enable rather than mix



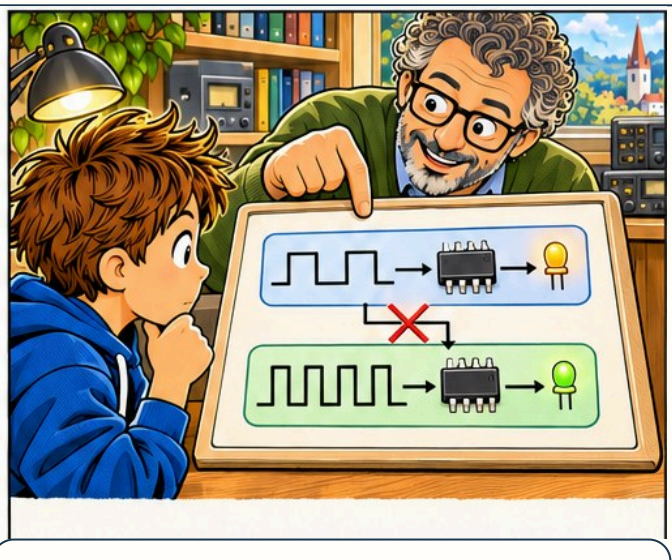
The slow signal will drive RESET on block B to enable or stop its oscillation.



When RESET is held low, the output B remains low and oscillation is interrupted.



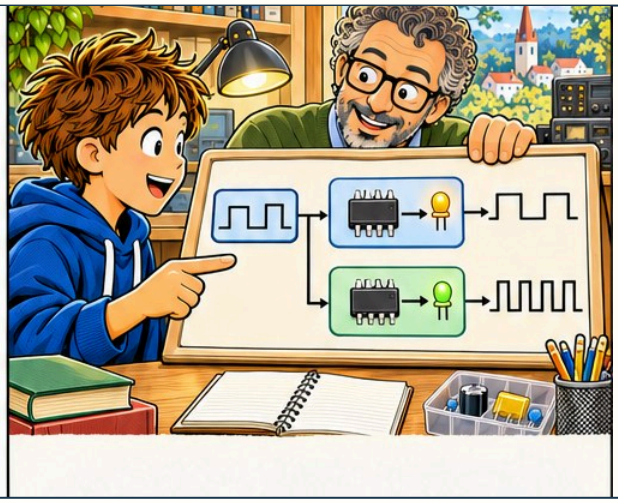
When RESET receives a valid high level, block B can run as its circuit allows.



Output A will not be summed with output B.

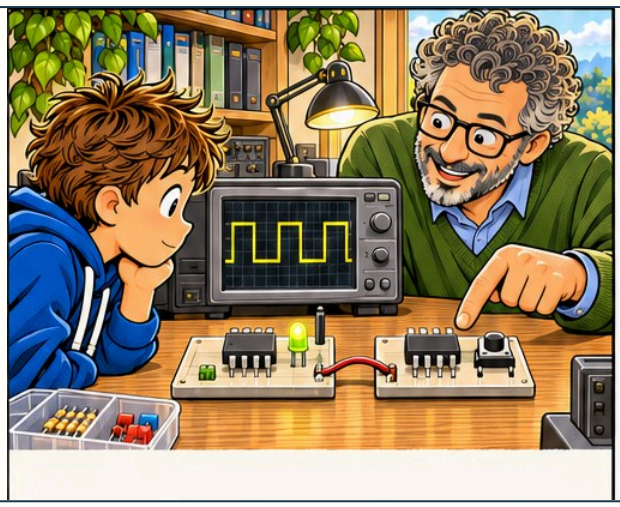


Henri follows the control connection, then its ground return.



Lucas now sees two linked functions, and not a single circuit that has become mysterious.

Check the logic levels



Henri compares the guaranteed limits of output A and the RESET input of block B.



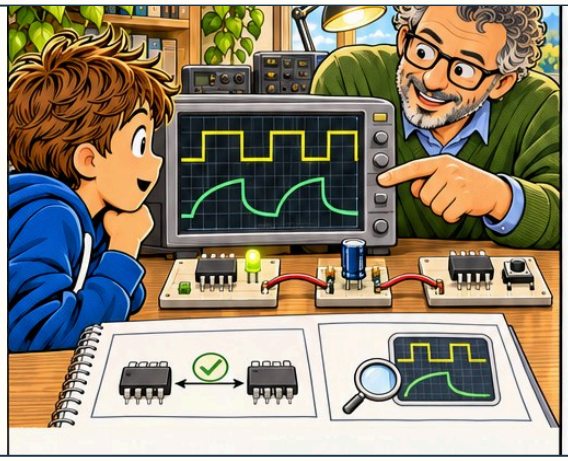
The check includes the load currents and their 5 V supply.



A typical high level does not replace a properly designed electrical margin.



If the levels were incompatible, they would need a suitable interface.



The chosen schematic must justify compatibility; measurements can then confirm the test conditions.



Lucas keeps references to the datasheet tables they used.

Keep the outputs separate



Lucas shows the output pins of the two circuits, then puts away the wire that might connect them.



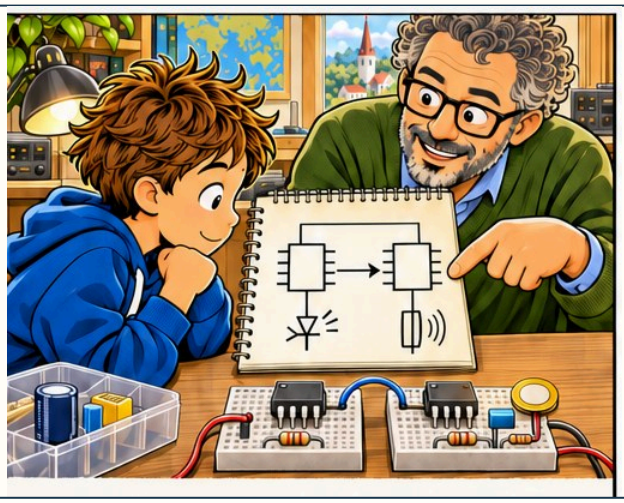
Two active outputs can impose opposite states and create excessive current.



The planned connection goes from output A to a control input of B.



The load currents follow the paths provided by their respective driver stages.



Henri checks that the schematic and breadboard agree.



This verification remains included in the procedure before each modification.

A clear choice of control



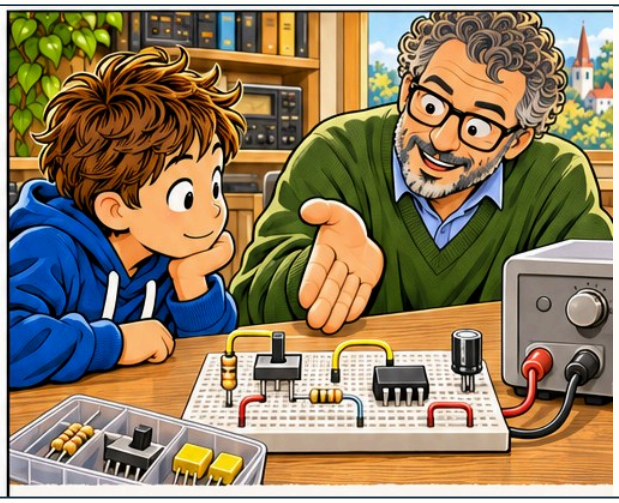
For the standalone test, RESET of B receives the high level specified by the schematic.



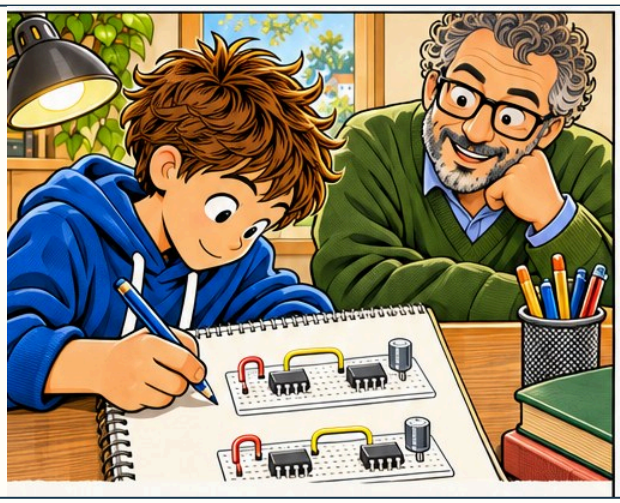
For the combined test, this input receives the control signal from A.



They change configuration with the power off, without connecting output A to the positive rail.



Any selector must avoid floating inputs and short circuits.

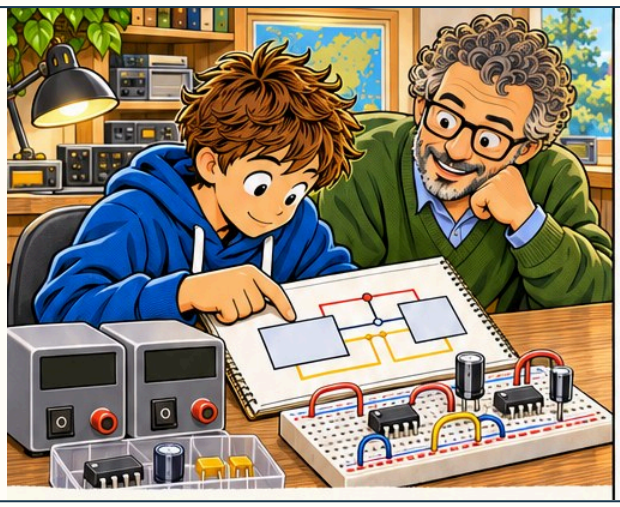


Lucas draws the two permitted configurations separately.



Henri makes him reread the connections before moving on to the next step.

Checks with the power off



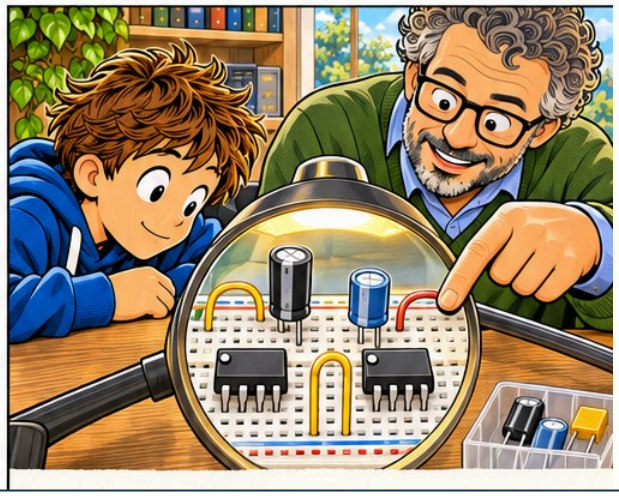
With both supplies off, Lucas follows every connection on the schematic.



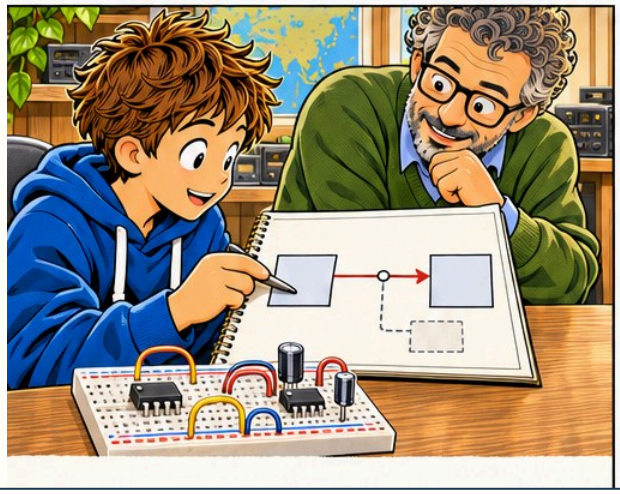
He checks common-ground continuity and makes sure the outputs are not bridged.



They check the breadboard rails, including any breaks in them.



Henri inspects the polarity of the capacitors and the orientation of both packages.



The control path only reaches the intended input of block B.



They complete this check before switching the isolated supply back on.

The first combined test



Lucas powers the combined circuit with the prepared current limit.



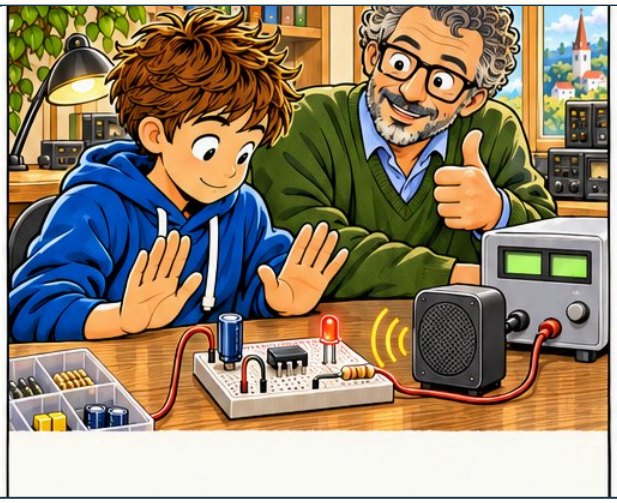
The slow indicator shows the rhythm; sound appears during the enabled intervals.



Henri monitors current consumption and voltages rather than relying on sound alone.



At any unexpected behaviour, they switch off and check the schematic again.

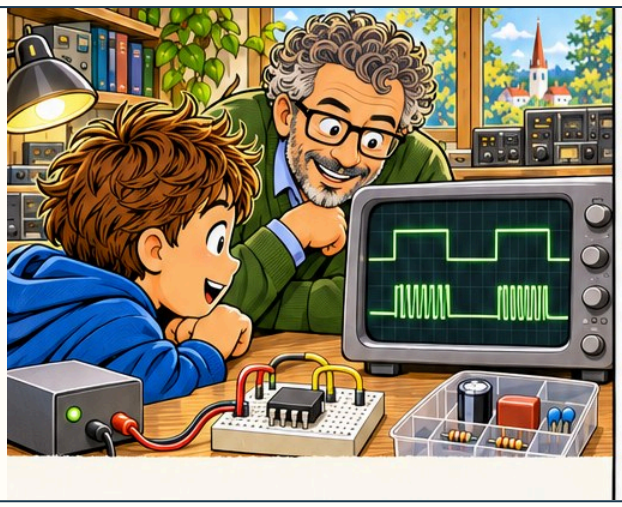


Lucas changes no wires while the circuit is powered.

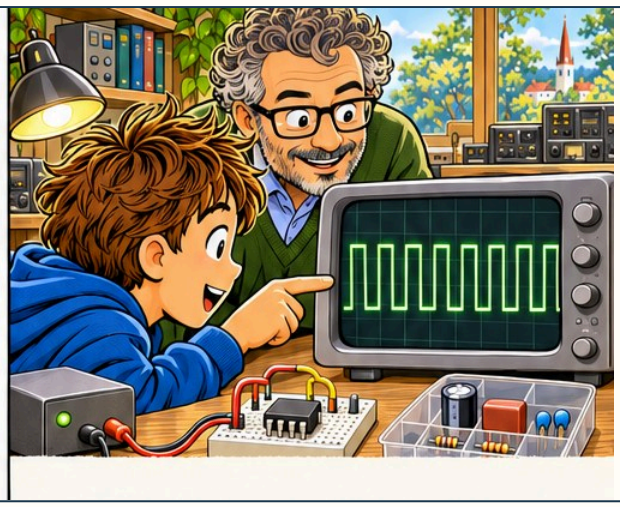


The first attempt becomes a documented observation, not yet a general conclusion.

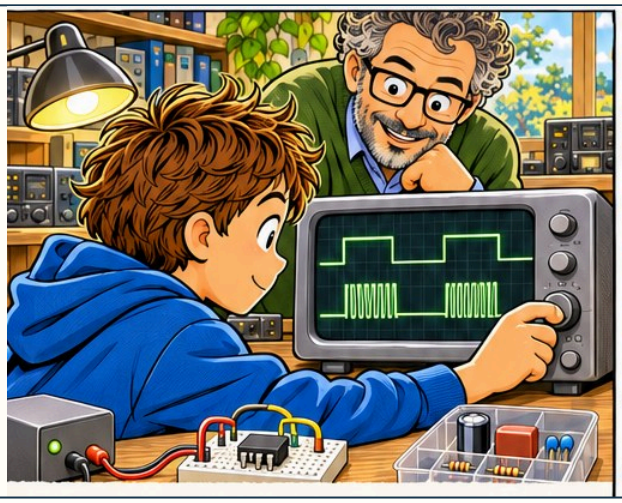
Two time scales, one story



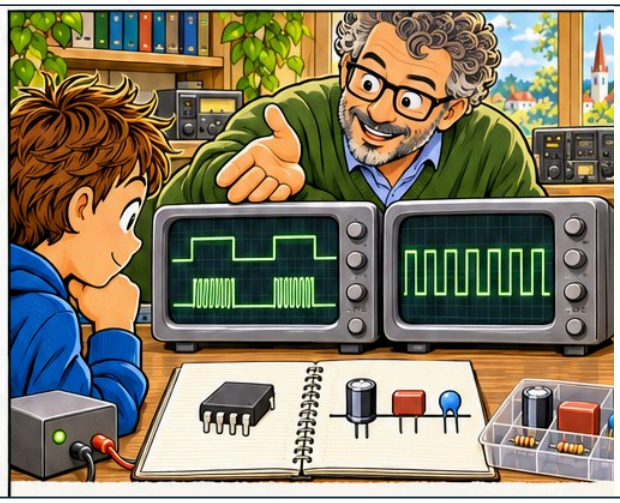
The first recording shows the slow control signal and the tone bursts.



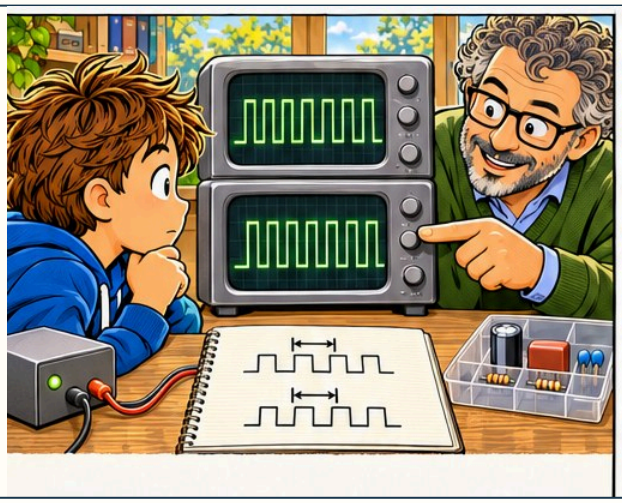
Another recording zooms into a burst to reveal the fast cycles.



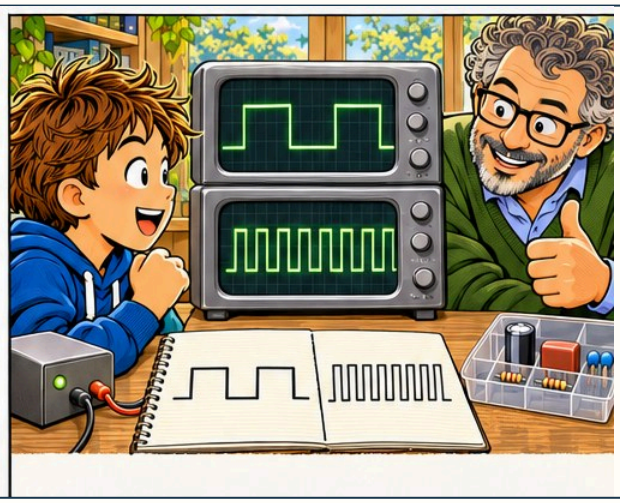
Lucas adapts the time base to the question asked.



Henri asks him to identify the same electrical connection in both views.



The slow signal does not magically change the natural frequency of block B.



The recordings distinguish the burst rate from the audio tone within each burst.

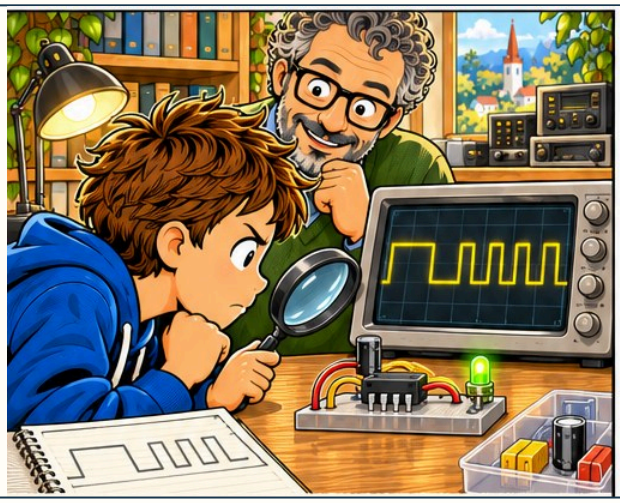
The start of a burst



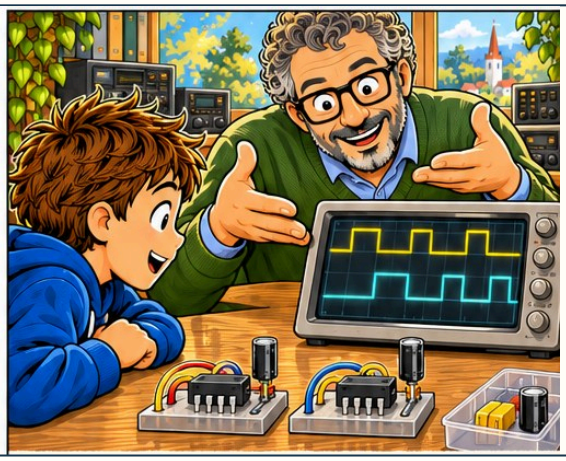
Each time it is enabled, block B restarts according to the state of its timing network.



The first pulse in a burst may differ from steady-state pulses.



Lucas observes it without confusing it with a random failure.



The phases of the two oscillators are not guaranteed to behave like a synchronized clock.

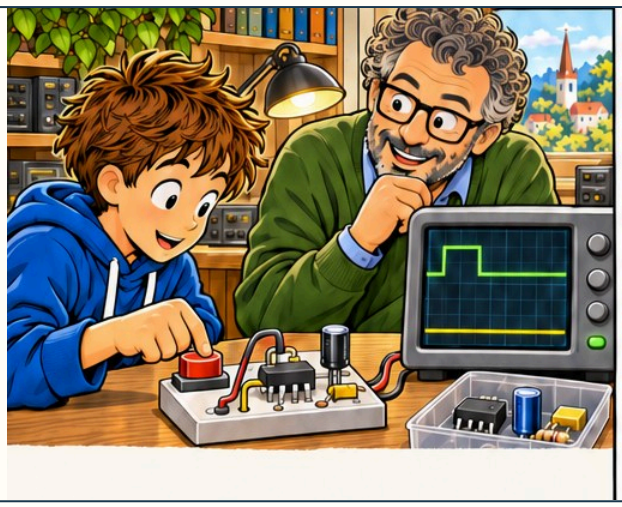


Henri describes this behavior in their demonstration instructions.



A need for strict synchronization would require additional design.

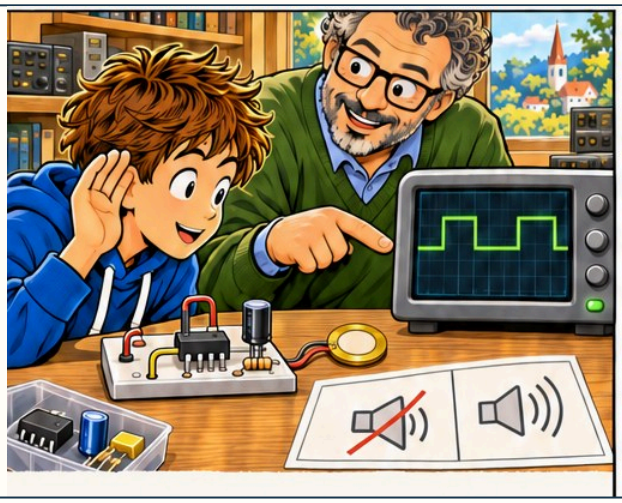
Silence contains information



While disabled, output B stays low under the conditions of their circuit.



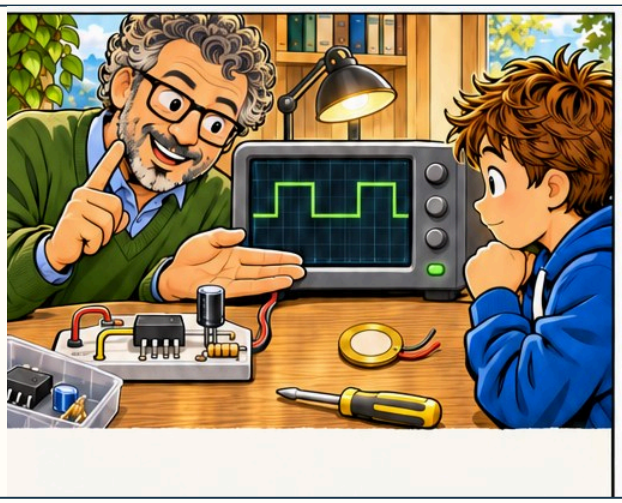
Capacitor discharge and the RESET command are part of this state.



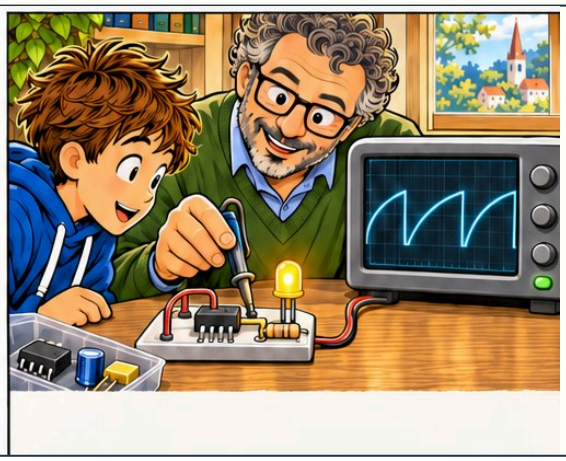
Lucas distinguishes controlled silence from a failure of the audio stage.



The RESET trace shows whether the audio tone should be enabled.

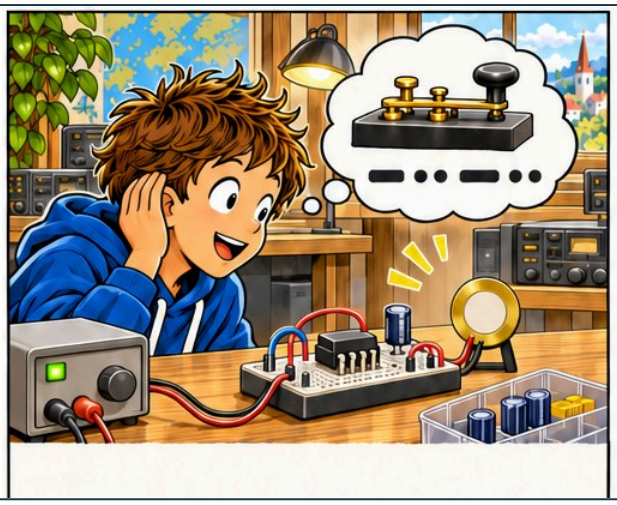


Henri asks him to check the control signal before replacing the transducer.



The slow light becomes a useful clue, accompanied by a measurement at the right point.

A rhythm is not a message



Lucas hears the regular bursts and immediately thinks of Morse code.



Henri distinguishes a sound repetition from a coded message with defined durations and spaces.



The circuit does not generate a callsign simply because it makes short sounds.



Their project remains a local workshop signal, with no radio transmission.



A real Morse exercise would need suitable control and message content.



Lucas keeps the trainer of volume 70 for this other use.

Adjust the rate



With the power off, they prepare a different value in timing network A.



Lucas predicts the effect on the slow period before switching on again.



The tone of B must be checked to verify that it remains close to its reference.



Decoupling and common source can influence actual conditions.

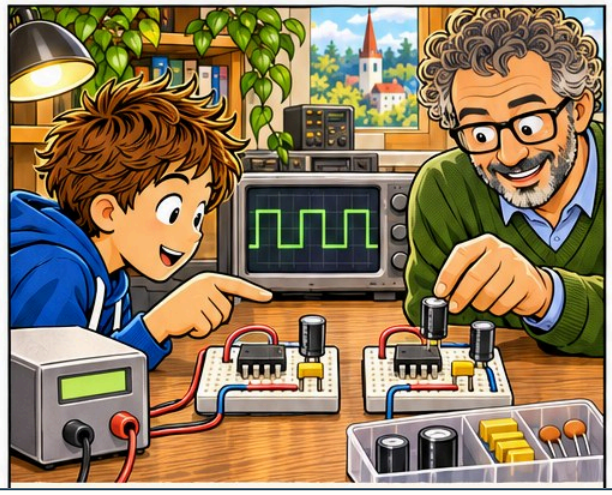


Henri keeps only one modification per test.



The table separates the slow frequency, the enabled interval and the audio frequency.

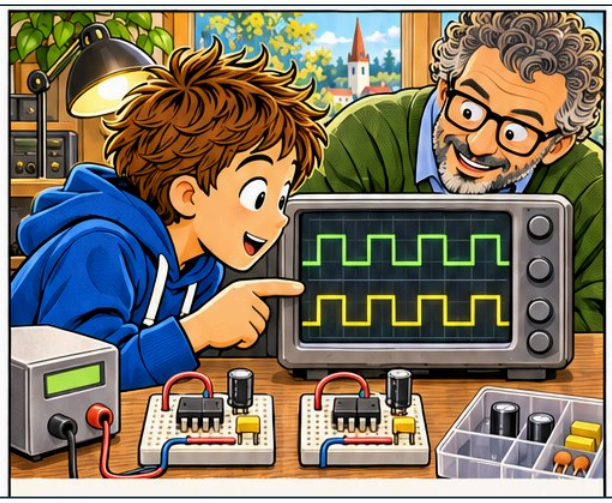
Adjust the tone



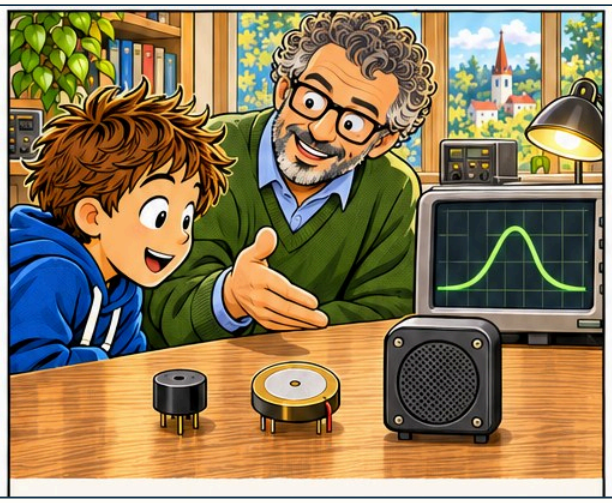
They return to the reference rhythm, then modify only timing network B.



Lucas predicts a different tone without confusing pitch with sound level.



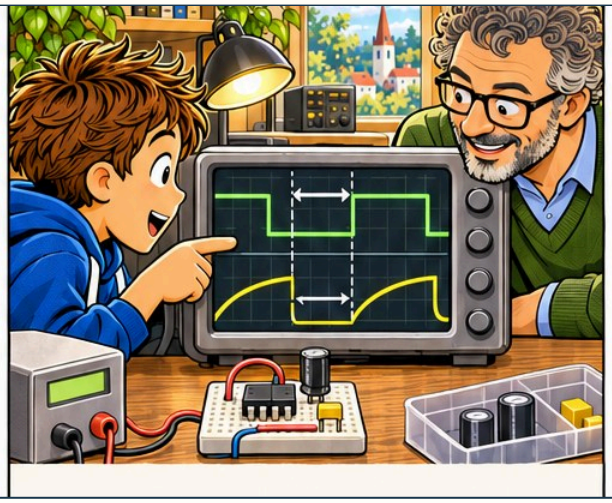
The burst rate should stay close to the reference rate of block A.



The transducer may sound louder or quieter depending on its frequency response.



Henri keeps settings within the range intended by the components.

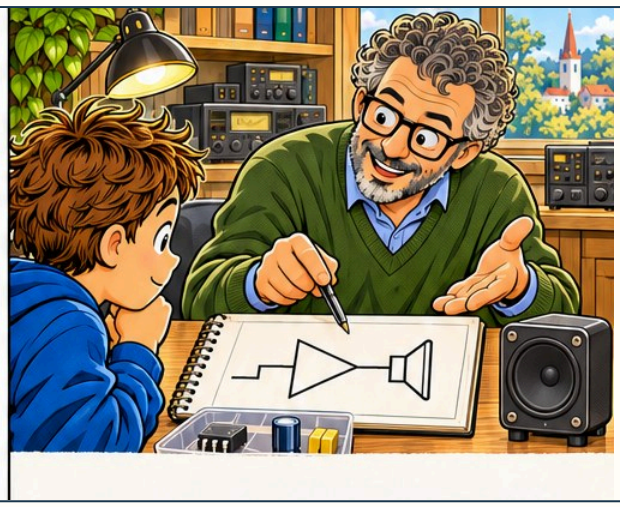


The enlarged waveform recording allows you to identify what has really changed.

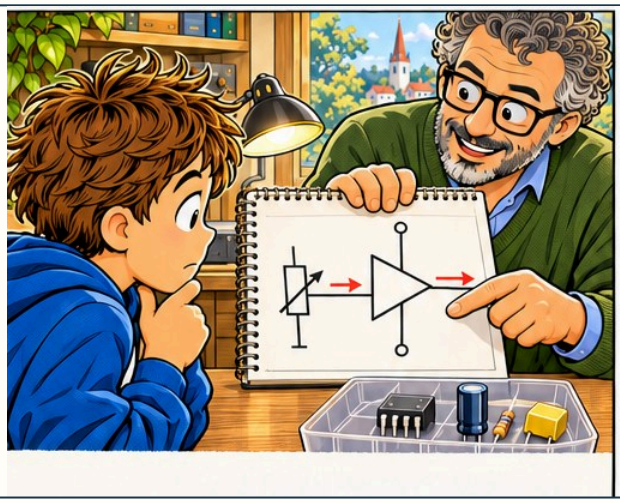
Sound level needs its own stage



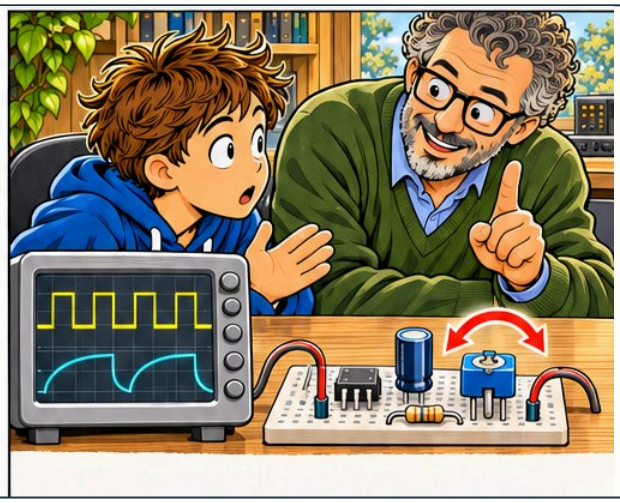
Lucas wants to change the sound level without changing the rhythm or pitch.



Henri returns to the audio stage and the load specified by its schematic.



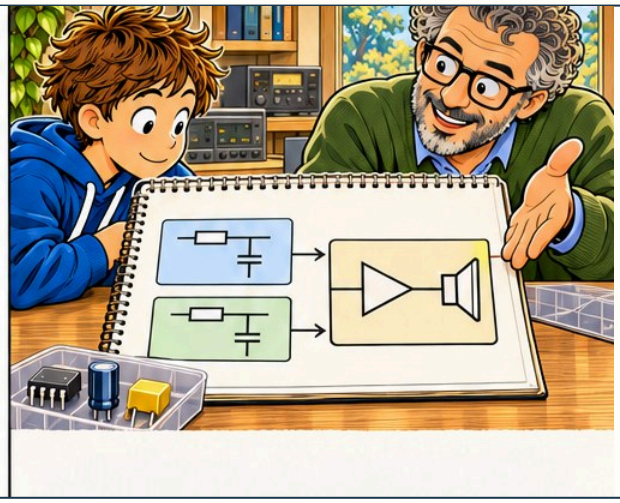
A level control must respect the currents and voltages of this stage.



Adjusting a timing-network resistor is not a general way to control volume.

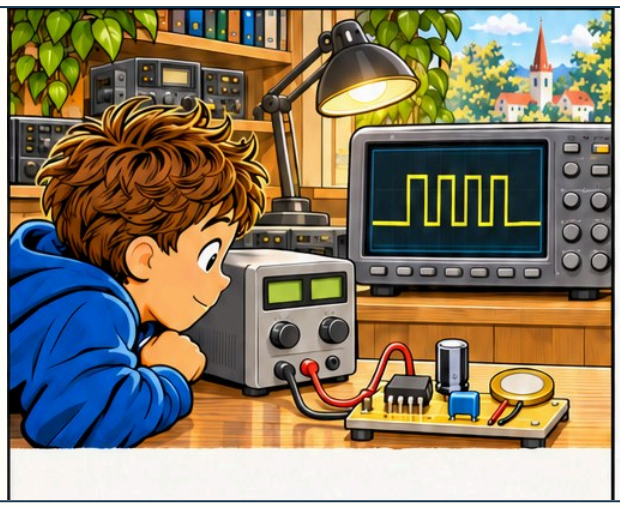


They plan a suitable solution for the selected transducer, including a silent setting.

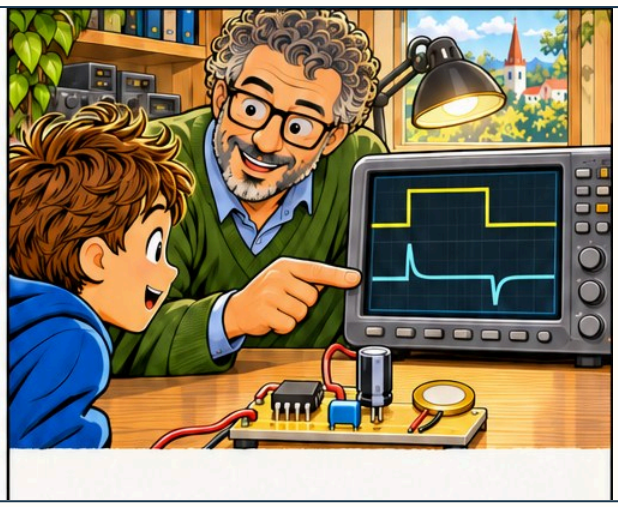


The audio interface diagram remains distinct from the two timing networks.

Current during transitions



Lucas observes the supply near each timer during the sound bursts.



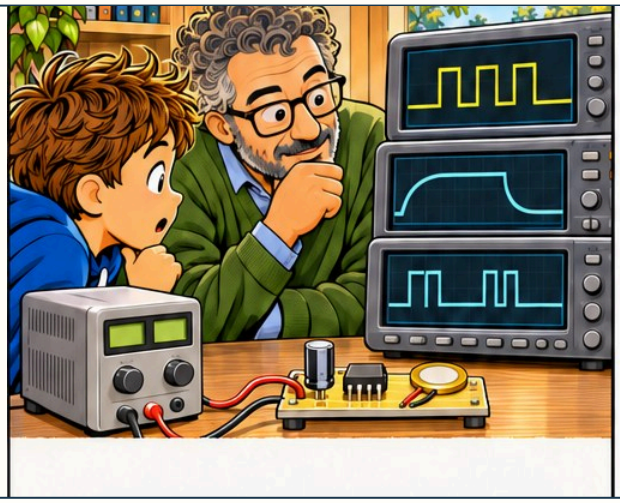
State transitions can cause current spikes and disturbances.



Henri checks that the decoupling capacitors are present and correctly placed.



Short return paths keep load current from crossing sensitive areas unnecessarily.

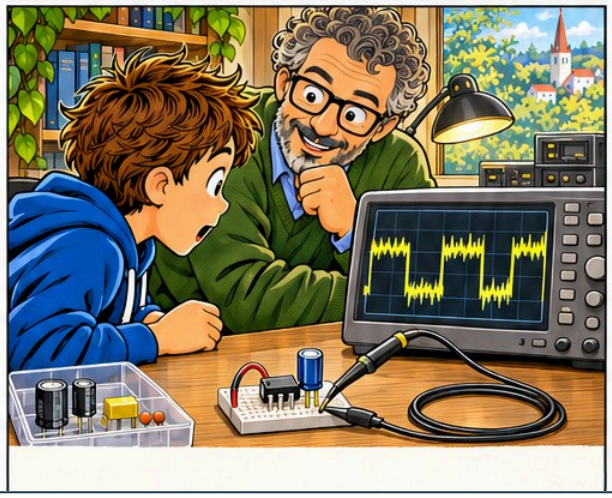


An inadequate supply can change several observations at once.



Lucas records the voltages and current consumption with the test conditions.

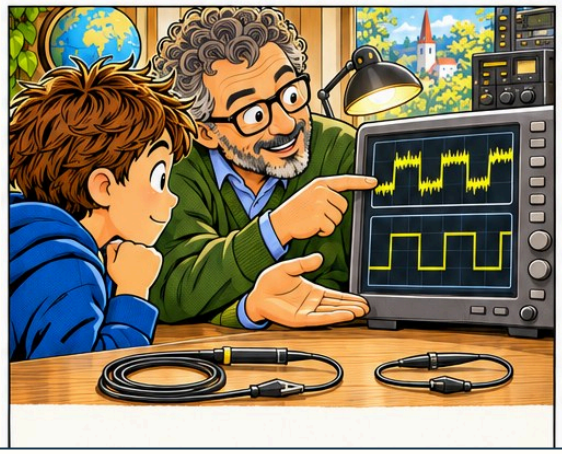
A longer wire changes the picture



A longer ground lead makes more noise appear in a recording.



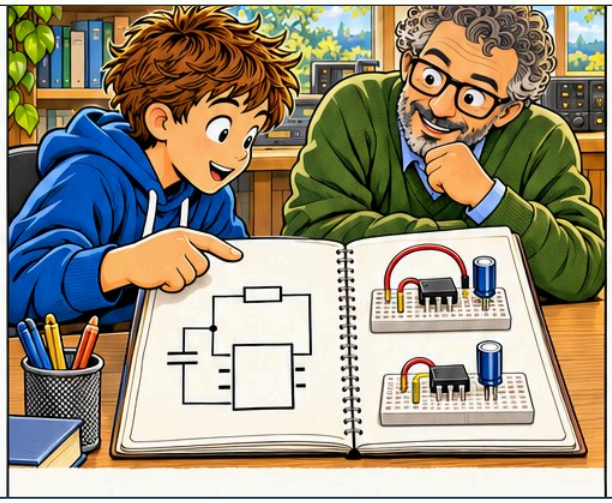
Lucas returns to the short connection before deciding the circuit is faulty.



Henri distinguishes between real disturbances and those that the measurement method may introduce.



They keep large loops away from timing capacitors.



The diagram explains the connections; the layout also influences the result.



The notebook keeps a photograph of the measurement conditions.

Stop the demonstration properly



The stop control must leave the device in a clear state for the visitor.



Lucas checks what it disconnects and what remains powered.



Turning off the sound does not necessarily mean cutting off all power.



The instructions distinguish stopping the demonstration from disconnecting power before work.



Henri provides easy access to the isolated supply switch.



Components must not be changed while the breadboard is powered.

Measure the restart



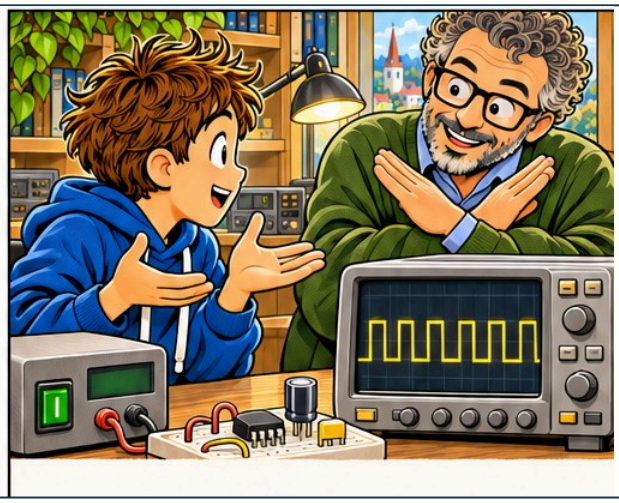
They disconnect the supply and wait for the expected discharge before trying again.



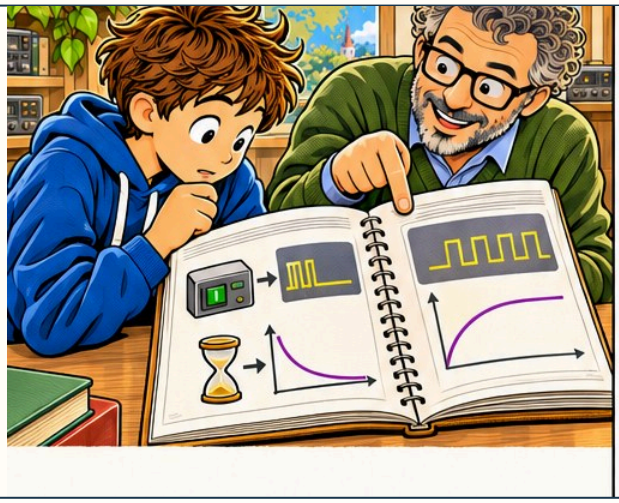
Lucas observes the first burst on restart, separately from the steady rhythm.



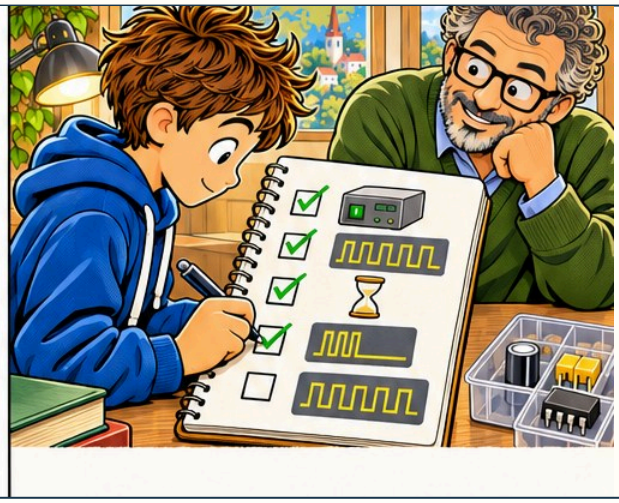
A specified initial state would require a properly designed reset circuit.



Henri refuses to promise a specific phase because one test seemed regular.



The instructions state the startup conditions and their limits.



Lucas adds this test to the complete procedure.

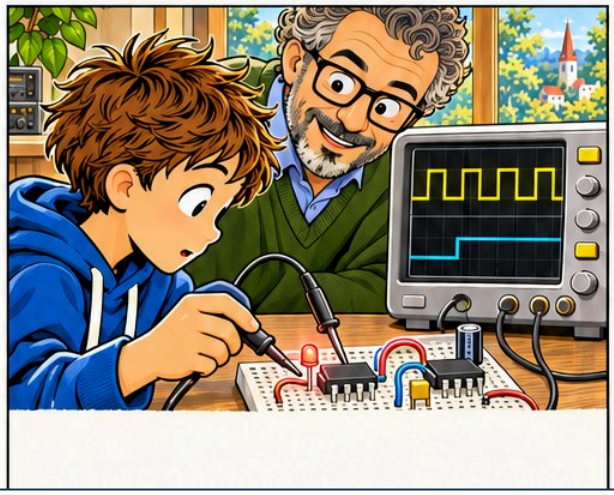
A fault that leaves it silent



With the power off, Henri prepares a troubleshooting exercise with one control-connection error.



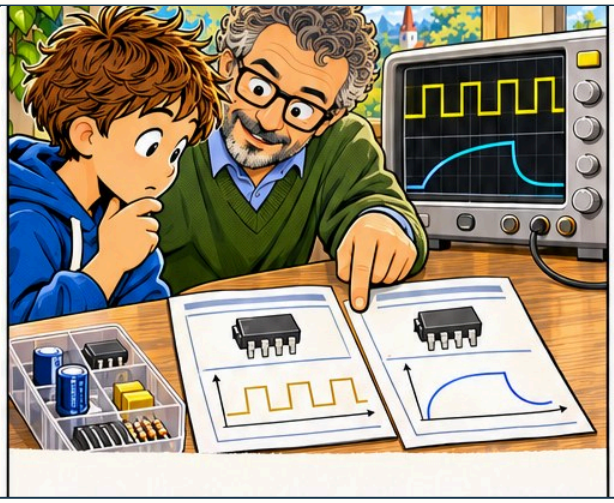
Block A flashes, but there is no sound.



Lucas checks the supply of B, then the RESET level, before the audio stage.



An input held low can explain the silence even if block B is intact.



He compares the measurements with the two standalone operating worksheets.

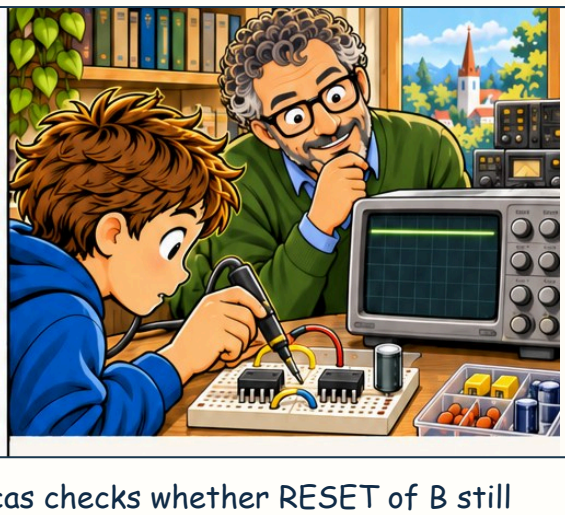


The search follows the functions instead of replacing both circuits at once.

A fault that leaves the tone on



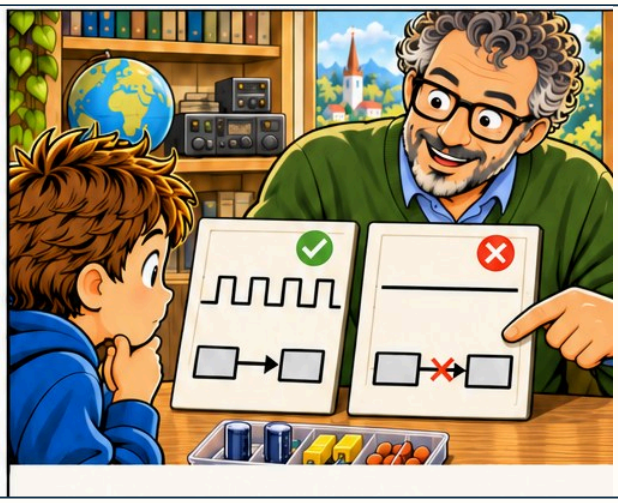
This time, the tone exists without the expected interruptions.



Lucas checks whether RESET of B still receives a changing control signal or stays high.



He follows the signal from output A to the intended input.



Henri asks him to distinguish a rhythm-generator fault from a bad interconnection.

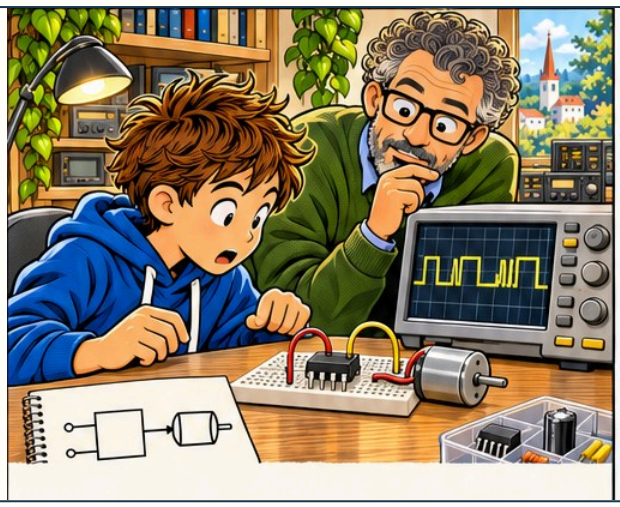


The indicator light and the oscilloscope provide additional clues.



The faulty connection is corrected with the power off before a new test.

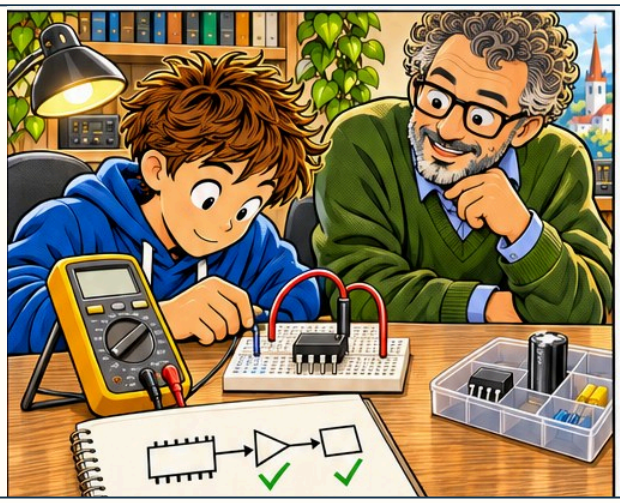
A fault caused by the load



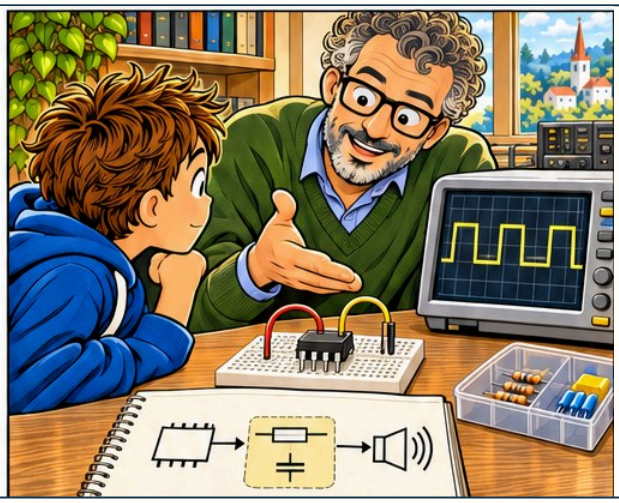
A test becomes unstable when an unsuitable load is considered in the schematic.



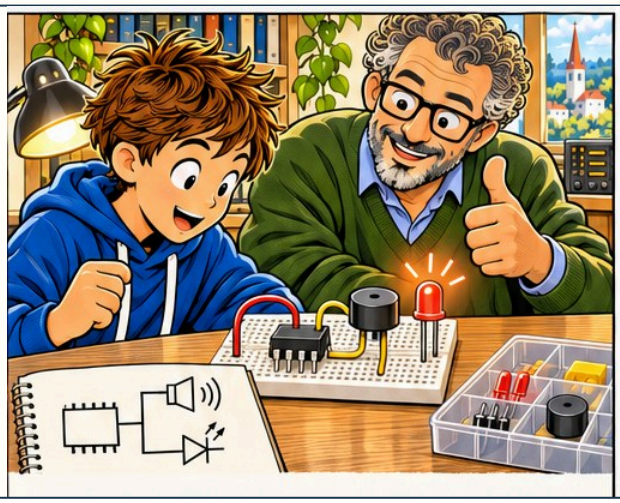
Henri switches off and rejects the unverified connection before continuing.



Lucas checks the requested current and output stage compatibility.



Having an output does not remove the need to design its interface.



Their small transducer and LED remain the only loads intended for this circuit.

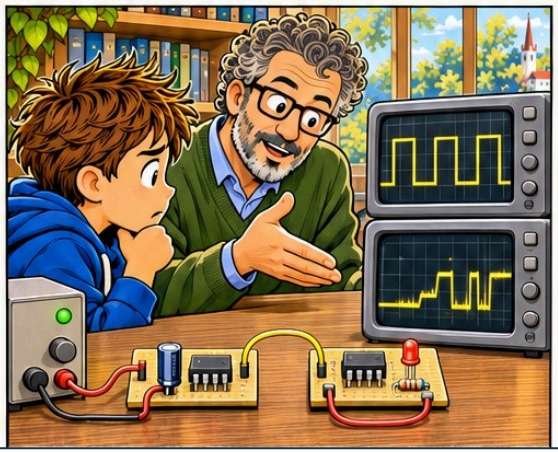


Motors, relays and external devices would require further study.

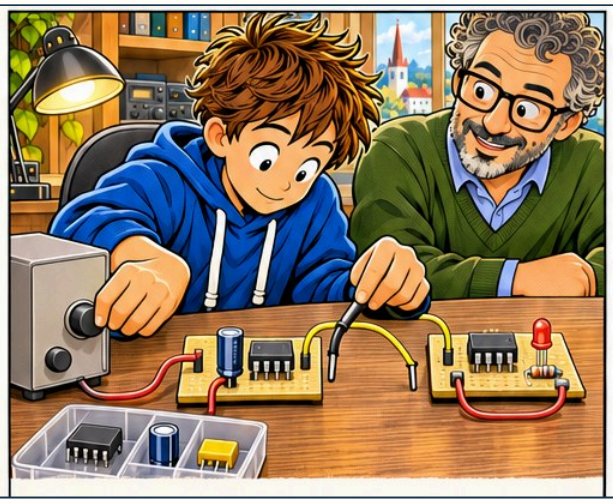
A forgotten connection



Lucas finds a ground connection missing in the exercise prepared by Henri.



Without a correct common reference, control between the blocks is no longer defined as intended.



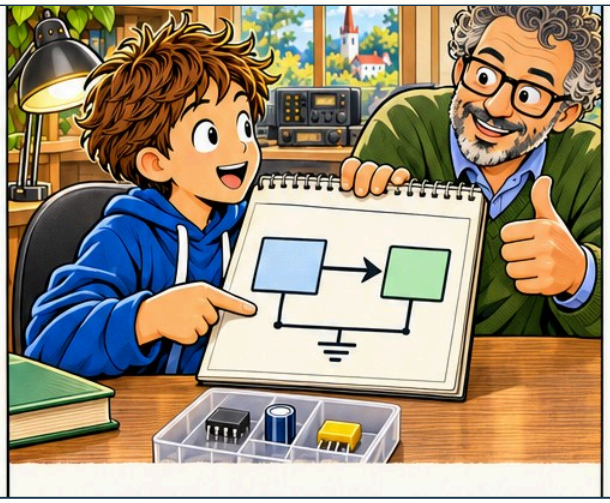
They switch the circuit off again before restoring the missing connection.



Continuity must be checked; the colour of a wire does not prove it.



The ground return becomes part of the systematic checking procedure.



Lucas understands that the block diagram arrow needed this path too.

Keep the unsuccessful tests



The notebook now contains working waveform recordings and troubleshooting exercises.



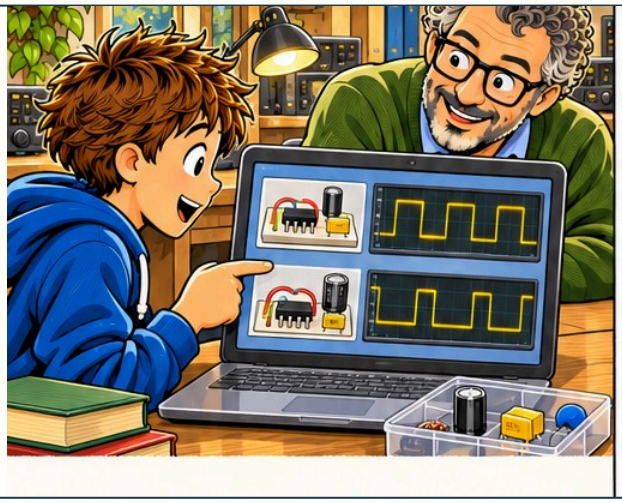
Lucas describes the identified cause, correction and check after switching on again.



An abandoned hypothesis remains distinguished from an established result.



Henri asks him to keep the conditions that made a test misleading.



The next person will then be able to recognize the same symptoms.

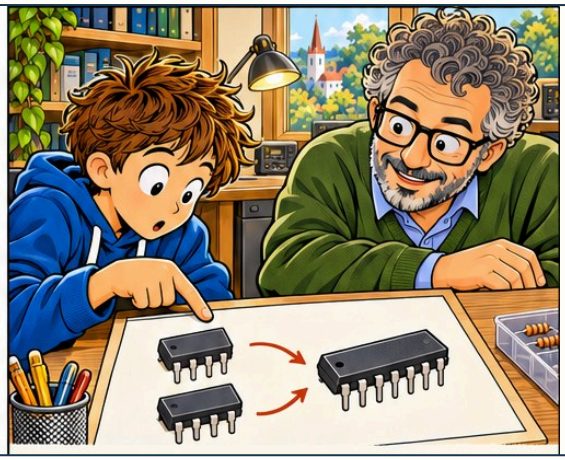


Troubleshooting becomes a transferable part of the project.

Two timers in one package?



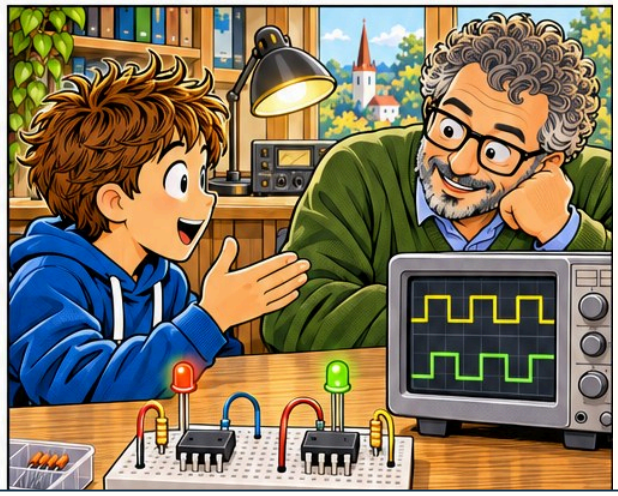
Henri introduces the NE556 family, which combines two timers in a different package.



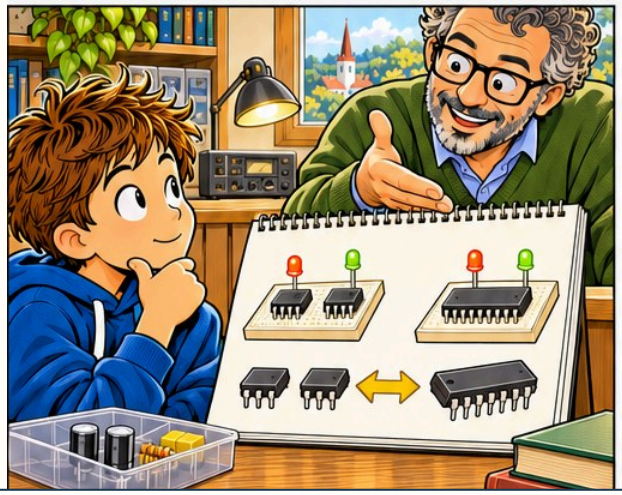
Lucas immediately sees that its pin connections cannot be copied from the two DIP8 devices.



Supply and signal connections must be checked in the datasheet for the exact part.



Their project keeps the two tested NE555 timers so each function remains visible.



The dual variant becomes a design possibility, not an improvised replacement.



Lucas stores the component with its separate documentation.

A CMOS variant to study



A CMOS version may change current consumption and some output characteristics.



Henri asks Lucas to read its own datasheet and the pinout of the selected package.



Interface levels and audio loads should be double-checked.



Lucas keeps the reference values to compare under the same conditions.



A similar family name does not guarantee every margin in the circuit.



The project keeps its NE555 timers until this variant has been studied and checked.

Battery life must be estimated



Lucas imagines a portable demonstration; Henri first asks him to measure current consumption.



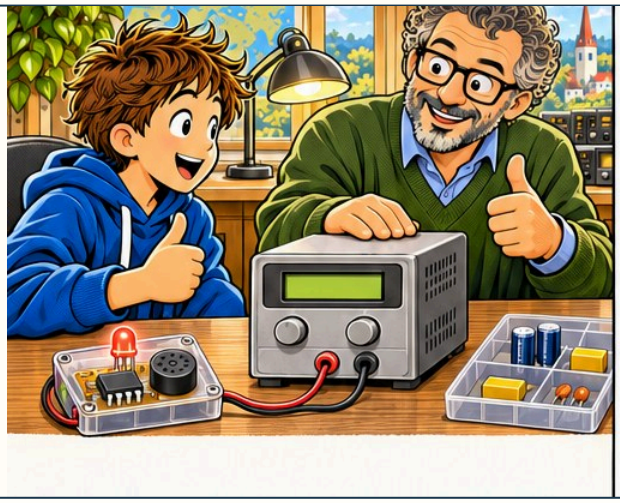
The timers, LED and audio stage all contribute to the current drawn.



Supply capacity alone is not enough; operating conditions and usable voltage matter too.



Estimated operating time remains an estimate, distinct from an actual test.

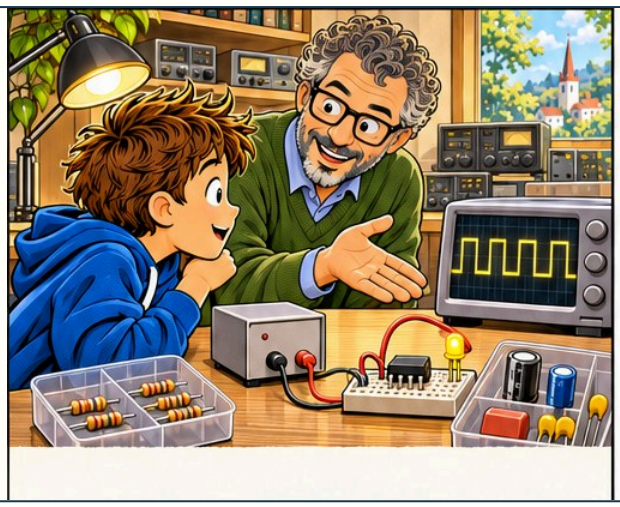


They keep their 5 V regulated isolated source for this workshop.



The portable version gets a page of questions rather than a promised duration.

The project is not a clock



The timing depends on resistors, capacitors and circuit characteristics.



Lucas compares this workshop rhythm with a need for precise timekeeping.



Henri explains that another reference system may better suit this need.



A demonstration that looks regular does not guarantee timing accuracy.



They indicate this limit to prevent their signal from being used for an unsuitable task.



The choice of an architecture begins with the expected precision.

Plan the enclosure



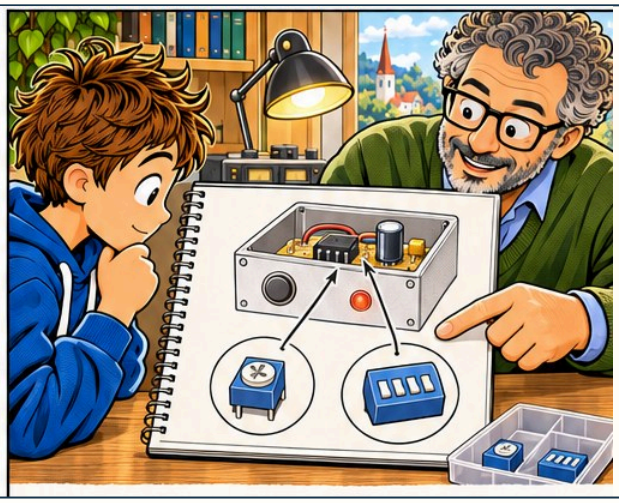
Lucas draws a front panel with clear controls and a visible indicator.



The enclosure must protect connections and provide access to the stop control.



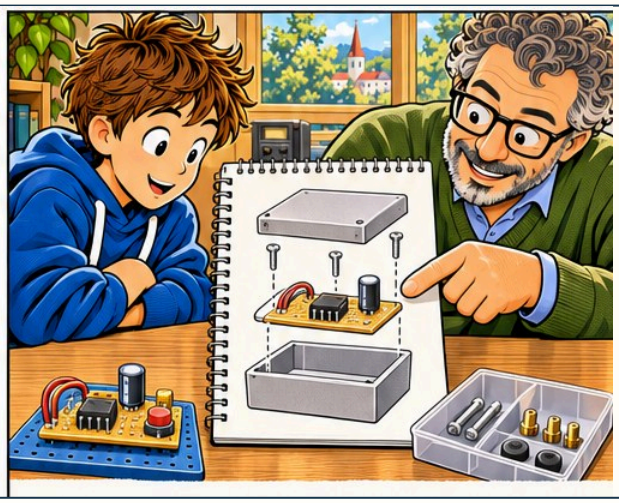
Henri checks the fixings, cable entries and clearance between bare wires and conductive parts.



The internal settings remain identified on the diagram.



The supply requirements and polarity will be marked beside the appropriate connector.



The project stays on the breadboard until the assembly plan is understood.

The wiring remains recognizable



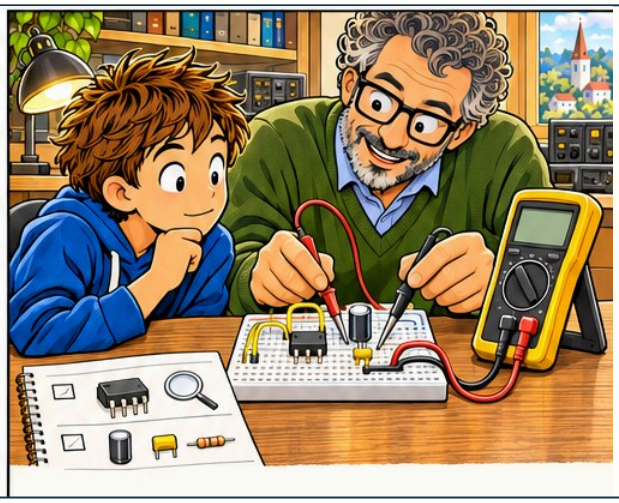
In the assembly plan, Lucas keeps the blocks A and B separate and easy to follow.



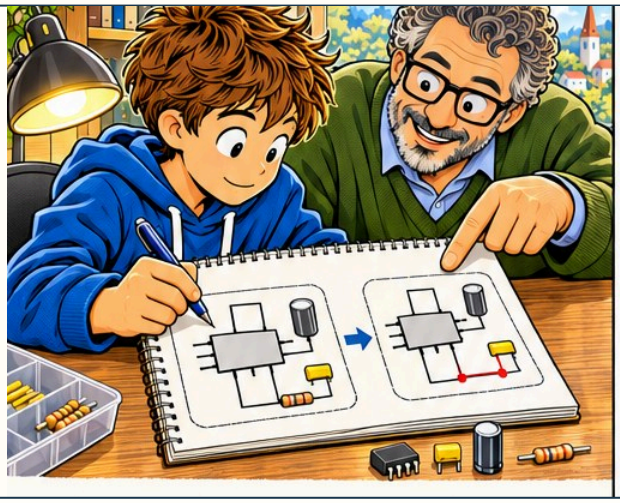
Control wires are not confused with load wires.



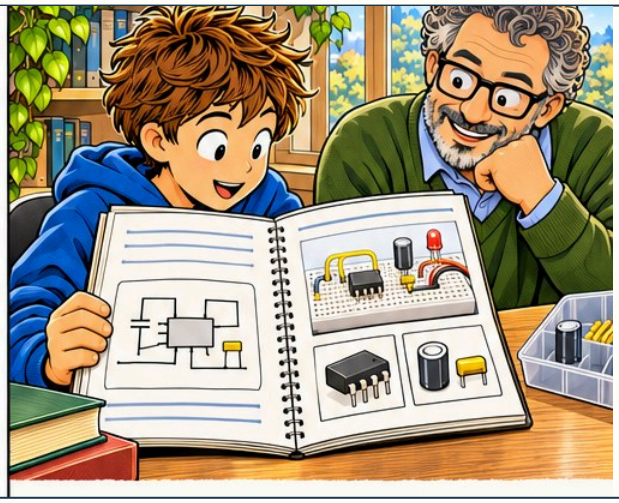
Henri checks that return paths and decoupling remain short and accessible.



A clean installation does not replace the electrical check before the first power-up.



The schematic is updated whenever a connection actually changes.

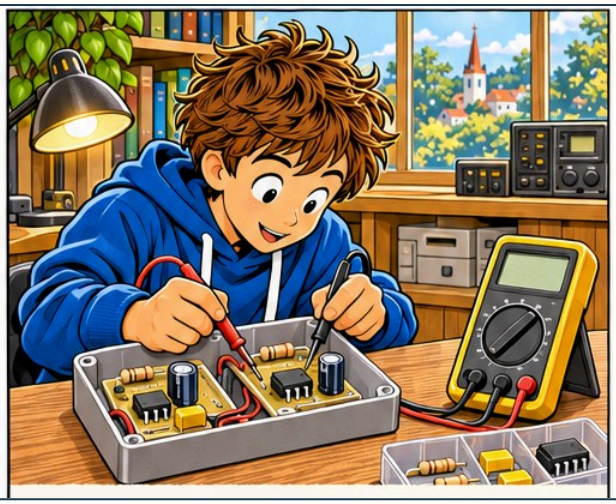


Lucas keeps an overview and useful details in the instructions.

Check before closing



With the supply disconnected, they inspect the fixings and connections.



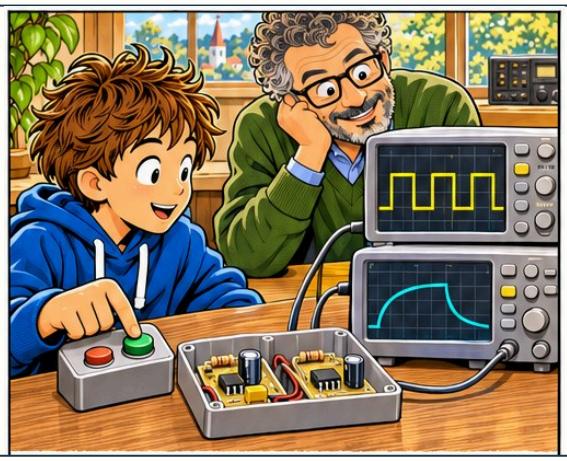
Lucas checks the continuity of the planned paths and the absence of short circuits.



Henri checks the values, polarities and orientation of the two circuits.



The first power-up keeps the appropriate current limit.

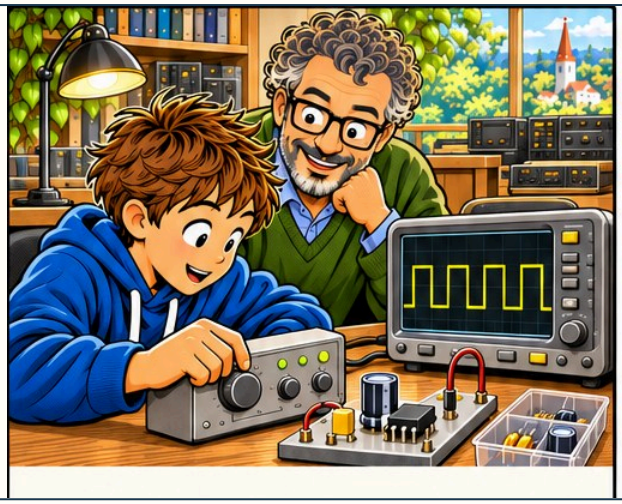


The housing remains accessible during the planned tests, without contact with the moving parts.

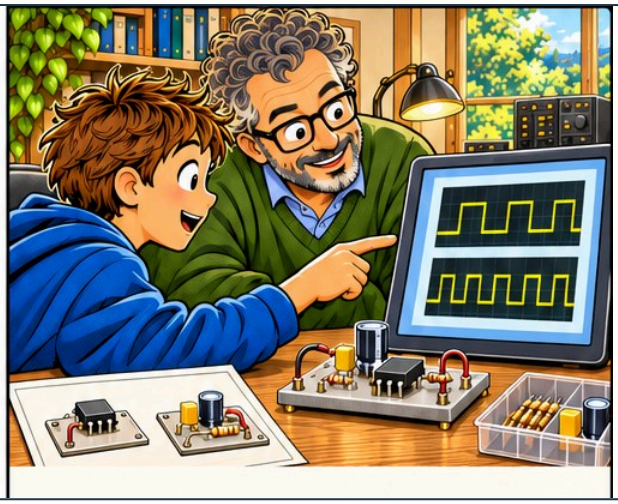


They wait for measurements and control checks before closing the enclosure.

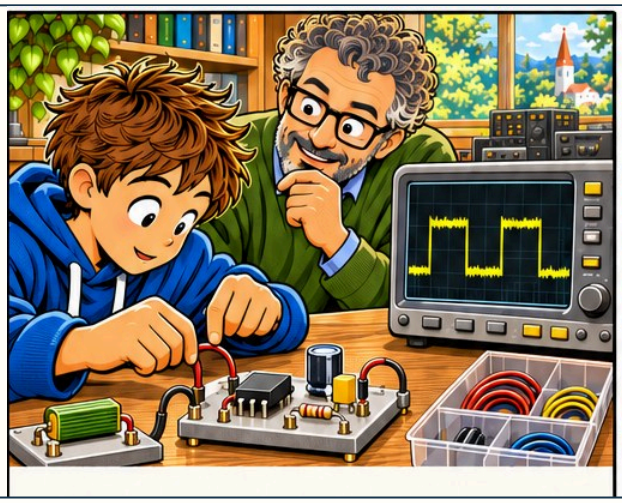
Measure again in the enclosure



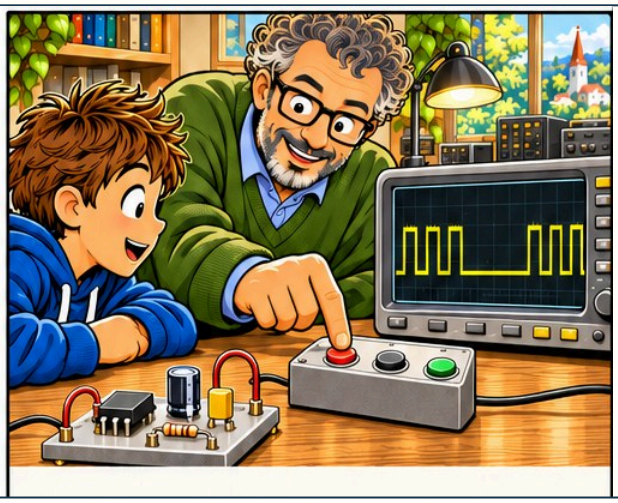
Assembly has changed the conditions: Lucas repeats the rhythm and tone checks.



He compares the results with the recordings from the separate breadboards.



Wiring changes can affect noise and loading conditions.



Henri also checks shutdown, silent mode and restart.

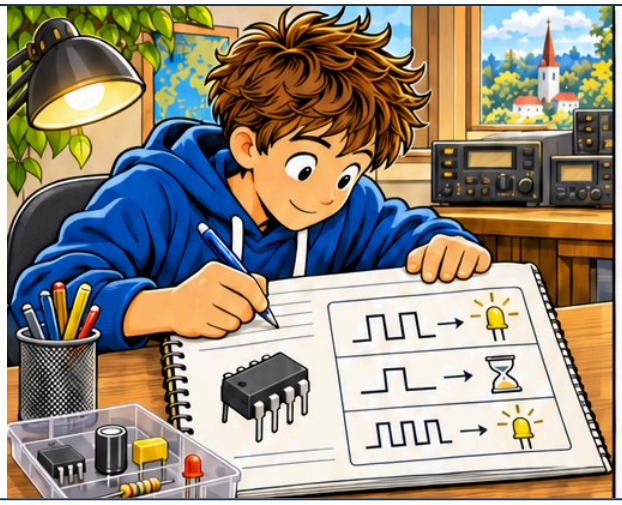


The notebook identifies which circuit version each measurement describes.



The enclosed project must answer the same questions as the open circuit.

Instructions for someone else



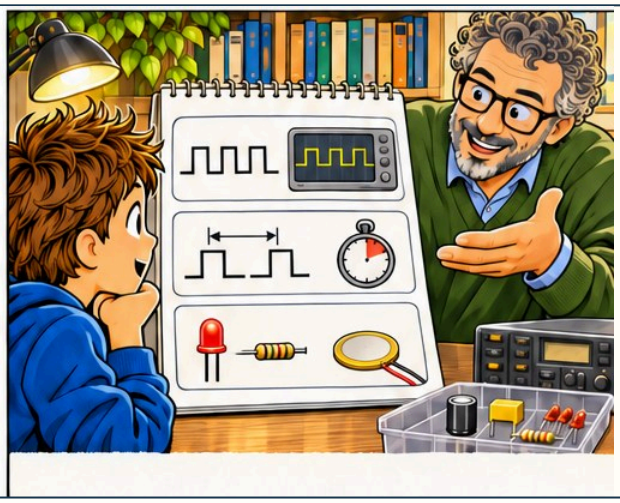
Lucas prepares instructions which describe the functions before the settings.



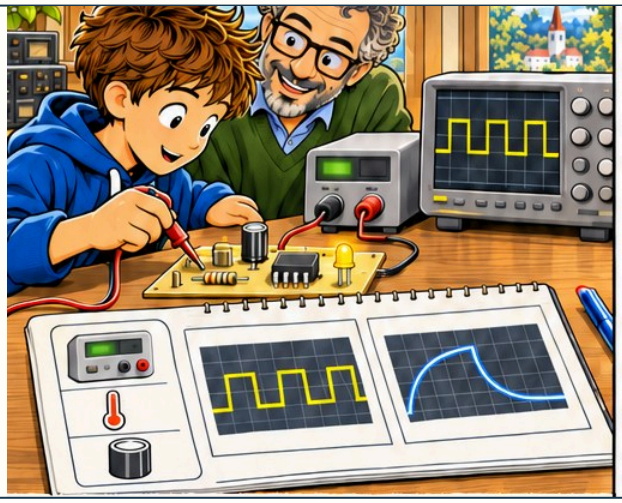
The schematic, values and component part numbers remain accessible.



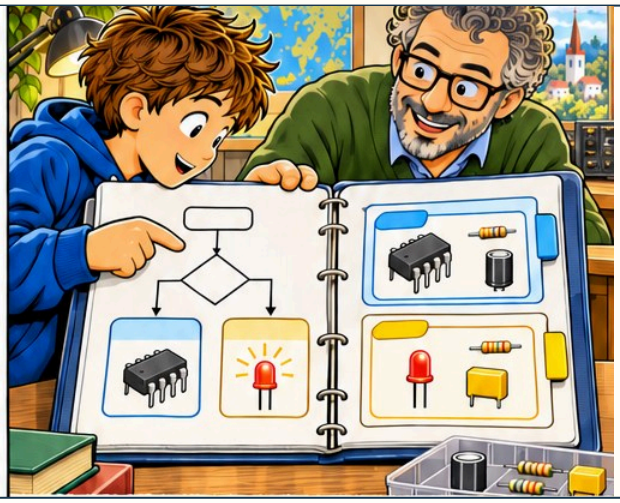
The procedure distinguishes switching on, stopping operation and disconnecting power before work.



Henri adds the limits: local signal, approximate cadence and defined loads.



The measurement points and expected results are presented with their conditions.



A troubleshooting page links to the sheets for the two separate blocks.

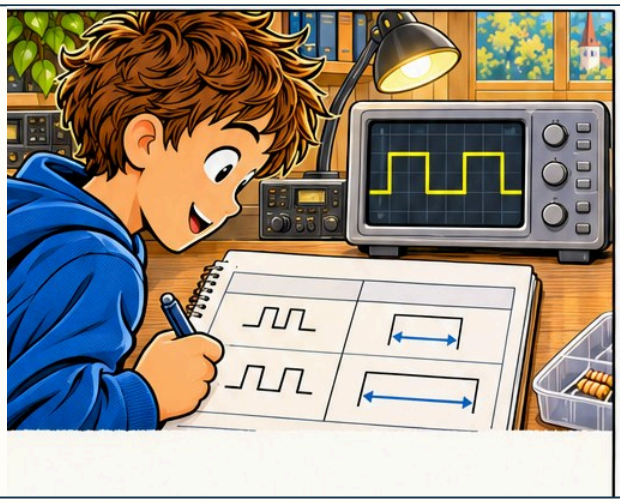
The rhythm worksheet



Lucas puts the schematic and nominal calculation for block A on one worksheet.



He records the fitted values and the tolerances that affect the period.



The observed durations remain in a separate column.



The light is described as an indicator, with no promise of precise measurement.



Henri verifies that the output A is connected only to the intended loads and input.



The sheet shows how to test this block without sound.

The tone worksheet



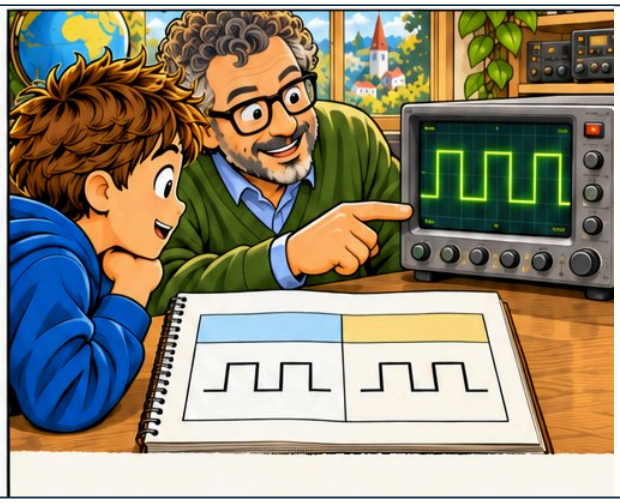
The second worksheet describes block B, its timing network and its audio stage.



Lucas distinguishes the passive transducer from an active buzzer or speaker.



The coupling and protection follow the schematic actually selected.



The nominal frequency and the measured frequency do not share the same column.



Henri checks that the standalone RESET test configuration is explained.

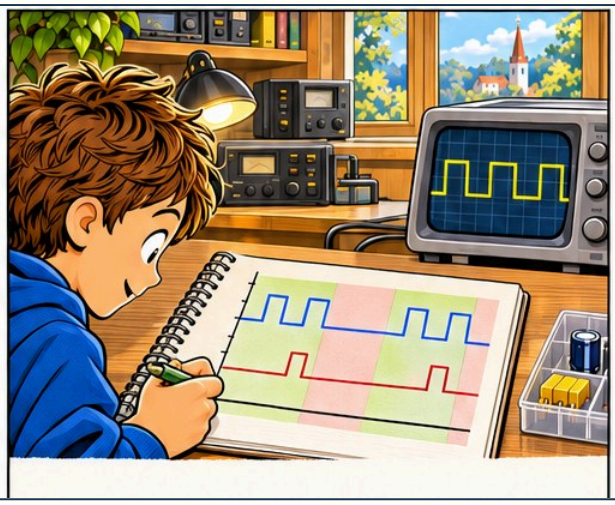


This worksheet lets them recover the tone even with the slow control disconnected.

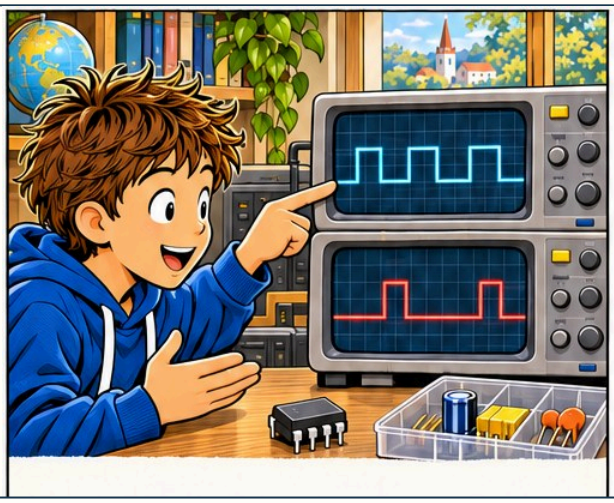
The interface worksheet



Lucas draws output A, the RESET input of B and their common reference separately.



He records the expected levels during enabled and disabled intervals.



The A and B outputs remain distinct on each view.



Henri adds compatibility checks and conditions for their verification.



They switch between standalone and combined tests with the power off, following the procedure.

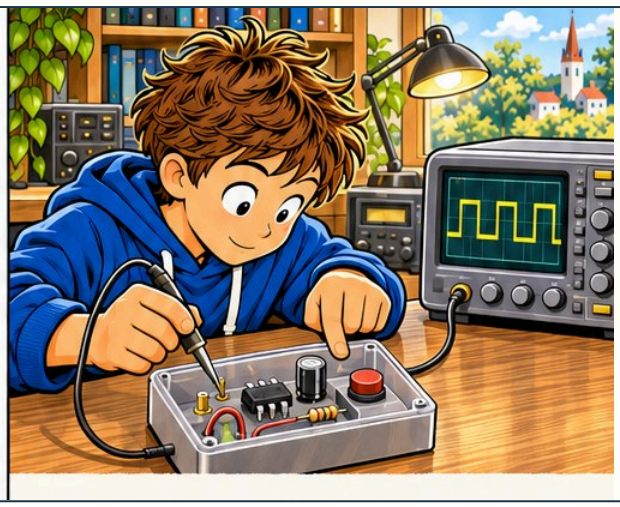


The interconnection now has its own checking worksheet; it is no longer a mysterious wire.

A test without help



Henri takes the three worksheets and plays the role of a new participant.



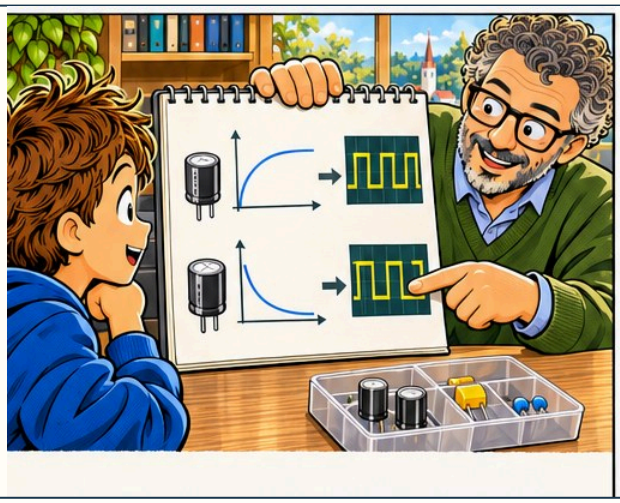
Lucas watches whether he finds the controls and test points without spoken guidance.



A sentence that is too vague is rewritten before the box reaches the club table.



The limits and start conditions should be as easy to find as the button.



Henri successfully explains the two rhythms by showing the diagram.

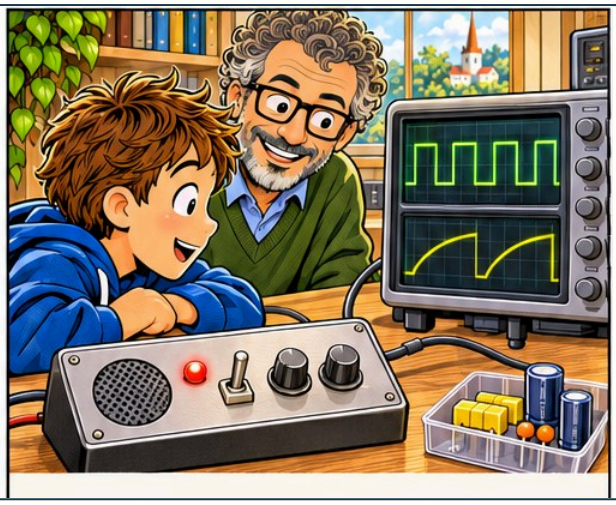


The instructions have passed a practical test too.

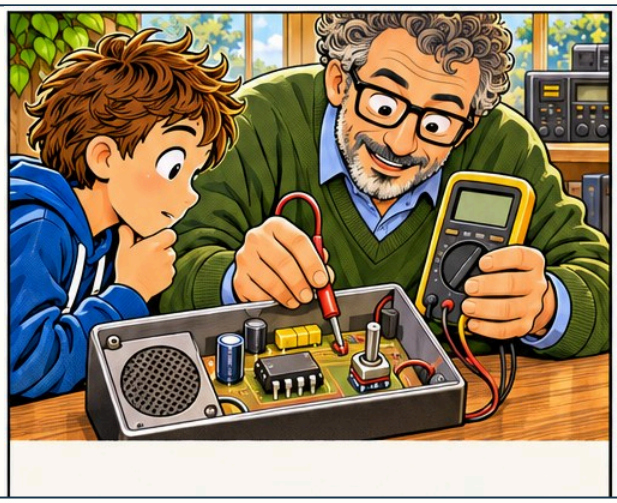
Check silent mode



Lucas switches off the audio stage with the intended control, leaving both timing networks unchanged.



The light continues to indicate the cadence and the traces remain observable.



Henri checks that this control does not leave a sensitive input floating.



The instructions clearly explain which functions continue to work in this mode.



Sound must not return unexpectedly while a visitor reads a worksheet.



Lucas checks each control position again before putting the device away.

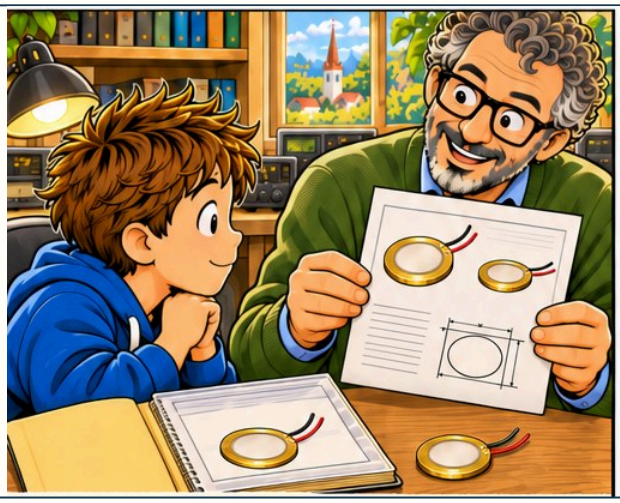
Prepare spare parts



They prepare a small spare-parts box with the exact part numbers used.



Lucas separates timing capacitors from supply-decoupling and audio-coupling capacitors.



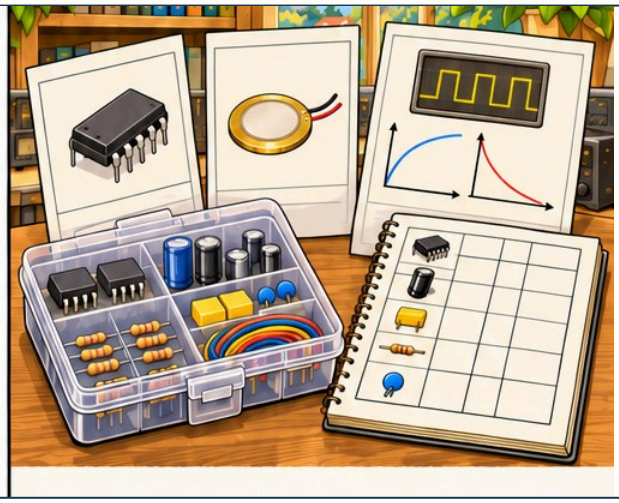
Henri keeps the transducer documentation with its part number.



A similarly shaped component does not become a guaranteed replacement.



The log specifies what will need to be rechecked if a part changes.



The three worksheets and bill of materials now accompany the enclosure.

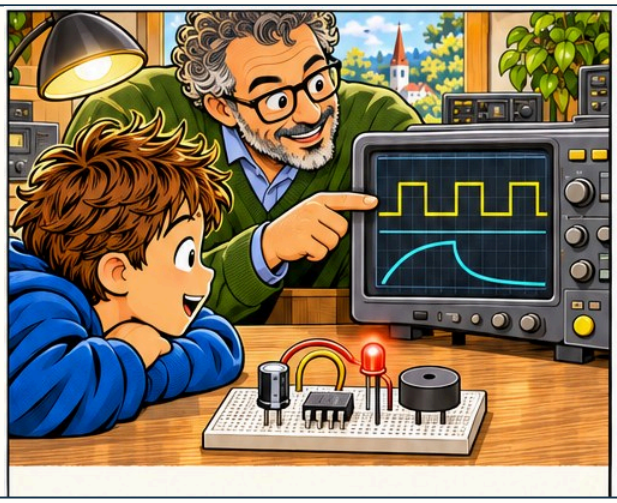
Visitors return to the table



Lucas sets up the project with its worksheets and the recordings of the separate blocks.



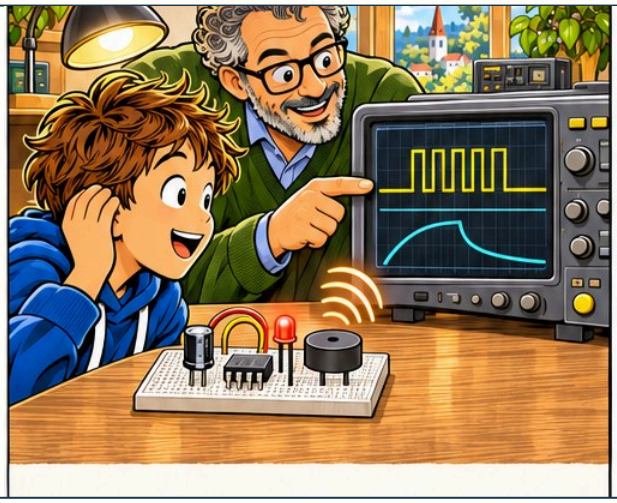
Henri checks the isolated supply, cables and access to the stop control.



Silent mode allows you to start with the indicator light and traces.



Lucas asks what the visitor expects before showing the result.



They enable the sound briefly to link the electrical bursts to the sound heard.



The workshop rediscovers the pleasure of understanding before making an adjustment.

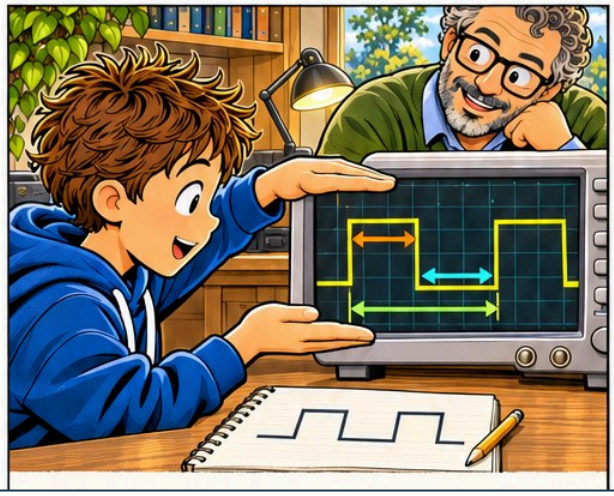
Explain the rhythm



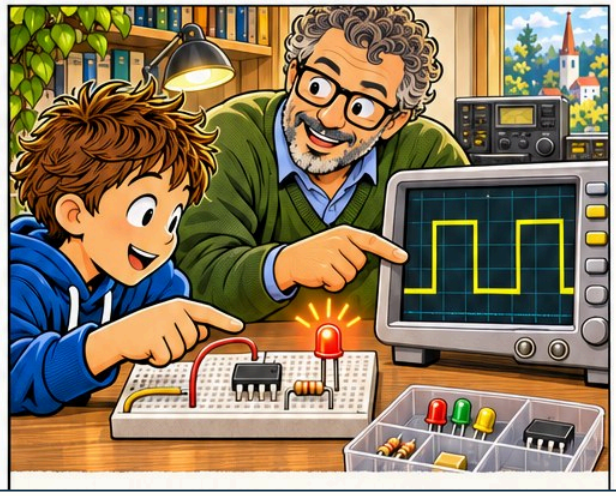
Henri asks Lucas to show what sets the burst rate.



Lucas shows timing network A and its slow waveform recording.



He distinguishes high time, low time and the complete period.



The LED makes the control signal visible; the instrument supplies the measurements.

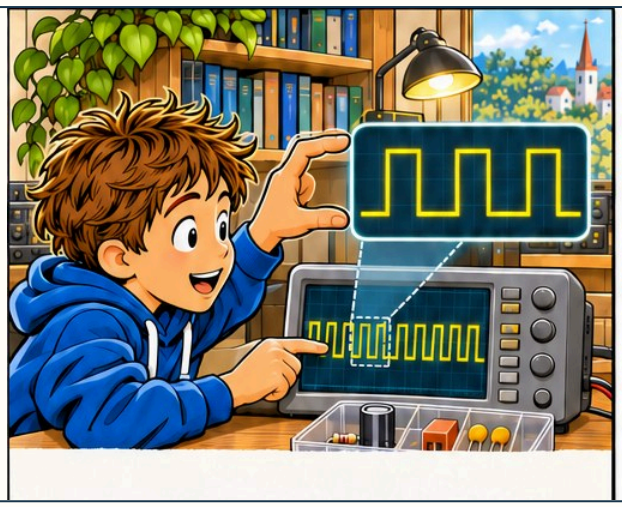


Tolerances explain why the project does not announce an exact second.



Lucas lets the visitor trace the control path.

Explain the tone



Lucas zooms into a burst to show the fast cycles of block B.



Adjusting the rhythm does not adjust the pitch.



Henri recalls the role of the transducer and its coupling stage.



The rectangular electrical signal and the acoustic response are different quantities.



The demonstration remains at low level and alternates with silent mode.

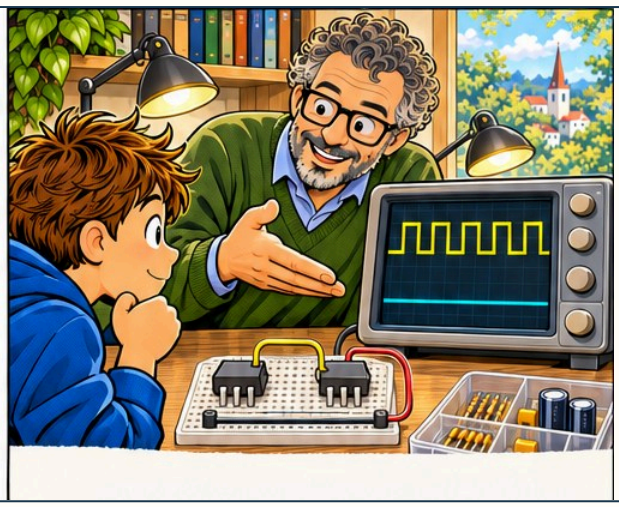


The visitor can now distinguish the two time scales.

Explain the interface



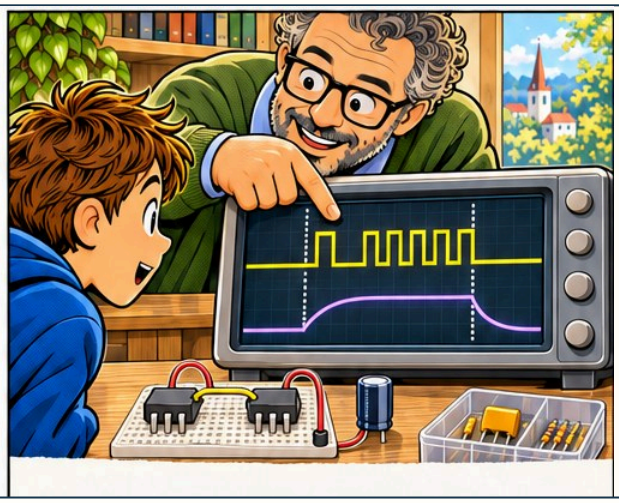
Lucas follows output A to RESET of B, then shows the common ground.



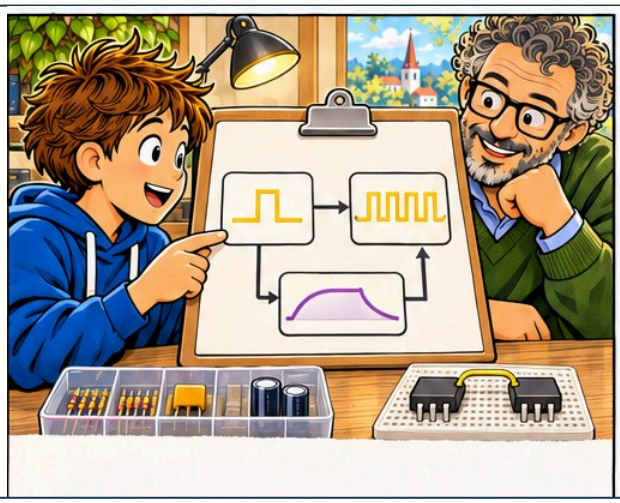
The enabled interval lets the tone run; the other interval keeps output B low.



The two outputs are never brought together to make the sound.



Henri shows the first pulse of a burst and the startup limits.



The result becomes understandable because each block retains its function.



Lucas closes the interface worksheet only when the visitor can trace this path again.

A fault as an exercise



After the demonstration, Henri returns to a recording of the permanent-silence fault.



Lucas first asks whether RESET actually enabled the tone.



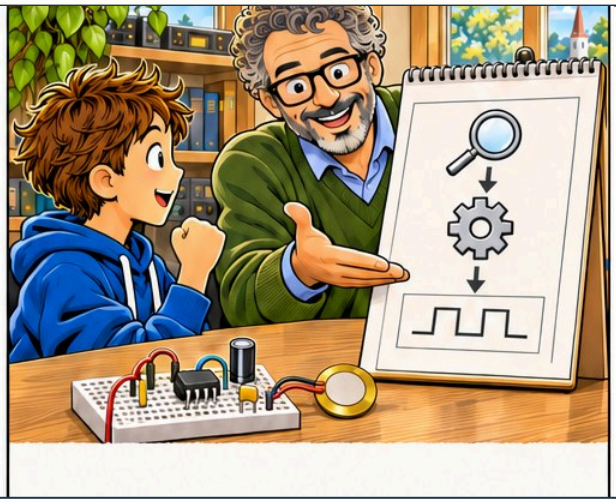
He checks the supply, control and then output before blaming the transducer.



The visitor finds the three worksheets that separate these questions.



The deliberately introduced fault stays a documented exercise, never a hidden defect in the display device.

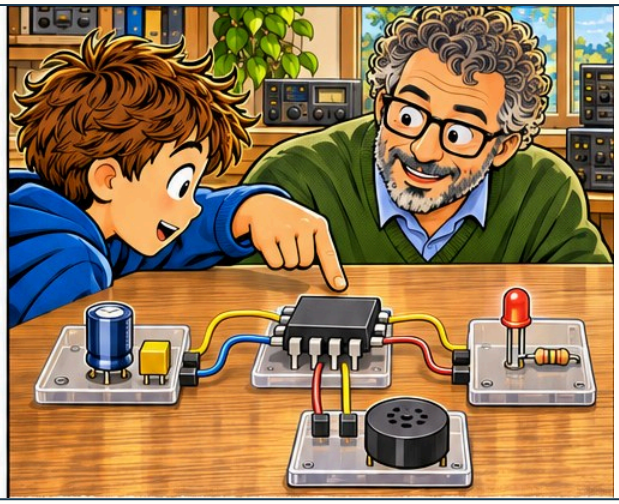


The project teaches a troubleshooting method as well as a sound effect.

What two timers taught us



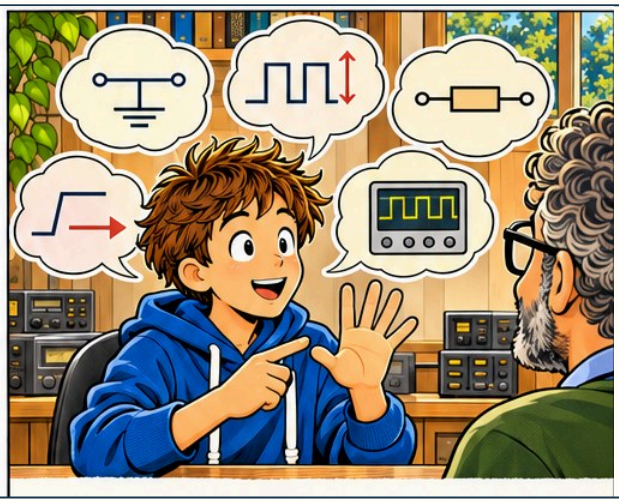
Lucas aligns the notebook of volume 70, the measurements of volume 71 and the three project sheets.



He recognizes the same eight pins, but now sees the interfaces between functions.



Henri asks what matters before combining two circuits that work on their own.



Lucas answers: references, levels, loads, start-up and measurement conditions.



A clearly explained connection turns two experiments into a project others can reproduce.



Their box remains on the table, ready for a new discovery session.

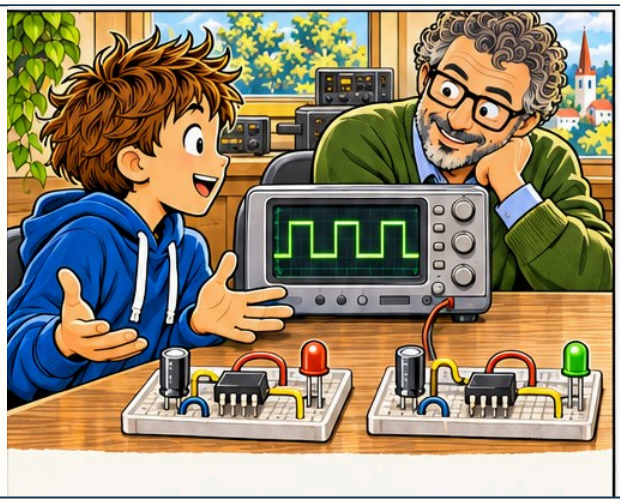
A notebook for the next idea



The room becomes quiet again and Lucas disconnects the supply after the last demonstration.



Henri stores unused parts with their references and documents.



The two NE555 timers sent no radio signal; they gave their method a voice.



Lucas rereads his first question and smiles at the three worksheets they now need.



He turns a blank page. Henri asks him what function he would like to understand next.



The next project starts like this: a clear question, a diagram and the desire to share.